RAILWAY MASTER MECHANIC

VOL. XXXI CHICAGO JANUARY 1907 NEW YORK NO. 1

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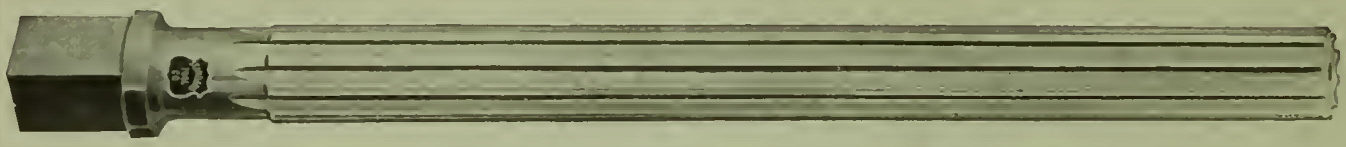
THE STANDARD TOOL CO'S Reamers for Locomotive Work



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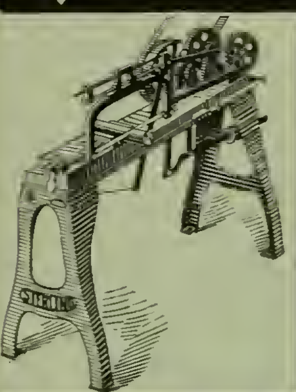

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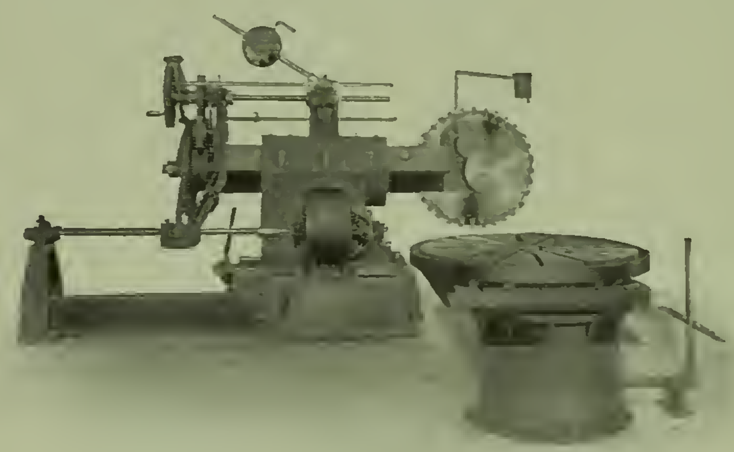
WORTH BROS. CO. COATESVILLE, PA. ACID OR BASIC, FOR ALL BOILER PURPOSES, LOCOMOTIVE FIRE-BOXES, ETC. Having the largest and most modern Plate Mill and Flanging and Dishing Plant in the country, can furnish all maximum sizes. OPEN HEARTH STEEL PLATES



THIS machine has many decided advantages. Notably the triple action of the work tables—they have a vertical, horizontal and circular movement, which, in the easiest manner, places the casting before the saw at any angle you may desire. The head swivels through 360 degrees.

If interested, permit us to send you full particulars.

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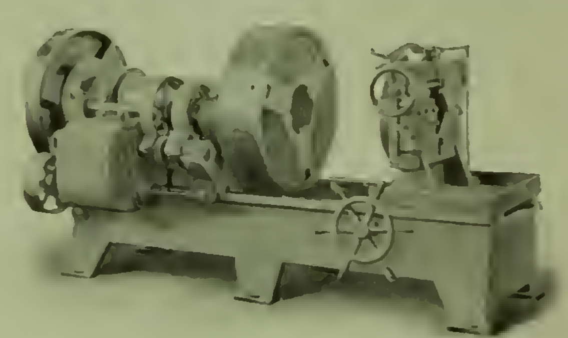

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Each machine was designed with the idea of getting the work out rapidly, with as little wear on the tool as possible. Hence we use hardened steel instead of cast iron in many places.

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Security Building

CHICAGO

BRUCE V. CRANDALL, President **WARREN EDWARDS, Manager**

MAHAM H. HAIG, Managing Editor **B. W. BENEDICT, Editor**

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January to December, 1907

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A Monthly Railway Journal

Devoted to the interests of railway motive power, car equipment, shops, machinery and supplies.

Communications on any topic suitable to our columns are solicited.

Subscription price, $1.00 a year; to foreign countries, $1.50, free of postage. Single copies, 10 cents. Advertising rates given on application to the office, by mail or in person.

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Papers should reach subscribers by the first of the month at the latest. Kindly notify us at once of any delay or failure to receive any issue and another copy will be very gladly sent.

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VOL. XXXI CHICAGO, JANUARY, 1907 NO. 1

CONTENTS.

Output of the Blacksmith Shop

THE blacksmith shop as one of the important divisions of the railway shop organization has not in all cases received the attention it deserves. The output, while generally sufficient to keep pace with the demands of the other departments, has not generally been brought up to the standard of the other shops.

That the output of the blacksmith shop responds quickly to improvements is illustrated in the case of an old shop recently equipped with modern machinery. The number of fires was not changed, but the output of the shop was increased fifty per cent and the cost of production per unit was decreased forty-two per cent.

The chief cost in operating the blacksmith shop is for labor. The problem is to get a maximum output from each man. By installing labor saving machinery combined with proper supervision, this can be obtained.

Can you, Off-Hand, Answer the Following?

WHAT was the cost of coal per ton on your tenders last month? Last year?

What was the cost of coal per ton mile on your line last month? Last year?

What was the cost of engine repairs per mile last month? Last year?

In compiling the figures on the latter, is the cost of new equipage, surcharges and repairs due to wrecks added to the monthly figures? And to the yearly figures?

If not, how is it that your impression that your cost of engine repairs was 5 cents per mile appears at 10 cents in the annual report of your road?

What is your maintenance cost per 1,000 miles for freight equipment? For passenger equipment?

What is your cost per 1,000 miles for engine oiling? For freight car oiling? For passenger car oiling?

What is your per car cost of coach cleaning?

What is your per engine cost of turning engines at the engine terminals of a particular division?

What is the average time required to turn an engine at this terminal?

Are you qualified for advancement unless you can answer these questions?

Cold Weather Locomotive Cabs

THE cab of a locomotive is designed as a protection for enginemen. It fulfills this duty in the summer time, but fails to do so in the storms of winter. It then becomes necessary to resort to the use of special devices to make cabs habitable. Humanity and safety demand that enginemen be protected against inclement weather.

It would seem that proper effort has not been directed toward designing cabs to meet winter conditions. As a rule the old side and drop curtains are relied on to keep out the cold, but they are only partially successful in this. In the heavy engines of today, with the half deck cabs the ordinary canvas curtains offer little protection against the severest storms. The temperature in the cab drops so low that enginemen cannot properly perform their duties; snow blows in and the lubricators freeze up. This condition of affairs does not tend to produce good results on the road, nor loyal employes.

A well directed study of this problem should bring a satisfactory solution. A similar condition formerly existed on passenger cars. This has been overcome in a successful manner by the introduction of vestibules. These make an almost storm-proof connection between cars. It is believed that an equally satisfactory arrangement can be designed as a connection between the locomotive and tender.

Running Repairs

THE smaller details of locomotive repairs should receive the same round house attention as that given to the more important, from which engine failures are known to result directly. A loose nut here and there or a missing split key are sometimes responsible for engine failures, and this fact should be borne in mind by the foreman and repairmen, especially those who are inclined to make lead pencil repairs.

For instance, take the case of loose nuts on a guide bolt. When these nuts begin to work, they soon lose their grip on the guides and the liners may fall out before the motion of the guide is noticed by either the engineer or fireman. Sometimes emergency repairs may be made by using a washer or other small pieces of metal as a liner and a job so done might hold. This is not always the case, however, and work of this nature might be tinkered with all through the run. Time is lost, and if not made up the engineer is charged with an engine failure. Sometimes delays of such nature could be obviated by replacing a lost jam nut and by care in tightening it.

A case which was recently brought to notice reflects the lack of thoroughness in making repairs and would indicate a lack of judgment as well. An engine starting from a division terminal on a passenger run stopped at a remote round house about fifty miles from the terminal and reported a key lost from the back end of the left main rod. The roundhouse foreman at that point had no keys thin enough to fit this rod. As a makeshift, a wooden key was applied and the engine worked its way over the road. A few days later the same engine stopped at the remote point on account of repairs needed in the same place. This time the key had not been thrown out of the rod, having been held by a cotter pin in the lower end of the key. However, the key was loose and the brass was pounding.

It was found that the set screw intended to secure the key was loose and the head of the set screw was so worn that a wrench would not grip it. The position of this set screw was such that it could not be renewed without taking down the side rod, and inasmuch as the engine was standing on the main track coupled to its train, the foreman did not deem it expedient to make this change, so tightened the set screw as much as possible with an alligator wrench and let it go.

This second delay would not have occurred had a new set screw been applied when repairs were made at first. Seemingly, the removal of a side rod was considered too big a job to undertake, merely to replace a set screw. Nevertheless, a roundhouse man should know that a set screw holding the main rod key must be capable of manipulation by the engineer, and if wrenches had been used on this key so often as to wear away the corners of the head, the tip was probably so worn as to reduce its holding capacity.

Delays of this nature are not always made known at headquarters—except in the event of failure to make up lost time—and the poor roundhouse work continues until an engine failure results and then everybody wonders how it could have happened.

Steel Passenger Cars

THERE is much interest being evinced in steel passengers cars by prominent roads, which is no doubt primarily traceable to the successful performance of metal construction in freight service, backed by the few steel mail cars already built and still further fortified by the results shown by the steel cars in the New York Subway.

Whatever the cause may be for favorable consideration of the steel passenger car, that type of construction has many points of superiority over the modern car, points that cannot be ignored from cost and repair viewpoints, which are most vital factors when the longer life of the steel car and comparative immunity from harm to the passenger in case of trouble, is considered.

Steel construction is the logical solution, because it is mechanical. The absence of wood, glue and screws, is compensated for by the permanency of all joints of the riveted form, which when properly made, remain tight under strains and shocks that necessitate constant following up when bolts have a wood backing.

The scheme of framing as worked out on the very recent examples of steel passengers cars, is well adapted for the ends sought. The longitudinal sills, of which there are four, are made up of two I-beams at the center and an angle section at each side. This is in wide contrast with the eight and sometimes ten wooden sills seen in the old time equipment.

The post framing of angles, from sills to belt rail and from thence to plates need and have no post rods. The roof carlines, also of angles and extending from plate to plate in a continuous curve, is one of the strongest forms of construction, making the frame practically a solid box. Two truss rods aid the sills in sustaining the load between bolsters, which is no doubt preferable to deeper and heavier sills to accomplish the same purpose.

Designs of steel passenger cars no longer present serious difficulties so far as concerns the mechanical features involving strength and utility of details, and their most advantageous disposition in the assembling. There is, however, in the steel car problem, the question of finish, exterior and interior, that will take some time and thought to give satisfactory results to those who lean to the ornate.

As to the outside of the car a piano finish is as much out of place, as was the elaborate brass ornamentation on locomotives, a few years ago. Gold leaf on cars is rapidly coming to be a thing of the past. While wood for interior finish is also becoming more severe as to carving and polish, as appeals to the esthetic taste, it is a long stride to a total abandonment of it for interior finish.

Many friends of the steel car believe that wood has no place in its construction and would relieve the flat surfaces now covered by mouldings, by the use of pressed metal shapes. Steel cars built on these lines, having a capacity for seventy passengers can be built inside of the 100,000 lb. mark, but the present trend is not so much a reduction of dead weight, as a construction that will stand the test of service and be safe in wrecks.

Transfer Tables for Locomotive Shops

JUDGING from the number of locomotive shops constructed within the last few years, which are not served by transfer tables, and from plans prepared for contemplated shops in which transfer tables are not included, it would seem that the present inclination is unfavorable to the transfer table as an adjunct of a large locomotive shop.

Modern transverse shops, not employing transfer tables, are commonly equipped with cranes capable of lifting an engine over the others standing on the erecting floor and are served by a turn table outside of the building, either at one end or at the center, connecting with the shop by a single lead. All engines entering or leaving the shop are dependent upon this lead and even though the most careful supervision is exercised, the track and turn table often become congested. For this reason the transfer table is regarded by some as providing a more satisfactory method of delivering engines to a shop, in that there are more entrances and consequently less likelihood of congestion. Furthermore the crane is not required in transferring engines from the entering track to the various repair pits and therefore is always available for general work.

A transverse locomotive shop without a transfer table, is commonly served by two cranes, operating on different levels. The higher crane is naturally of greater capacity as it is used in transferring a locomotive over the others on the erecting floor and in unwheeling, while the crane of lighter capacity is on the lower level where the operator is in a better position to observe closely the required movement of the hoisting hooks; and the different levels provide for the cranes to pass each other.

It has been mantained that a shop having 24, or more, erecting pits and operated to turn out more than two locomotives per month on each pit should be equipped with two cranes on the upper level and each crane should be of such capacity as to transfer the heaviest locomotive when the boiler contains three gauges of water and there is a fire on the grates.

In a busy and well organized shop, operated to its fullest capacity, supervision of the cranes requires great care and good judgment in using them to best advantage and with least unproductive movement up and down the shop, and it is believed that relieving the heavy cranes of transferring engines would simplify the movement of both cranes.

It is generally conceded that for a small shop plant, embodying both a car and locomotive department, the transfer table is the most satisfactory method of serving all shop buildings and of providing intercommunication. This is looked upon as covering the situation at a shop plant in which there are about fifteen pits, or less, in the locomotive shop, and the other departments are of corresponding size.

In the larger plants one table is insufficient to handle all traffic and movement among the buildings and there has been a marked tendency to dispense with transfer tables, except in connection with the passenger car department.

It is maintained that the transfer table offers too great an impediment to shop yard traffic, to justify its use. At the same time, however, the question now arises as to whether there is a greater impediment caused by congestion on the single entering lead and turn table, or by the presence of the transfer table pit.

It is also said that the larger number of doors necessary with a transfer table results in a colder shop than when all engines are received and discharged through one door. This argument is claimed to mean but little for the reason that a single door must be opened every time an engine passes in or out, and it is merely a question of one door being opened frequently or several doors being opened occasionally.

While the location of the boiler department is not dependent upon the transfer table, it is interesting to consider the function of the transfer table where the boiler shop and locomotive shop are in different buildings.

A number of new locomotive shops have been constructed of such size as to accommodate the boiler shop within the same building as the locomotive erecting and machine floors. This practice has been followed in shops having both longitudinal and transverse pits, so that the arrangement of pits does not affect this method of providing for the boiler department. Where this arrangement obtains, the more general practice has been to locate the boiler department as an extension of the erecting and machine floors in order to take advantage of the continuous crane service in transferring boilers, flues and other materials. An exception to this, however, is the Collinwood shop of the Lake Shore and Michigan Southern railway where the boiler department occupies a side bay in the locomotive shop. In this shop the machine tool floor is between the boiler department and the erecting floor. Such a layout of the locomotive shop floor requires a greater number of movements over the middle track connecting the two departments and serving as a delivery track to the erecting floor, causes more inconvenience, in transferring between the erecting floor and the boiler department, than prevails where the boiler department is a continuation of the other. The latter arrangement also provides greater flexibility of each department in the event of one or the other being overtaxed temporarily.

Some of those who favor having the boiler shop in a separate building advocate the location of the locomotive and boiler shops in such relation to each other that they may be served by a common transfer table operating between the two buildings.

At the C. & E. I. repair plant at Danville, Illinois, the boiler shop and locomotive shop are in separate buildings and both are served by a common transfer table. These buildings are on the same side of the table with a distance of 70 feet between them. Each building is well equipped with cranes, the crane in the locomotive shop having a capacity of 160,000 lbs., sufficient for wheeling engines, and the crane in the boiler shop having a capacity of 40,000 lbs.

At the Chicago shops of the C. & N. W. Railway—old shops extended in 1901—a transfer table serves the locomotive shop and the boiler shop, which are in separate buildings and both are on the same side of the transfer table pit. The locomotive shop has no overhead traveling crane—except for light air hoists—but the boiler shop is a comparatively new building, modern and having good crane service. When locomotives are brought in for all classes of repairs, they are delivered first to the boiler shop where all stripping is done and where engines are unwheeled and when necessary, boilers are removed by the crane. The frame and machinery are then transferred to the locomotive shop on trucks, by means of the transfer table.

The original layout of the Burnside shop of the Illinois Central Railroad, provided for a transfer table operating between the locomotive shop, of 24 pits, on one side and the boiler shop and blacksmith shop on the other. Changes and additions to the machine floor have so increased the capacity of the erecting floor as to require greater boiler shop capacity and the enlarged car shop facilities, as well as the demands of the locomotive shop, have increased the requirements of the blacksmith shop. To meet these demands, a new boiler shop has been built in an isolated building and the old boiler shop is being converted into an extension of the present blacksmith shop. The new boiler shop is served by a transfer table, which does not connect with the erecting and machine shop, making two transfer tables in the locomotive department of the plant.

The original locomotive shop of the B. R. & P. at DuBois, Pa., included the boiler department in the same building as the erecting and machine shop. This shop is arranged with three longitudinal pits in a center bay, with the machine tool equipment in two side bays and was built to turn out about twelve locomotives per month.

Recently a new boiler shop has been built in a separate building 145 feet from the locomotive shop and the capacity of the locomotive shop has been increased to about twenty locomotives per month. The boiler shop is beyond one end of the locomotive shop and is arranged longitudinally with the latter. It has 16 transverse stalls, about half of which are used at present for boiler work and the remainder for tank work. The boiler erecting bay is served by a traveling crane of 60,000 lbs. capacity. The boiler shop is served by a transfer table which provides for communication between any of the boiler shop pits and the locomotive shop pits, as well as with a delivery track.

The largest modern plant using the transfer table pit as the principal avenue of inter-communication is that of the L. & N. R. R. at South Louisville, Ky. Here the transfer table serves the locomotive department on one side of the pit and the freight car erecting shop, planing mill, coach and tender shop and store house on the other. The transfer table operates over a distance of about 920 feet. The locomotive shop is not dependent entirely upon the transfer table, as engines may be brought in over a track entering the shop at about its center and the crane runways are at such height that an engine so entering may be lifted over the others on the erecting floor and placed on any desired pit. This arrangement presents an excellent provision against congestion, and while in general every day service the table is used only about five per cent of the time by the locomotive shop as against 95 per cent. by the car department, either the crane or the transfer table may relieve the other in case of emergency, and it is hardly likely that both of them will be out of order at the same time.

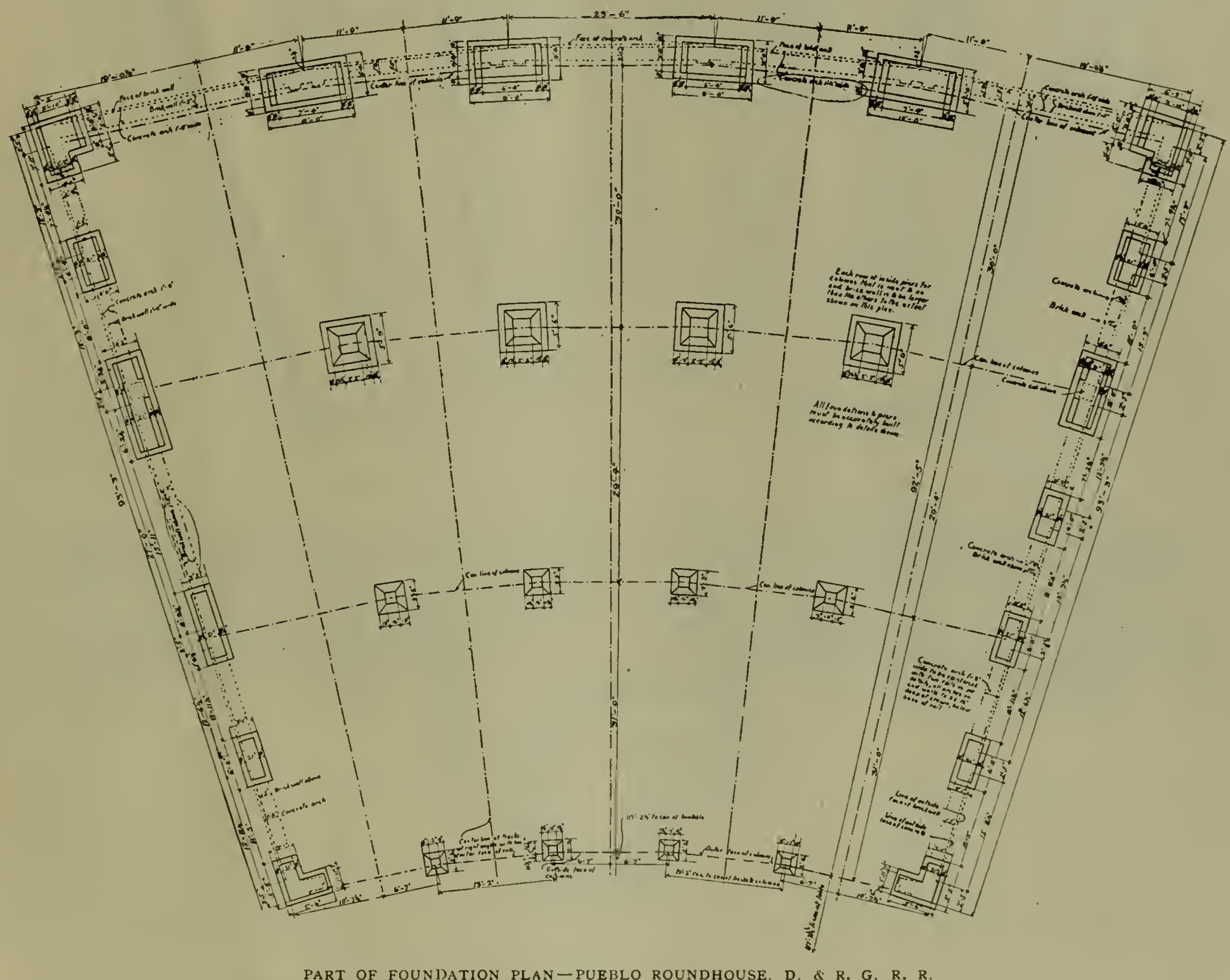
There appears to be a rather general impression that the installation of transfer tables in connection with large locomotive shops is no longer good practice; but the experience in some shops would seem to indicate the contrary.

Roundhouse With Crane Service

Denver & Rio Grande R. R.

(CONCLUDED FROM PREVIOUS ISSUE)

THE roundhouse has a span of 92 feet 5 inches measuring from the center line of door columns to the outside face of the roundhouse wall. The distance from the center of the turn table to the center line of door columns is 117 feet 2½ inches. The inner bay is 31 feet wide between centers of columns, the intermediate bay is 29 feet 4 inches and the outside bay is 32 feet 1 inch, measuring from the center line of columns to outer face of wall.



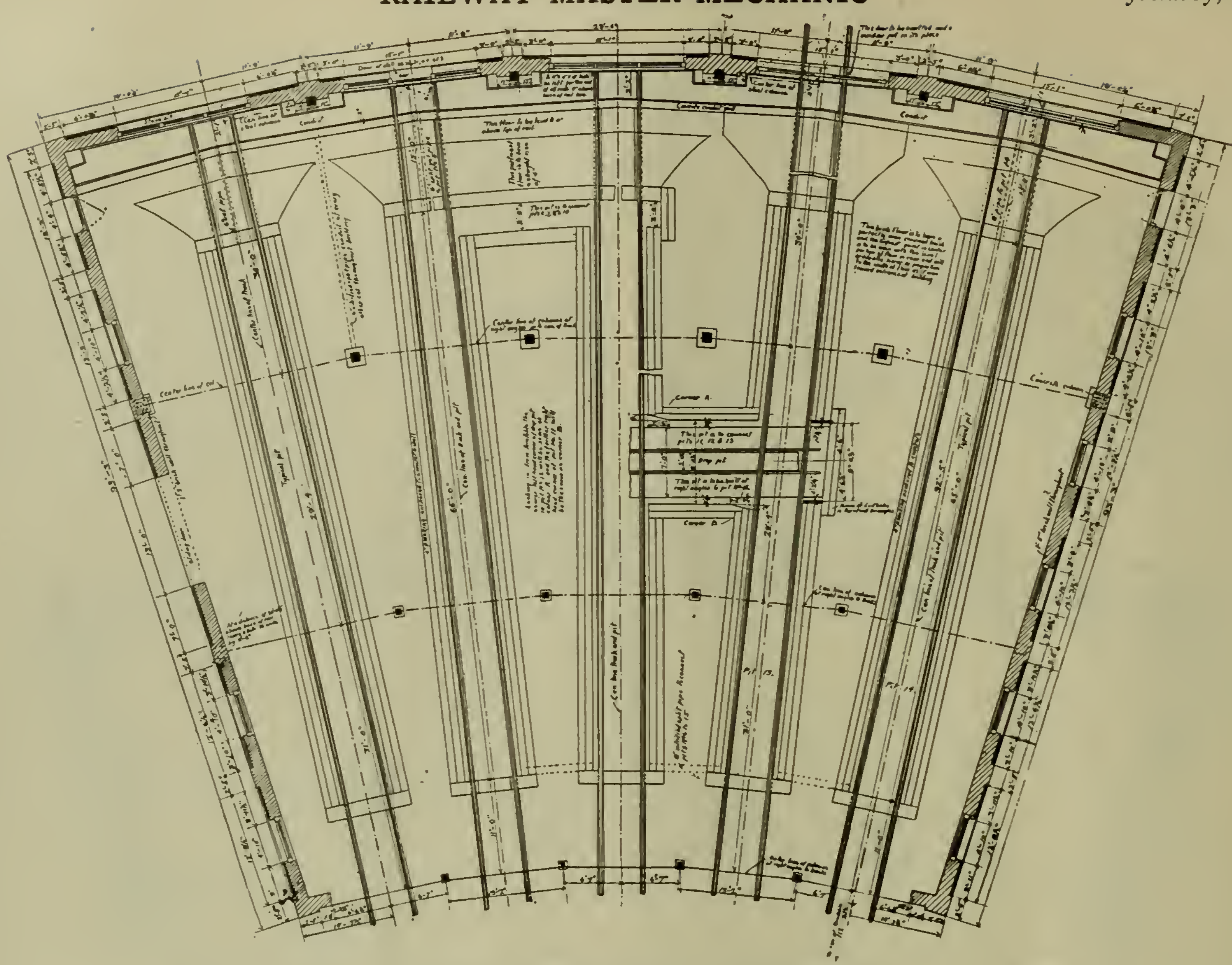
PART OF FOUNDATION PLAN—PUEBLO ROUNDHOUSE, D. & R. G. R. R.

The round house is served by an 80 foot turn table. The end walls of each section are well supplied with glass windows, a feature unusual in general round house construction. The outer wall is also well provided with large glass windows so that ample day lighting is provided throughout the round house.

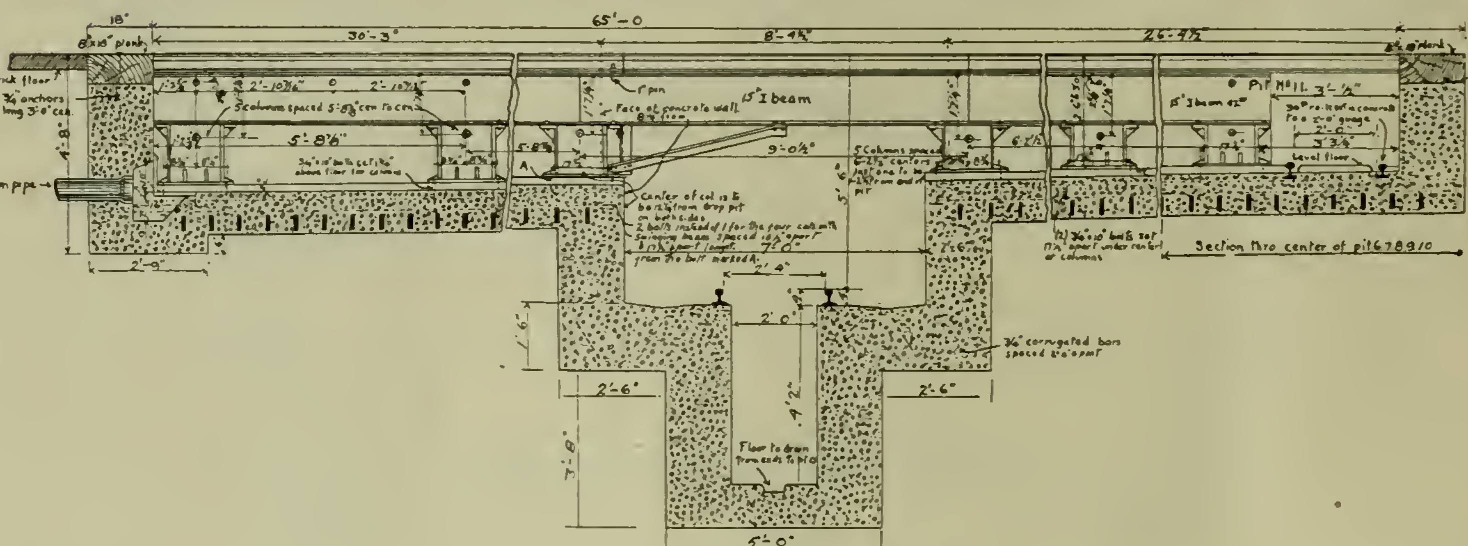
The walls of the round house are of brick, 1 foot 5 inches wide supported on concrete foundations 1 foot 9 inches wide. The outer circle of the round house is encircled by a concrete conduit for carrying steam, air and water pipes. These pipes, with the exception of the steam heat piping system, are led from conduit to columns between alternate pairs of pits by 6 inch vitrified pipe.

The locomotive repair pits are of novel construction. They are entirely of concrete, the side and end walls being 18 inches thick and the bottom of the pits being 14 inches thick. Longitudinally the pits incline towards the turn table having a drop of 6 inches in the length of the pit. They are 3 feet deep at the outer end and 2 feet 6 inches deep at the turn table end. Extending the full length of the pit is a gutter 8 inches wide by 2 inches deep. Transversely the bottom of the pit is level. The gutter drains to a pocket, or sump, in the turn table end of the pit and this in turn is drained by a 4 inch cast iron pipe connected with the sewer system.

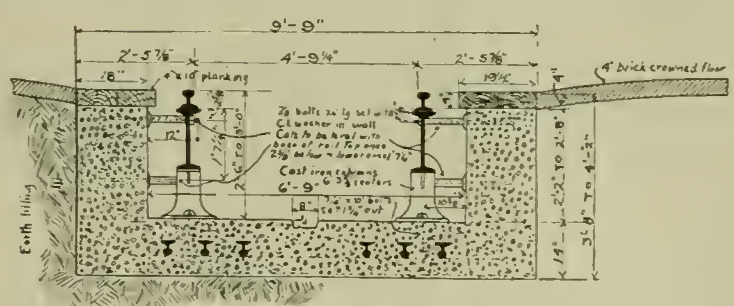
The walls of the pit are surmounted by planking 4 inches thick, this planking being provided for facility in jacking locomotives. The pit is 6 feet 9 inches wide between inside faces of wall. The rails are set to 4 feet 9¼ inch gauge and the inner face of the ball of each rail is 12 inches from the inner face of the side wall. The



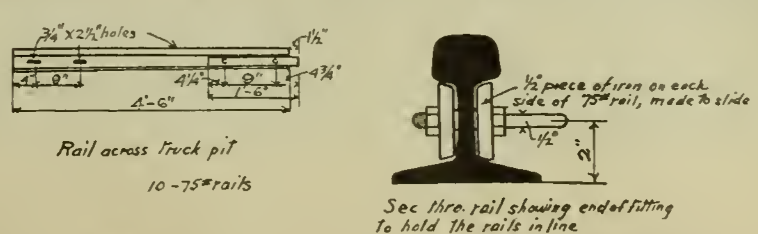
FLOOR PLAN OF HIGH PORTION INCLUDING DROP PIT—PUEBLO ROUNDHOUSE, D. & R. G. R. R.



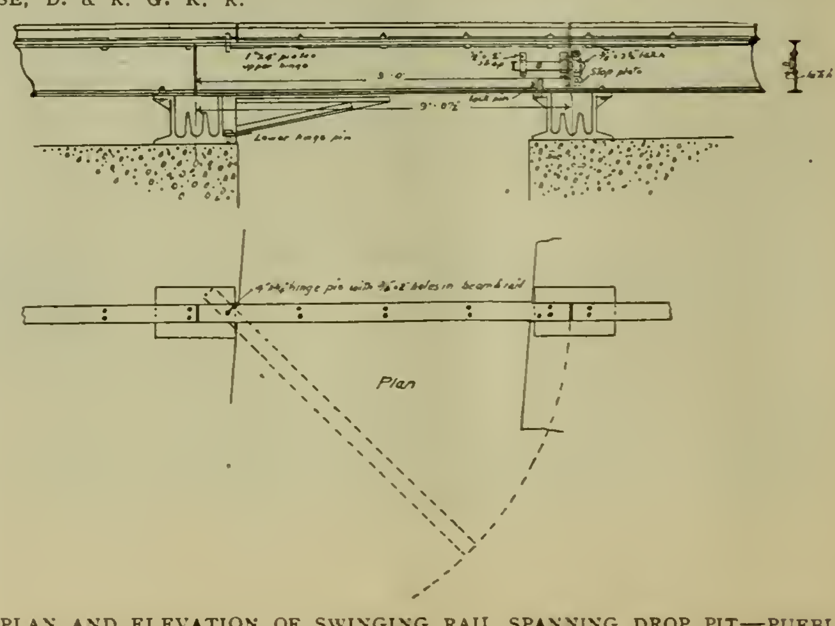
LONGITUDINAL SECTION OF PIT, INCLUDING SECTION TOWARD TURN TABLE, SECTION OF DRIVING WHEEL DROP PIT AND SECTION OF TRUCK DROP PIT—PUEBLO ROUNDHOUSE, D. & R. G. R. R.



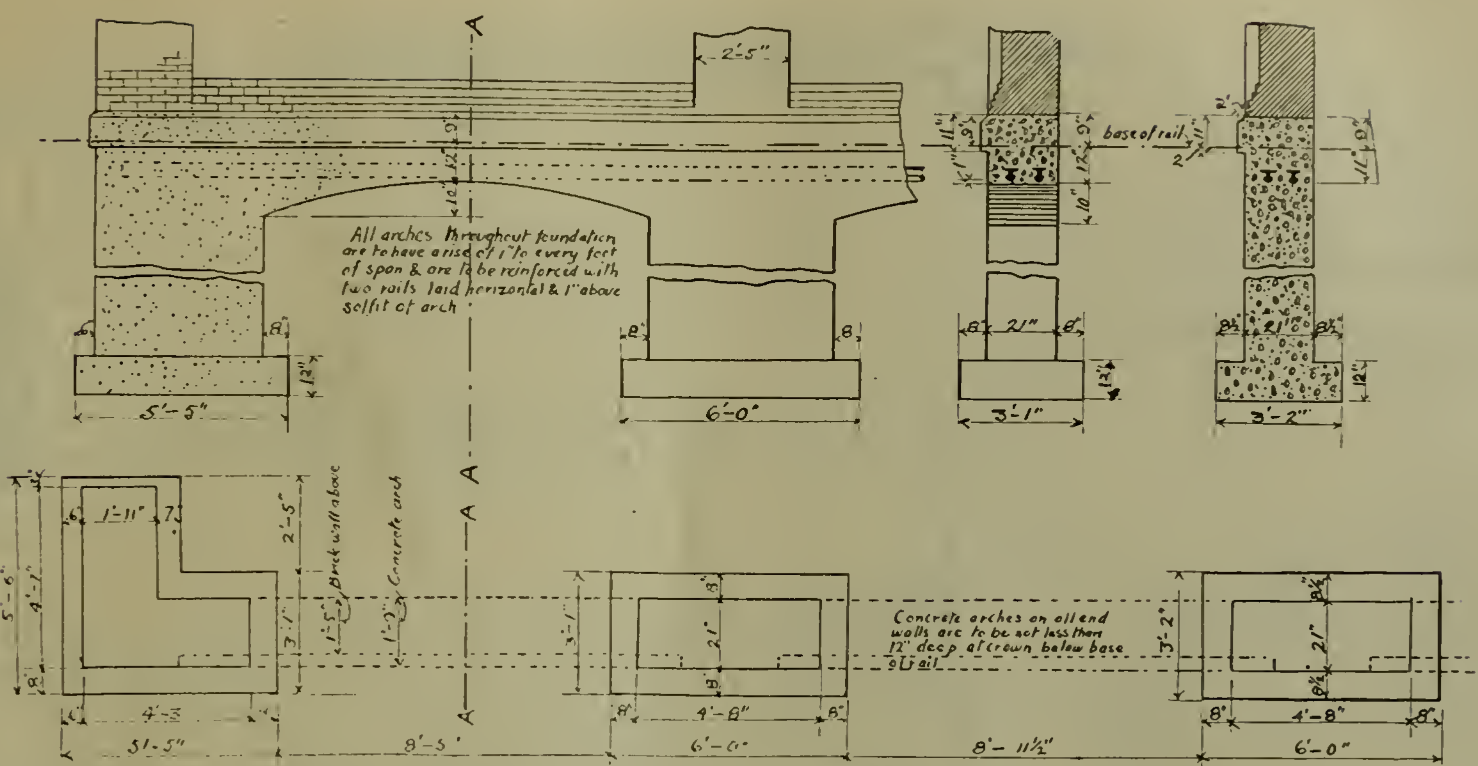
TRANSVERSE SECTION OF PIT—PUEBLO ROUNDHOUSE, D. & R. G. R. R.



METHOD OF SECURING DROP PIT RAILS—PUEBLO ROUNDHOUSE, D. & R. G. R. R.



PLAN AND ELEVATION OF SWINGING RAIL SPANNING DROP PIT—PUEBLO ROUNDHOUSE, D. & R. G. R. R.



DETAILS OF CONCRETE FOUNDATION—PUEBLO ROUNDHOUSE, D. & R. G. R. R.

rails are carried on 15 inch, 42 lb. beams supported by cast iron pedestals arranged on 5 feet 8⅞ inch centers. The center line of the pedestals is 10⅝ inches from the face of the side walls. The iron beams and pedestals are anchored to the side walls by ⅞ inch bolts, 28 inches long, set with cast iron washers in the wall. Imbedded in the concrete floor immediately beneath the pedestals are three rows of rails extending the full length of the pit and arranged with balls down, to give greater rigidity to the foundation of the pedestals. These are 30 to 40 lb. rails arranged with broken joints, and no joints are within 24 inches of center of columns. These rails rest on ⅞ inch by 4 inch scrap bars arranged transversely with the length of the pit and on 8 inch centers.

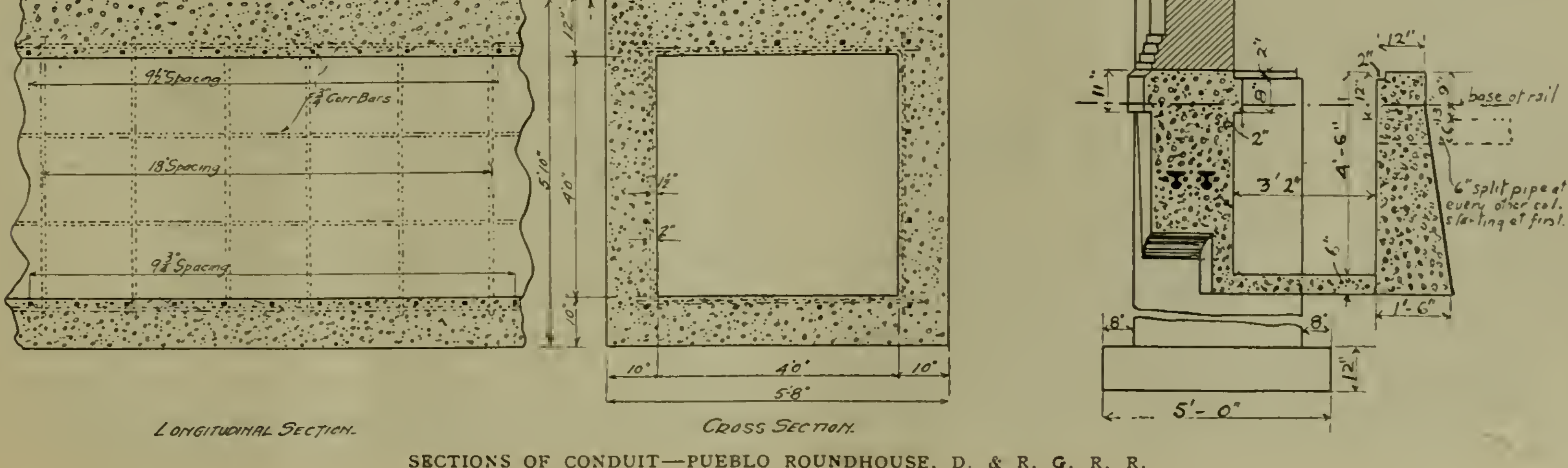
To support the planking surmounting the pit walls, beveled sleepers 4 inches by 4 inches flush with the top of the concrete are laid on 3 foot 2 inch centers and under every fourth sleeper is placed a vertical piece flush with face of the concrete.

Pits No. 11, 12 and 13 are connected by a pit drop which is arranged at right angles to pit No. 12, the drop pit being built on straight lines. The tracks and supporting beams spanning the drop pit are arranged to swing from one end as shown in the plan drawing illustrating the drop pits. This method applies to both rails of the central pit and inner rails of the outer pits. The outside rails of pits 11 and 13 are arranged to slide to one side as is common practice.

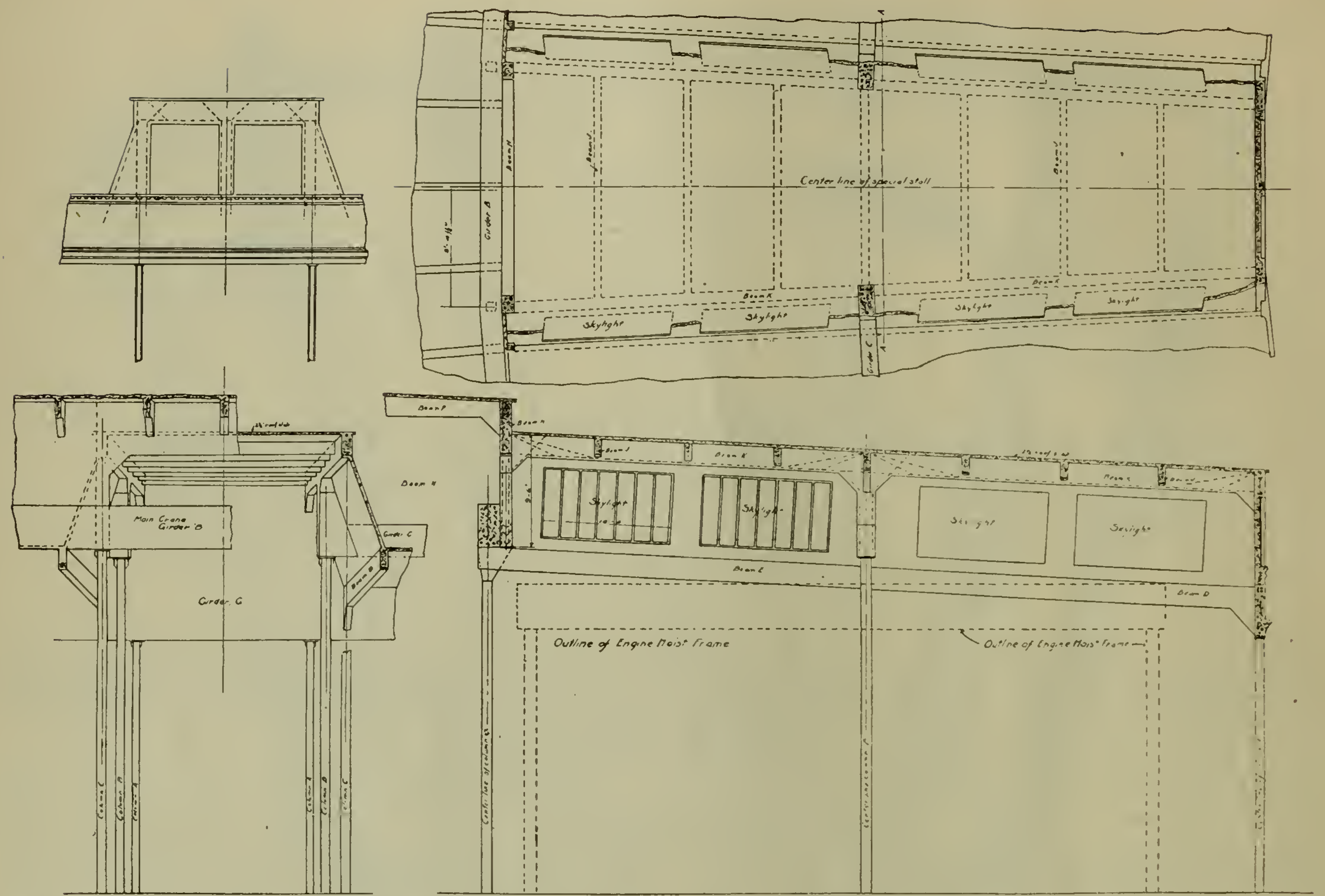
A portion of the pit wall at the juncture of the erecting pit and the drop pit are cut away as shown to allow beams to swing. Two iron slabs ½ inch wide and 18 inches long and arranged on opposite sides of the rail web, are used to secure the rails in position when the spanning tracks are in line. Details of this device are shown in the accompanying line drawing.

The rails for the transfer of the drop pit jack are set on 2 feet 4 inch gauge. The top of these rails is 5 feet 6 inches below the top of the pit rails. The pit for the jack cylinder is 4 feet 6 inches below the top of the jack rail. The drop pit is 7 feet wide. The pit is of concrete of similar construction to the erecting pits. Jacks for the driving wheels and truck drop pits are operated by compressed air.

Pits No. 6, 7, 8, 9 and 10 are arranged with drop pits for moving engine truck wheels and the pit connected with the several stalls is constructed on circular lines on a radius with the center of the turn table as a center. The rails for the transfer carriage are imbedded in con-



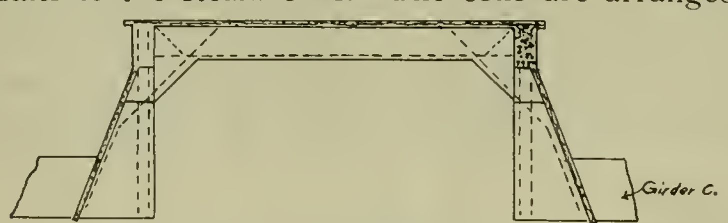
SECTIONS OF CONDUIT—PUEBLO ROUNDHOUSE, D. & R. G. R. R.



CROSS SECTION OF STALL, PLAN OF ROOF OVER ENGINE HOIST, ELEVATION AND END OF STALL LOOKING TOWARDS TURN TABLE AND LONGITUDINAL SECTION THROUGH STALL, INCLUDING ENGINE HOIST FRAME—BURNHAM ROUNDHOUSE, D. & R. G. R. R.

crete and are set on a 2 foot gauge. In the accompanying line drawing is shown the longitudinal section of the erecting pit. The cross sections of the driving wheel pit and engine truck wheel pit are shown in the same drawing.

The roundhouse is heated by direct steam radiation. Steam is supplied from the power house and the steam connections are led around the inside of the outer wall of the house through the concrete conduit and from this conduit supply pipes are led through short vitrified pipe conduits to the steam coils. The coils are arranged on



SECTION A A, SHOWING RODS AND BEAMS — BURNHAM ROUNDHOUSE, D. & R. G. R. R.

the walls of the pits outside of the pedestal and beams supporting the rails so that they are entirely protected from damage, and heat from the coils rises between the wood coping and the rail.

Artificial light is provided by incandescent electric lamps placed on the outer wall and on each column, stationary and extension sockets being provided in every case. Feed wires are run around the top of the columns and under the crane girders along the outer wall. Iron conduits are provided for connection to the sockets and the sockets are arranged at a height of about 7 feet from the floor.

The round house floor is of brick and has a perfectly even finish. The highest point in the center is even with the level portion of the floor in the rear of the house and gradually lowers in proportion as it extends towards the end of the building.

In the construction of girders, beams, etc., expanded metal of 10 inch gauge and 3 inch mesh is used. The rods used in connection with this construction are the St. Louis Expanded Metal Company's corrugated bars. The concrete is one part cement, three parts sand and six parts stone. The roof slabs are 2½ inches thick of a composition averaging about one part cement, two parts sand and four to five parts of broken stone and fine gravel.

At Burnham, a suburb of Denver, a roundhouse is being erected which is practically of the same construction as the high section of the Pueblo house. However, at Denver there are 30 covered stalls. The roof of one stall over the inner bays of the house is raised to provide for the care of a locomotive hoist. The radius of the inner circle of the Burnham house is 141 feet 5 inches instead of 117 feet 2½ inches as at Pueblo.

For the illustrations presented, we acknowledge the courtesy of Mr. J. R. Groves, past superintendent of motive power and car department, and Mr. Arthur Ridgway, acting engineer of bridges and buildings.

Freight Car Repair Facilities

THE preceeding issue of the RAILWAY MASTER MECHANIC contained an editorial advocating better repair and maintenance facilities, as tending toward the greater earning capacity of freight cars generally, by reducing to a minimum the time necessary for cars on the bad order track. Several mechanical officials have expressed themselves with regard to this editorial and most of them hold the opinion that a greater saving could be obtained by the introduction of more adequate facilities for repairing freight cars.

That too often facilities for repairing freight cars are overlooked in consideration of what may appear, to some managers, as the more important features, and that this is a mistaken idea, in that he considers the freight cars the greatest source of revenue, is the opinion of one master car builder.

Another master car builder says, I am of the opinion that railroad companies could afford to spend hundreds of thousands of dollars in providing proper facilities for freight car repairs, both on account of the economy that would be attained, as well as the expedition in getting cars into service.

A superintendent of motive power writes, it would seem that the economy and advantage of maintaining the number of bad order cars at a minimum could not be over-estimated, and yet to endeavor to keep them on a too low percentage and insist on this would result in an enormous increase in the cost of repairs. Bad order cars (including heavy, light and running repairs), where every car that is on the repair track is counted at a certain time each day, should be not less than four or five per cent of the total cars owned. The profits of managing a railroad company accrue from the economical handling of freight business,—that is, by means of the freight car, and notwithstanding the large number of freight cars owned and the enormous investment in same, as a rule they receive less attention than any other part of the railroad. The facilities afforded for the repairs of freight equipment are, in most cases, totally inadequate. One of the most inviting economies of economies of present day railroading would be to furnish ample facilities for the care and repair of freight equipment and to giving it the same care and economical management as the other parts of the railroad.

While the track facilities for repairs to freight cars on the railroad with which this official is connected, are considered unusually generous, work has been commenced on a large modern car shop, which will add still more to the capacity of the car department. This shop will be equipped with modern tools and facilities for repairing all classes of equipment, including steel cars.

In discussing the earning capacity of a freight car a superintendent of machinery quotes a few figures which are pertinent to this subject. His road is considered a conservative operating system, but earned in freight traffic last year $27,732,625, equivalent to $76,000 per day. It had 32,000 freight cars in revenue service all of this time which average about $2.40 or $2.50 a gross earning power per car per day.

This official continues in reference to large systems of railways that cover a great territory. The bad order cars will accumulate in different territories in different times of the year. If you build large repair shops at one end of the line they will not care for the cars at the other end and vice versa. He thinks as a general rule railroad companies look to the repairing facilities with a great deal of care, but during the last four or five years of prosperity railroad companies have not been able to keep their freight car repair facilities equivalent to their demands.

Other opinions which are of much interest in discussing this subject are contained in the following communications:

Editor, Railway Master Mechanic:

While the conditions mentioned in your editorial on freight car repairs may apply on many roads, they don't apply to some railroads in this territory—at least for the one of which I have the best personal knowledge, I can say that the present management has always appreciated and recognized the importance of prompt handling of the car repairs.

While the traffic and transportation conditions existing all over the country seems to have a tendency to little by little delay and decrease the average miles run per day for freight car equipment of all kinds, yet on the road referred to the condition of freight car repairs has been kept for several months in such shape that the average number of cars requiring repairs each evening has not been quite as large a number as would be repaired the following day.

There is one important question in connection with freight car repairs that is not touched on in your article which has a great deal to do with the delay in making freight car repairs, and that is the use of special designs of detail parts, which when broken or damaged, and requiring renewal, cannot ordinarily be found in stock, and can only be obtained after long delays.

Yours truly,
R. P. C. SANDERSON,
Supt. Motive Power,
Portsmouth, Va. Seaboard Air Line.

Editor, Railway Master Mechanic:

The subject which you have in mind, as evidenced by your editorial on freight car repair facilities, is quite an extensive one. I think there is as much distrust among railroad officials, generally speaking, as among prominent politicians, and it is on account of their feeling of distrust and also that one railroad will reap a greater benefit than the other, that we find in a great many transfer yards and railroad yards and railroad companies' yards, if not all, the very worst condition imaginable. There are many transfer yards in this country, and in so far as needed economy is concerned, we may call them neglected gold mines in which the railroad companies refuse to dig.

An up to date railroad freight terminal is one with every facility for freight car repairers, separate and apart from all other shops, having a mill of sufficient size to meet the demands, and the mill located centrally with the repair tracks. By such an arrangement a vast amount of money could be saved, not only for the company having the car but for the company owning the car.

The true principle of railroading is to keep a car moving forward to its destination, if safe to run, and if a transfer is the destination and the car is safe to run, it should go forward, and when unloaded at the transfer or railroad yards, as the case may be, they should be in position to make repairs to the car and charge the same to the owners, thereby saving the expense of sending the car home light.

As I said at the beginning, there is too much distrust among railroads and they are all standing in their own light for true economy. I know that many cars are allowed to go to transfer yards because they are safe to run, and at the same time they are needing repairs, and owing to the fact that the transfer yards or the railroad yards are not in position to make repairs economically, the cars are sent to the owners of car, and if car is owned by one of the roads running into the transfer, they will have to haul the car at least eight or ten miles to the owners for repairs. When we consider the enormous number of cars handled at the transfer yards, is it not surprising that railroads are so neglectful of these gold mines which are under their own care? But here comes again the old feeling of distrust and as a result they drum away in the same old rut and wonder why it costs so much to keep cars in repair.

These are plain every-day requirements and can be seen possibly in hundreds of places in the United States, and it is safe to say there is no business which can be entered into that would yield as rich returns as an up to date railroad yard and transfer company's repair yard. It is well said that "a penny saved is worth two earned," but here is a description of conditions where railroad companies refuse to save and at the same time subordinates are being pounded on the back over expenses, and that subordinate who is receiving such a pounding, knows full well where most of the trouble lies, but he is one of those weaklings who may possibly have a mind of his own but has a fear of expressing it.

When there is a relapse in trade, the first move that is made is to cut down the forces. This is the general practice. It is when a relapse of trade comes that the opportunity is given to the shops to catch up on repairs, and the wise railroad man is the one who will set apart a portion of his earnings in good times so that he can run his shops in hard times, make his repairs and be ready for the hum of trade when it comes again.

John Tonge,
Master Mechanic,
Minneapolis, Minn., Minneapolis & St. Louis R. R.

Editor, Railway Master Mechanic:

I have read your editorial on "Freight Car Repair Facilities" and fully endorse your views as to the importance of better facilities for doing such work, than are generally provided in freight car repair yards.

It is clear that a car out of service earns little or nothing, while a car in transit is the one upon which the road depends for earnings.

On most roads the freight cars held for repairs each day average from two to three per cent of the total equipment owned, but if the "bad orders" increase to over three per cent, the situation becomes serious and calls for special attention.

The importance of good facilities for repairing freight cars is, as you say, quite generally underrated, and the loss of car service to the railroads which is caused by the poor facilities cannot be accurately estimated, but amounts to an immense sum of money.

Among the items of most importance for the prompt repairs of freight cars are, a sufficient supply in convenient locations, of all standard kinds of car repair material, such as bolts, castings, mounted wheels, framed timbers, etc.; it is almost equally important to have good facilities for handling material between the point of storage and the cars to which the same is to be applied. For this purpose narrow gauge material tracks with push-cars running between the car repair tracks are exceedingly useful, and not very expensive. There are various handy devices for moving such heavy material as draw-bars, journal boxes, car wheels, and also the heavier tools, such a jacks,—many of which have been illustrated in the technical papers.

It is a rare thing to find a gang of car repairers fully equipped with the right kind of tools to do their work to the best advantage, as they almost always lack a sufficient number of suitable jacks, air boring machines, or even of wrenches or similar small tools, the first cost of which could be saved every day. The capacity of a car repair track which turns out more than eight or ten cars a day will be very largely increased by furnishing a few wood-working machines, with the necessary power to operate them, the most essential being a rip-saw, cross-cut saw, and boring and mortising machine. I know of one instance where such tools were furnished to a repair gang turning out fifty to seventy-five cars a day, and the consequent increase in the output represented an addition of at least ten or fifteen men to the force, and also caused a reduction in the average time required per car for repairs.

A blacksmith fire near the repair track for straightening bent brake connections and other odd jobs, will save a great deal of loss of time both to the car repairers and to the cars, unless the main blacksmith shop is very near the repair yard.

A sufficient supply of compressed air has come to be one of the most essential requisites for prompt car repair work, as it is generally used for boring, and, frequently for jacking up cars.

The prompt switching of repair tracks and removing of finished cars and replacing them with bad order cars is most important and should be done at such times as it will interfere least with the car repair gang.

Freight repair sheds are generally furnished throughout the south for protecting car men from the sun, but are seldom seen in the north where they would be fully as useful in protecting the men from rain, snow and wind storms. There are many places where such sheds would enable men to work instead of going home during bad weather, and thereby shorten the time cars are held for repairs.

A system of air pipes installed throughout freight repair and switching yards will save much loss of car service, besides insuring greater safety to trains on the road, but very few yards are so equipped..

There are not many places on a railroad where a comparatively small expenditure will bring such large returns as in providing better facilities for freight car repair yards.

Yours truly,

Chicago, Ill. M. K. Barnum.

Wall Cranes in Locomotive Erecting Shop

Pennsylvania Railroad

THE crane service of a shop not only provides convenient equipment for handling and transferring heavy material, but is further a potent factor in the shop organization. The crane equipment largely affects the output of a shop and whether the shop is provided with but a single crane to serve the entire floor, or whether the floor is served by several cranes, careful management of the cranes and good judgment in their use are essential to the efficiency of the shop organization.

In the case of the single crane, proper management provides for its service for such work only as is absolutely necessary in the movement of the heavy parts, arranges for its operation in the best interest of the shop as a whole and secures order instead of chaos in the routine work.

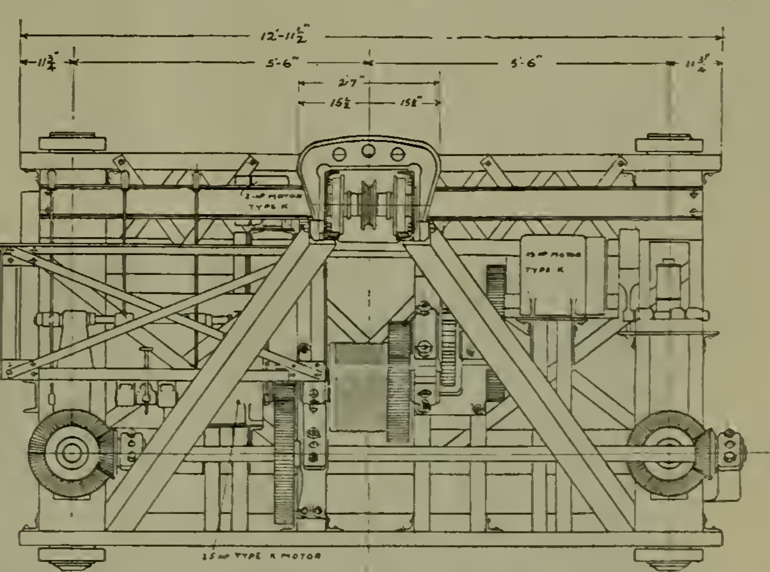
In longitudinal locomotive shops, the erecting floor is commonly served by two or more cranes operating on the same level. In transverse locomotive shops the erecting floor is frequently served by two cranes operating on different levels. In such cases the upper crane is of sufficient capacity to lift a locomotive and transfer it above others standing on the floor, while the crane on the lower level is usually of about ten tons capacity and is used for lifting and transferring the lighter parts of a locomotive, wheels, etc.

Unless the cranes are properly governed and the work on the floor is arranged to provide for their consistent movement, they are apt to interfere and the lighter crane might easily be blocked within a comparatively small territory and thus its usefulness will be limited temporarily.

The same argument holds good with regard to the interference of two cranes on the same level serving the longitudinal erecting floor, and when both cranes are in use as in wheeling or transferring a locomotive, the erecting floor is deprived of crane service temporarily for general work.

It therefore seems of advantage to provide a system of crane service in which the cranes for heavy work will not interfere with the cranes of lighter capacity and in which the latter will not be limited to a small territory on account of being intercepted by the hoisting ropes and hooks of the former.

A very practical plan for operating such a system has been developed in the new Altoona erecting shop of the Pennsylvania railroad. The erecting tracks are arranged longitudinally and there are three tracks extending the full length of the shop. Locomotives enter and leave the shop on the center track, on which they are unwheeled



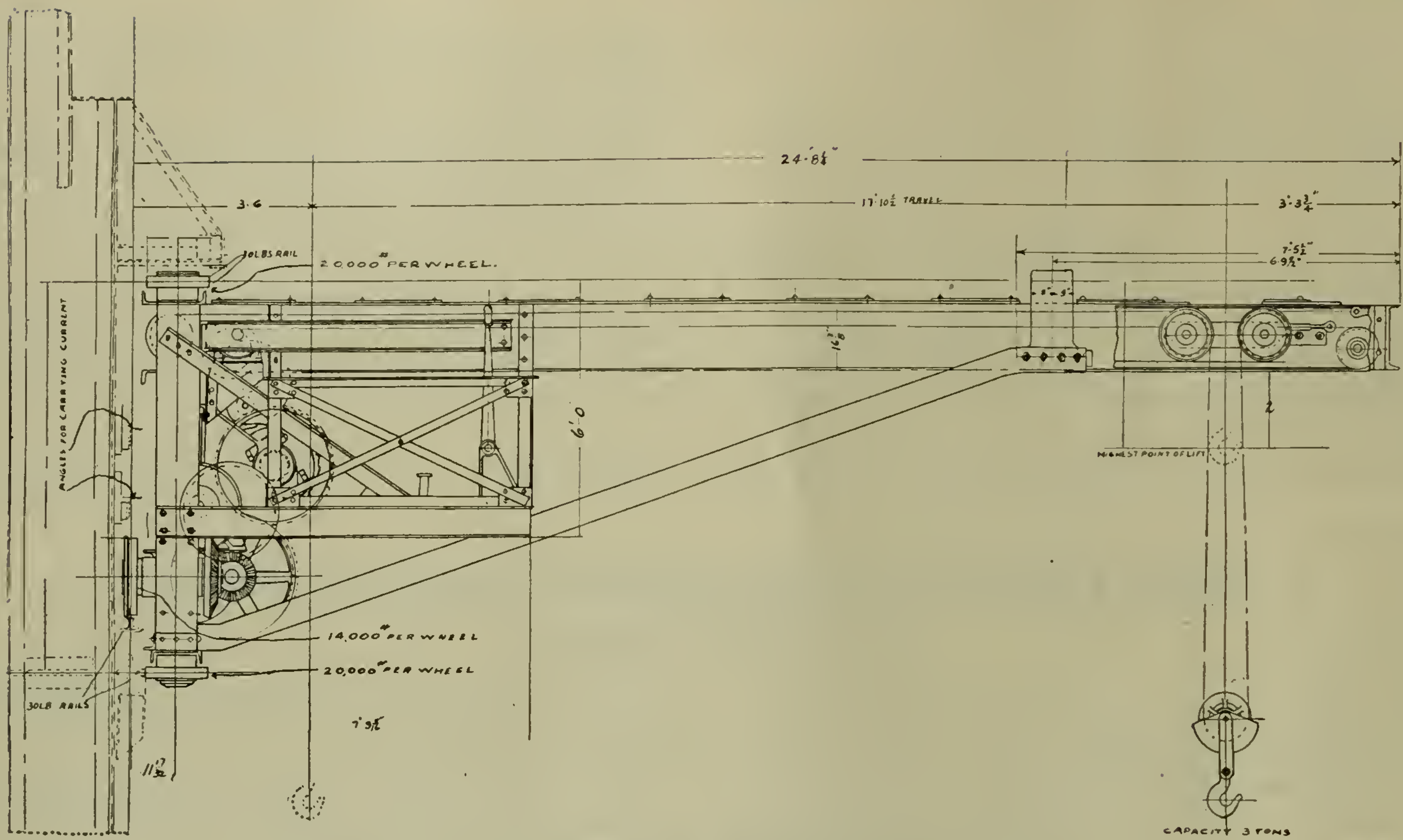
END ELEVATION OF WALL CRANE IN NEW ERECTING SHOP AT ALTOONA — P. R. R.

and stripped upon entering and rewheeled after repairs have been made.

Locomotives are transferred from the center track to the desired location on one of the other tracks by two traveling cranes, each of 130,000 lbs. capacity.

To provide for handling the various lighter parts requiring crane service, the two side tracks are served by wall cranes operating on a level below the girders of the heavier cranes. Each side track is served by three wall cranes, each of 4,000 lbs. capacity.

The length of each crane arm is such as to serve both sides of a locomotive conveniently and at the same time there is sufficient space between the end of the arm and a locomotive standing on the center track, to allow a locomotive being transferred by the heavy cranes to pass



SIDE ELEVATION OF WALL CRANE IN NEW ERECTING SHOP AT ALTOONA—P. R. R.

between the center row of locomotives and the wall cranes without interference.

Such an arrangement allows a free scope for the cranes in both light and heavy service. The work of one set of cranes is allowed to continue without limiting the operation of the other and the congestion of crane service sometimes experienced on account of the limitations provided by both sets of cranes spanning the entire width of the floor, is obviated.

The accompanying half-tone engravings illustrate very clearly the arrangement of the cranes and the layout of the erecting floor. One of the photographic reproductions illustrates a wall crane immediately beneath one of the cranes of heavier capacity, and at the right of this

WALL CRANES IN NEW ERECTING SHOP AT ALTOONA —P. R. R.

GENERAL ARRANGEMENT OF ERECTING FLOOR SERVED BY HEAVY TRAVELING CRANE, AND WALL CRANES AT ALTOONA SHOPS, — P. R. R.

illustration may be seen a portion of the sling for lifting the front end of a locomotive. The other half-tone illustrates three of the wall cranes which serve one erecting pit.

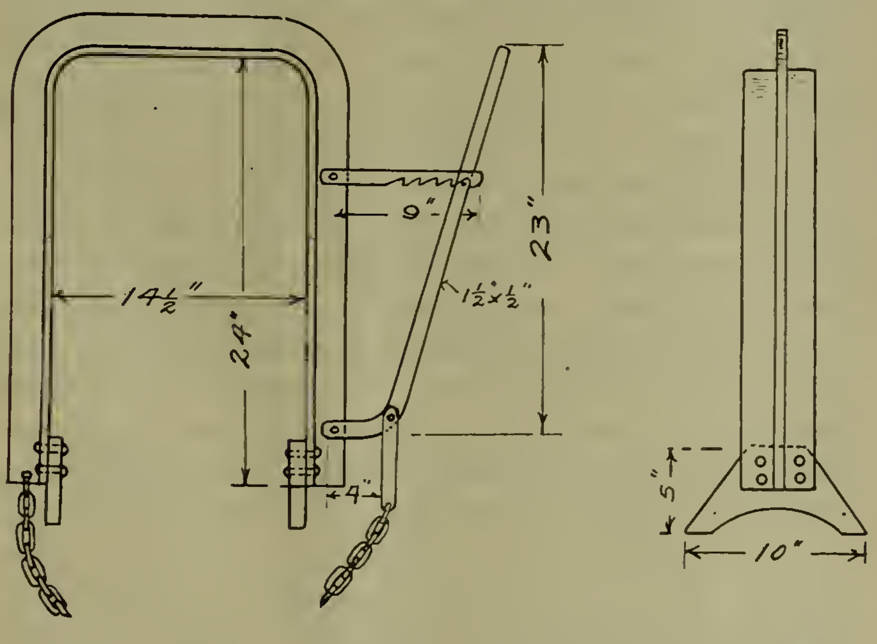
The design and construction of the wall cranes are shown by the accompanying line drawings. They were built by the Morgan Engineering Company of Alliance, Ohio. The large travelling cranes in this shop were built by the Case Manufacturing Company, Columbus, Ohio.

"Holder On" for Drilling Boilers

FOR drilling holes in boilers on the erecting floor, a very practical and convenient "holder on" has been devised at the Collinwood shop of the Lake Shore and Michigan Southern Railway. This attachment is illustrated by the accompanying sketch and its purpose is very readily evident. Because of the impracticability of attaching a drilling brace, or "old man," to the side of the boiler, to secure a drilling machine, the work of drilling holes in a boiler, under ordinary circumstances, is very inconvenient.

To facilitate this work and provide a method of securing a drill, this "holder on" has proved very successful. It is made of 3 by 3 by 3/8 inch T iron, bent in the form of a U, with a pair of braces, or feet, riveted on to steady the device and maintain it in an upright position. It is secured to the side of the boiler by a chain passed around the barrel and a lever attachment draws the chain taut to secure rigidity. This device is simple in construction, economical in cost and is very serviceable.

We are indebted to Mr. Le Grand Parish, superintendent of motive power, for the sketch and description.



"HOLDER ON" FOR DRILLING BOILERS—COLLINWOOD SHOP, L. S. & M. S. RY.

The man who confines his work and thought strictly to his profession cannot possibly expect to work into higher executive positions. The work of constructing and operating railways involves such great diversity of problems that unless a man has the capacity to work and think in directions other than his profession, and unless he has a decided interest in all of the other important questions outside of his profession, he cannot hope to get beyond the confines of his professional field.—S. P. Bush, in Stevens Institute Indicator.

Mr. George W. Smith has been appointed traveling fuel inspector and general traveling fireman of the Chicago Milwaukee & St. Paul, with headquarters at St. Paul, Minn.

Combustion of Fuel in Relation to Locomotive Firing

(Third of a Series of Articles on this Subject.)

MOST substances can, by proper methods, be separated into two or more substances of a simpler nature, and these can again be separted into still simpler means, which cannot be further separated or decomposed by any means known. Such substances as cannot be decomposed into simpler ones are called elements. Although there are thousands of different substances, they are really made up of a comparatively small number of elements. There are but sixty or seventy elements that are known, and a large number of these are rarely met with. The following is a list of a few of the more common elements, the letter or letters after each name being the "symbol" of the element: Oxygen, O; Hydrogen, H; Nitrogen, N; Carbon, C; Sulphur, S; Tin, Sn; Copper, Cu; Lead, Pb; Zinc, Zn; Silver, Ag; Gold, Au; Mercury, Hg; Nickel, Ni; Aluminum, Al; Platinum, Pt. The elements, oxygen, hydrogen, and nitrogen, are gases at ordinary temperatures. When two or more elementary substances combine chemically, they form what is known as a compound substance. For example:—Water, being composed of hydrogen and oxygen, is a compound substance.

Carbon is the main element of organic nature, whether animal or vegetable. Every living thing, from the smallest to the largest animal, and from the moss to the largest tree, contains this element as a most necessary part of its structure. It is found not only in living things but in their fossil remains, such as coal. In the uncombined state, pure carbon is found in the two very different forms: as first, diamond; second, graphite or plumbago. Carbon also occurs more or less pure in lamp-black, charcoal, coal and coke. In this condition it is porous, absorbs gases, is valuable as a disinfectant, and as charcoal, coal or coke, it is used as a fuel and burns in ordinary air at temperature corresponding to the red heat of iron.

Oxygen is the most widely distributed element in nature, and it exists in very large quantities. It forms between forty and fifty per cent of the solid crust of the earth, eight-ninths of the water, and about one-fifth of the air. Oxygen is an invisible, tasteless gas and has no odor. It is slightly heavier than air. For equal volumes of air and oxygen, the oxygen will weigh 1.1066 times as much as the air. Under very high pressure and a very low temperature it becomes a liquid. Oxygen is necessary to animal life and combustion; without it for breathing purposes, all animals would die, and as it is the element which supports combustion, nothing could burn without it.

Hydrogen is found in nature in large quantities, and very largely distributed. It forms one-ninth the weight of water and it is contained in all substances which enter into the combination of plants and animals. Hydrogen is a colorless, tasteless gas, and has no odor. It is the lightest known substance, being fourteen and one-half times lighter than air and sixteen times lighter than oxygen. In order to burn hydrogen, it must, like wood and other combustible substances, be heated to the kindling temperature before it will ignite or take fire. The hydrogen flame is colorless or very slightly blue. When hydrogen burns it combines with oxygen and forms an invisible gas, which, when condensed, will be found to be ordinary water. Hydrogen forms about fifty per cent of coal or illuminating gas, or about one-half of the gases distilled from the coal in the firebox.

Nitrogen is a gas which has neither color, taste nor smell. It will not support combustion, neither will it burn. The air is composed of about twenty-one per cent of oxygen and seventy-nine per cent of nitrogen. An animal would die if compelled to breathe simply nitrogen, for the reason that it will not support respiration. It is very useful in the air, however, as it dilutes the oxygen, thus making the process of combustion less active than it otherwise would be. Its usefulness lies not in what it does itself, but in its preventing the oxygen of the air doing too much. If the proportions of oxygen and nitrogen were reversed, most substances now used as fuel would be destroyed by oxidation, (slow combustion or rusting) before they could be utilized in combustion, and the air entering our lungs, would, simply by too rapid combustion, shorten rather than lengthen our lives.

The element sulphur, is a yellow, brittle substance, which is almost colorless at fifty degrees F. below zero. It melts at 114½° F., forming a thin, straw-colored liquid. When heated to a higher temperature, it becomes darker and darker in color, and at 250° F. it is so thick it will not run. At 448.4° F. it boils and is then converted into a brownish yellow vapor. Sulphur is found as an impurity in most kinds of coal and by acting as a flux on other impurities of the coal it aids in forming the troublesome "clinker."

Water is made of two parts of hydrogen to sixteen parts of oxygen, by weight, or, by volume, two volumes of hydrogen to one of oxygen.

Air is the gaseous substance which fills the atmosphere surrounding the earth. It has no color, taste or smell. It is made up by weight, of oxygen 20.61 parts; nitrogen, 77.95 parts; carbondioxide, .04 parts, and water 1.4 parts and a slight trace of a newly discovered gas called Argon, of which little is yet known. Air is never perfectly dry, but always contains a varying amount of water vapor. It is estimated that the air or atmosphere extends to a height of from fifty to 200 miles. By virtue of its weight it produces a pressure in all directions at the sea level of 14.7 lbs. per square inch, or about one ton per square foot. 13.6 cubic feet of air at 60° F. weighs one pound.

Combustion is a word applied to any action whereby the element oxygen combines with any other element. Combustion is ordinarily understood to mean the act of buring fuel, such as wood, coal, etc. Quick combustion or ordinary burning, is simply oxygen of the air combining rapidly with the carbon or gases of the fuel.

Oxygen will not combine readily with other elements at ordinary temperatures, and in order that they may combine rapidly, their temperature must be raised to what is called their burning or kindling temperature. If this were not the case combustible substances would immediately burn up, as the air contains a sufficient quantity of oxygen for this purpose. If a piece of wood or coal is put on the fire, it will not burn until the temperature with which it combines rapidly with oxygen is reached, when it combines to burn. Watch a stick of wood burning and it will be seen that the fire creeps slowly along it. The reason for this is that only the portion of the stick nearest the burning part becomes heated to the kindling temperature. Different kinds of fuel have different kindling temperatures; a fact which should be remembered.

Coal gas will not burn below a temperature corresponding to the red heat of iron, and carbon has a still higher kindling temperature. The hydro-carbon gases given off from coal when burning, require for combustion a temperature corresponding to the cherry heat of iron. In order to burn coal it must be kept at a higher temperature still. The active portion of a fire in a firebox is constantly giving off gases from the fuel which require a high temperature for their combustion. Where these gases are burned in the firebox they give off a great deal of heat, but when the temperature of any part of the firebox is so low that the gases pass away unconsumed, there is a great waste of heat, and extra coal must be used to make up for this waste. A fireman, therefore, should never let the temperature in any part of the firebox fall below the kindling temperature of the fuel and the gases given off by it. It is a mistake to think that the temperature of a firebox is always hot enough to give complete combustion. Cold air coming through a thin fire may not be heated to the proper temperature, and when it touches the gases in the firebox it chills them, reducing their temperature below the kindling point and they pass off unburned. If "a heavy fire" be given, the cold material chills the gases given off by the hot fire beneath and they pass off unburned in the form of smoke and coal gas. The firebox sheets carry away the heat of the coal next to them so quickly that the gases given off in those parts of the firebox are liable to be wasted unless the fireman keeps a bright fire in the vicinity of the sheets.

It is to be remembered that a body gives off light only when heated to a sufficiently high temperature. The question naturally follows, is there any difference between the quantity of heat given off when a substance burns, and when it undergoes slow oxidation without giving off light? There is no difference whatever. In quick combustion the heat is all given off in a short space of time, and the temperature of the substance becomes high and it gives off light. In slow combustion (oxidation or rusting), heat is given off slowly for a much longer time, therefore, the temperature of the substance does not rise very high, as the heat is carried off by the surrounding air and adjacent objects as fast as it is produced. If the total quantity of heat were to be measured, however, we would find it to be equal in both cases.

Combustion is the result of oxygen of the air combining with the carbon and hydrogen of the fuel. If fuel be heated to the kindling temperature, oxygen from the air will combine with the carbon and hydrogen of the fuel and cause combustion or burning. This is due to the fact that all elementary substances, such as hydrogen, carbon and oxygen, have a strong attraction for each other when heated, and tend to enter into combination to form some compound substance.

When oxygen combines with any substance, we have either quick or slow combustion, depending upon the rate at which the action takes place. Combustion always gives off heat, and the quicker the combination the higher the temperature produced. This is one reason why a large piece of coal does not make as hot a fire as it would were it broken into small pieces. The smaller pieces of coal present more to the action of the oxygen, and consequently, they combine more rapidly, and as the temperature produced depends upon the rapidity with which the coal burns, the smaller coal will make the hotter fire.

It is a law of chemistry that the elements always combine in certain definite proportions. These proportions vary with the different elements, but any two elements will always combine with each other in a definite proportion or a multiple of that proportion. Thus, oxygen always combines with other substances in proportions by weight of eight, sixteen, twenty-four and thirty-two parts, all of which are a multiple of eight. Carbon always combines in proportions by weight of six, twelve, eighteen and twenty-four parts. Eight parts by weight of oxygen will combine with six parts of carbon, or sixteen parts of oxygen will combine with six parts of carbon, but fourteen parts of oxygen will not combine with six parts of carbon. If eight parts of carbon are mixed with eight parts of oxygen, six of the eight parts of carbon will combine with eight parts of oxygen, but the remaining two parts of carbon will not combine. This would be called incomplete combustion, and is caused by not having sufficient oxygen to completely burn the carbon.

To obtain perfect combustion of coal, the following conditions must be observed: First, a sufficient supply of air must be admitted to furnish enough oxygen for complete combustion; second, this air must be admitted in the proper location; third, sufficient time must be given for the combustible gases to completely burn when properly mixed with the air. The elements of carbon and hydrogen furnish about all the heat that is obtained from burning coal. If both are completely burned, the coal furnishes all the heat of which it is capable. If either one or both are not completely burned, part of the heat that should be furnished by the coal in burning, passes off in the unburned gases and smoke and is wasted.

When coal is thrown on a fire, before any burning can take place, the elements of the coal must be separated, as they always burn in the order of: First, the gases which are distilled from the coal, and combine with the oxygen of the air admitted and, secondly, after the gas has burned, the coke remaining burns also by combining with the oxygen, forming carbonic acid gas. The air admitted to the firebox mixes with the gases given off by the coal. The little atoms of gas combine with the atoms of oxygen from the air, generating sufficient heat to produce a little point of light, and the continuous combustion of the countless atoms of gas and oxygen in the different parts of the firebox produces a great number of points of light, or what is known as a flame. A bright flame in the firebox is an indication that the gases are burning, while a dull or absent flame and the presence of smoke, indicate that the gases are passing away unburned. If the gas does not have sufficient time to mix, atom by atom while in the firebox and at the kindling temperature, smoke will be produced. Time effects the burning of the gases, for the moment they are driven off from the coal they begin traveling towards the open air, and thus have but a fraction of a second in which to mix and burn, while in the firebox. The coke, however, remains in the firebox and has its own time in which to burn.

When more air than is necessary to produce complete combustion is admitted to the firebox, it reduces the amount of steam generated in two ways: First, by reducing the temperature of the gases, and second, by increasing the volume of gases which pass through the boiler tubes. The greater the volume which must pass through the tubes in a given time, the greater must be their velocity, and consequently, they remain in contact with the heating surfaces of the boiler for a shorter interval of time. Reducing the temperature of the gases and the time of contact with the heating surfaces, reduces the amount of heat given to the water and, consequently, the amount of steam generated. The ill effects of admitting too much air to a fire may be seen by opening wide the damper and draft of a stove when the fire is very low; the large volume of air rushing into the stove not only cools the gases, but actually cools the fire itself, reducing the temperature below its burning temperature, thus causing the fire to go out.

When a match is lit and then blown out, what happens? The friction between the sulphur and whatever it is rubbed against heats the sulphur to its kindling temperature, which is low, and the sulphur burns, heating the wood to its kindling temperature and causing it to take fire. When the match has been used and we wish to quench the flame, we generally blow on it. The strong current of air coming in contact with the flame and heated wood, carries away the heat from both at such a rate that their temperature is reduced below that of kindling and the match goes out. Blowing out a match is then but another instance of supplying too much air for combustion.

As before stated, when sufficient air is supplied to a fire, part of the gases must pass off in an unburned condition and a great deal of the coal is wasted. Particles of solid carbon, which are also set free and which are unable to burn for lack of oxygen, assume the form of soot and pass off as a cloud of smoke. Had sufficient air been supplied, this carbon would have burned and the heat thus generated, instead of being wasted, would have been utilized in forming steam.

A lamp chimney is used to produce a current of air against the flame of the lamp, so that sufficient oxygen is supplied to combine with all the particles of carbon set free from the oil. If either the bottom or the top of the chimney be partially closed so that the quantity of air admitted to the flame is insufficient to give complete combustion, the lamp will smoke. This illustrates what has been previously said about smoke.

The quantity of air admitted to a firebox depends upon the composition of the coal and the amount to be burned in a unit of time. Different kinds of coal require different quantities of air for complete combustion, the amount depending upon the kind of fuel used. Again, the quantity of coal used will depend upon the work being done by the engine, and as it requires an increased quantity of air to burn an increased quantity of coal, it will be seen that the air supplied must vary with the work required of the engine and therefore cannot be a fixed quantity.

Theoretically, the quantity of air necessary to completely burn one pound of carbon is twelve pounds by weight, or 150 cubic feet by volume. The theoretical quantity of air necessary to produce complete combustion of one pound of carbon is not the quantity that will give the best results with a locomotive, however, as has been found by experience. The results of a number of experiments made with a view of determining the proper quantity of air to produce the best results seem to indicate that eighteen pounds or 225 cubic feet of air per pound of coal is the quantity, if admitted in the proper manner. The proper quantity in any particular case of locomotive working can be easily noted by a careful fireman through observation of the results in smoke.

It is to be remembered that to obtain the best results from coal burned in a firebox, sufficient air must be supplied to burn both the coke and the gases. If the coke alone were to be burned, sufficient air for this purpose could be admitted through the grates, and coal by regulating the thickness of the fire on the grates. To burn the gases, however, an additional amount of air is required. If, now, the thickness of the fire be so regulated that sufficient air is admitted through the grates to burn both the coke and the gases when fresh coal is supplied, the fire will be too thin and will admit too much air after the gases have been consumed. Again, if the fire be kept so thin that sufficient air for combustion is admitted through the grates, it will be almost impossible to keep the fire level and free from holes when the engine is working hard, as the blast will carry the lighter particles of coal from the grates through the tubes unburned, thus making holes in the fire and permitting a rapid inflow of cold air when and where it is least desired. It is evident. then, that sufficient air for complete combustion of bituminous coal cannot be admitted through the grates alone, and that an additional amount, therefore, should be admitted above the fire to complete the combustion.

When air is admitted above a fire, it must be introduced in such manner that it will at once mix as completely as possible with the gases in the firebox, otherwise it will do more harm than good. If it is admitted in a large stream, as when the firebox door is opened, the air will not mix with the gases, but will form a distinct current of its own, just as water from a river forms its own current in the large body of water into which it empties.

The gases can only come in contact with the outer surface of this cold draft of air, and, without mixing, will be cooled below their burning temperature and pass away unconsumed. If the air above the fire be admitted through a number of small openings, it will mix more readily with the gases; will be heated to the proper temperature more rapidly, and will give more complete combustion than if admitted in a large stream. As the air admitted above the fire is used almost exclusively in burning the gases it should be regulated in amount so as always just to accomplish its purpose.

The volume of gases is greater just after firing than just before and consequently more air will be required just after firing to completely burn the extra amount of gases. In order to produce the best results then, the air required for combustion should be admitted as nearly as possible after the following plan: First, the thickness of the fire should be regulated, if possible, so that sufficient air for the combustion of the coke of the coal may be admitted through the grates. This will require a thin fire evenly distributed: Secondly, sufficient air should be admitted above the fire in small streams so as at all times just to complete the combustion. This requires that the quantity of air admitted above the grates shall be varied as the quantity of gases vary: Thirdly, the total quantity of air admitted through the grates and above the fire, should vary with the quantity of coal to be burned and should at all times be just sufficient to give complete combustion. All air which passes through the firebox must receive heat, and if more air than is required passes through it, it will absorb and carry away heat that should be used in making steam.

Experience proves that an engine may consume a large quantity of fuel without perfect combustion taking place, and that when it does take place a portion only of the coal is used in making steam. The principal causes of the losses of heat during combustion are: First, small pieces of unburned coal which fall through the grates or are drawn through the tubes by the blast unconsumed; second, in the unburned gasses passing off in a gaseous or smoky state; third, in the heat which the hot gases contain when they escape through the smoke stack; fourth, the loss of heat by radiation and convection from the boiler, due to the fact that the firebox is not sufficiently covered with lagging to prevent radiation and convection of heat from the hot boiler plates.

None of these losses can be entirely prevented, but the losses due to unburned coal, unburned gases, and radiation and convection may by proper means be very much reduced. There must always be a great loss of heat due to the hot gases carrying away heat and a fireman can do but little to reduce this loss. By permitting just the proper amount of air for combustion to pass through the firebox, he may reduce it somewhat. The loss due to unburned coal, may be prevented by wetting the coal and breaking it into lumps which will not pass through the grates, and by keeping the fire of such thickness that the blast will be unable to pick up pieces and force them through the flues. The loss due to unburned gases and smoke may be prevented by regulating the amount and distribution of air admitted to the firebox.

The quantity of heat wasted, due to the several causes already mentioned are as follows: The amount lost by radiation and convection may be anywhere between five per cent and ten per cent; the heat lost in the hot ashes, clinkers, and by coal falling through the grates and being drawn through the flues, from five per cent to fifteen per cent; the waste due to the gases escaping at a high temperature through the smoke stack, will vary from twenty-five per cent to thirty per cent; that due to incomplete combustion will vary from five per cent to fifteen per cent. From this it may be seen that in general practice about only forty-five per cent of the heat of the fuel is utilized in making steam, while the remaining fifty-five per cent is lost.

A fireman handles anywhere from six to twenty tons of coal per trip, out of which he uses but forty-five per cent or four and five-tenths tons out of ten tons in making steam, the remainder, or five and five-tenths tons being lost. It is true that part of this loss cannot be prevented, yet it is also true that a goodly share can, in some cases, be charged directly to carelessness or ignorance of the laws of combustion on the part of the fireman. Suppose this fireman makes 300 trips a year, using ten tons of coal per trip. The total quantity of coal used per year will amount to 3,000 tons, out of which fifty-five per cent, or 1,650 tons, are lost or wasted. If, now, by careful management and skillful firing, this 1,650 tons is reduced ten per cent, there will be effected a saving of 165 tons of coal per year per engine. For every 100 engines this saving would amount to 16,500 tons per year, and with coal worth $2.00 per ton the saving effected would amount to $33,000 per year for every 100 engines.

Smoke is the volume of vapor and gases out of the smoke stack, colored by particles of carbon or soot. The color of the smoke depends entirely upon the quantity of carbon present. When a large quantity of fresh coal is thrown on a fire, it absorbs heat very rapidly and reduces the temperature of the firebox to such an extent

MANDREL FOR CYLINDER BUSHING IN SERVICE—HAVELOCK SHOP. C. B. & Q. RY.

that all flame is extinguished and a black vapor formed. Now, as before stated, the presence of flame and absence of smoke is an indication that the gases of the coal are being burned, while the absence of flame or presence of smoke is an indication that the gases are passing away unconsumed. The black vapor or smoke seen in the firebox is of a different composition than the real smoke issuing from the smoke stack. The vapor or gas of the coal in the firebox is a mixture of hydrogen and carbon (carburetted hydrogen) colored by tarry matter, sulphur, and other volatile ingredients. When the carburetted hydrogen gas is heated to the kindling temperature, its hydrogen combines with the oxygen of the air, forming water which passes off as an invisible vapor. Part of its carbon which is liberated is burned, while the remainder passes away in the form of soot, coloring the invisible gases and forming what is properly called smoke. If sufficient oxygen is present in the firebox and at the proper temperature when the hydrogen gases are liberated, all the carbon will be consumed and the smoke prevented.

Smoke is an indication of imperfect combustion, and consequently of a waste of fuel. Without air there can be no combustion and therefore no smoke. With just the proper quantity of air there will be perfect combustion and no smoke; with either too much or too little air, there will be imperfect combustion and, consequently, smoke will be produced.

The absence of smoke generally indicates that perfect combustion is taking place, yet there are times when incomplete combustion takes place without the presence of smoke. If the draft is regulated so as to choke the fire, and sufficient coal is thrown on to cool the furnace below the kindling temperature of the hydro-carbons, there will be no flame and the hydro-carbons will pass off unburned, without producing smoke. This is a very wasteful method of preventing smoke, however, as the hydro-carbons amount to fifteen to forty per cent of the coal, besides the added disadvantage of making steam slowly and irregularly. The draft should always be increased instead of diminished, immediately after firing so as to make sure of the hydro-carbons being consumed.

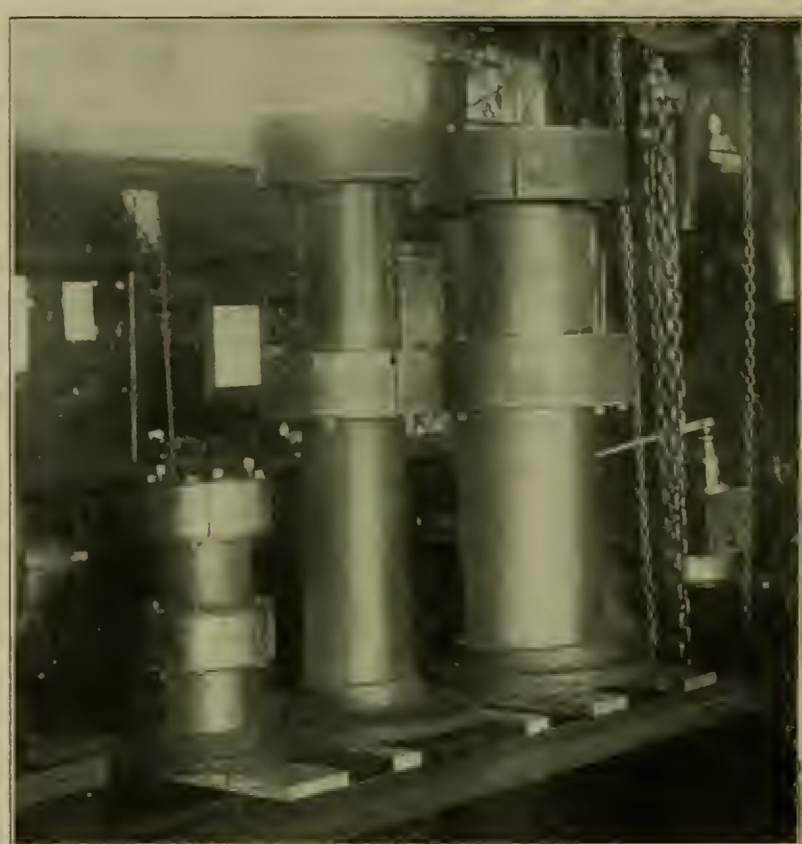
Mandrel for Valve and Cylinder Bushings—C. B. & Q. Ry.

AT THE Havelock shops of the C. B. & Q. Ry., a mandrel for turning locomotive cylinder and valve bushings has recently been designed and put in service by Mr. J. D. Young, foreman of machine shop. The idea is original and actual test has demonstrated that it is a practical and money saving device.

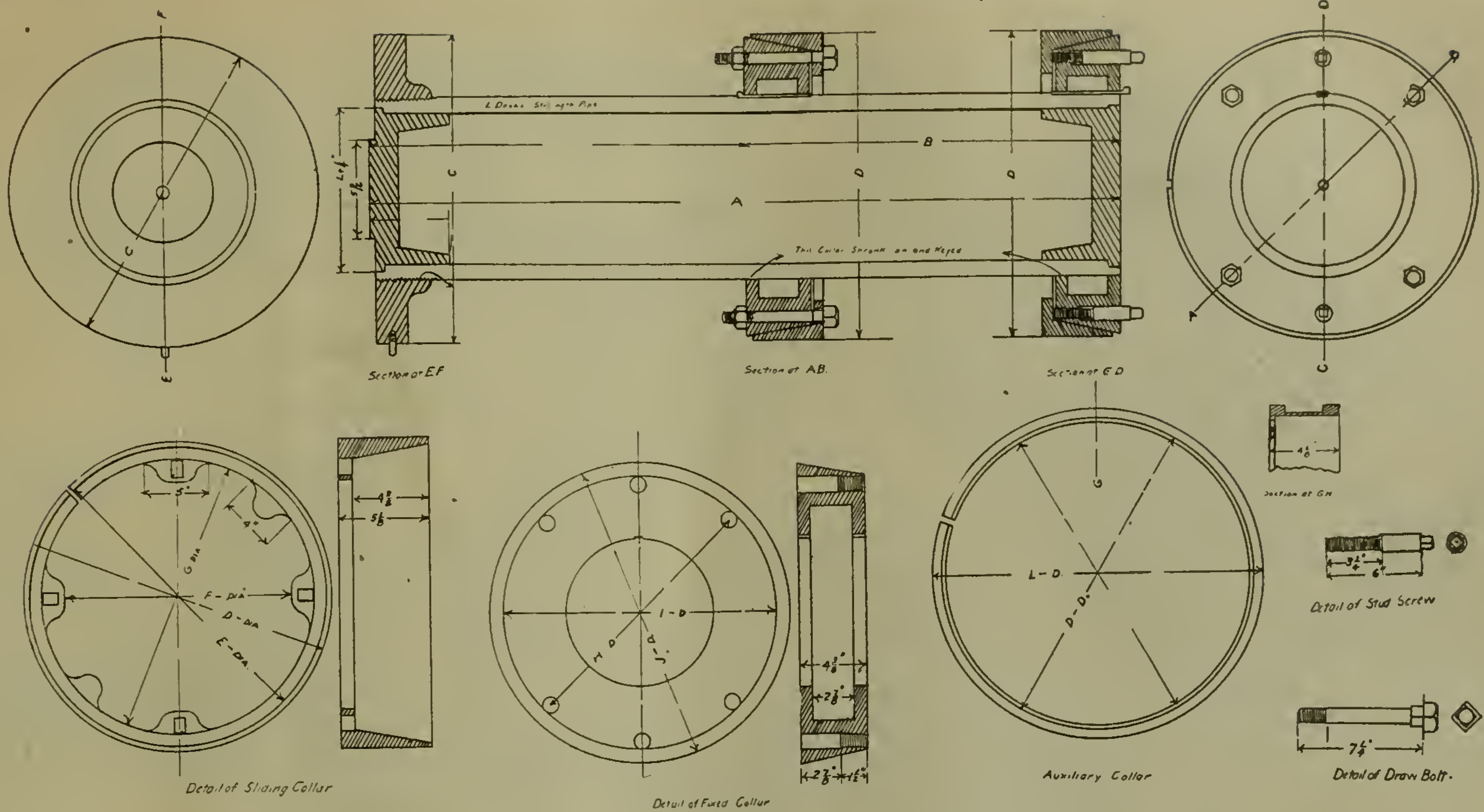
As will be seen from the illustrations, the mandrel consists of a shaft centered for a lathe. On one end a flange is attached which is either bolted to the face plate or caught in the jaws of the lathe chuck. On the other end of the shaft is a taper collar, identical with one at about the center of the shaft. Around each of these collars is placed a taper ring which is cut in two segments. Each ring is held in place on the collar by 4 bolts, and is adjusted in position by two set screws. It will be seen that by changing the position of the rings, the diameter of each is varied to suit the size of the bushing.

The operation of the mandrel is very simple. The bushing is slipped over the adjustable rings and the mandrel centered in the lathe. The rings are then adjusted until they are forced out against the walls of the bushing with sufficient pressure, and are clamped in that position. This centers the bushing and holds it in place for turning. The second illustration shows the holding power of the rings where ¾ of an inch of material is being removed when turning a 17 inch bushing for a 15 inch cylinder.

Three sizes of these mandrels have been made. The



MANDRELS FOR VALVE AND CYLINDER BUSHINGS—HAVELOCK SHOPS, C. B. & Q. RY.



DETAILS OF MANDREL FOR VALVE AND CYLINDER BUSHINGS—HAVELOCK SHOPS, C. B. & Q. RY.

	Size	A	B	C	D	E	F	G	H	I	J	L	M
Valve	10 in. x 12 in.	20¼	13	12½	9⅞	9½	6⅜	8	7 5/16	8 3/16	9 11/16	11⅞	6 in. pipe
Cylinder	17 in. x 17½ in.	48	24	16	16⅞	16½	13⅜	15	14 5/16	15 3/16	16 11/16	17⅜	8 in. pipe
	18 in. x 19 in.	48	24	16	17⅞	17½	14⅜	16	15 5/16	16 3/16	17 11/16	18⅞	8 in. pipe
	20 in. x 22 in.	48	24	20	19⅞	19½	16⅜	18	17 5/16	18 3/16	19 11/16	21⅞	12 in. pipe

largest size for 20, 21 and 22 inch cylinder bushings, the second size for 15, 16, 17, 18 and 19 inch bushings and the smallest size for 10 and 12 inch piston valve bushings.

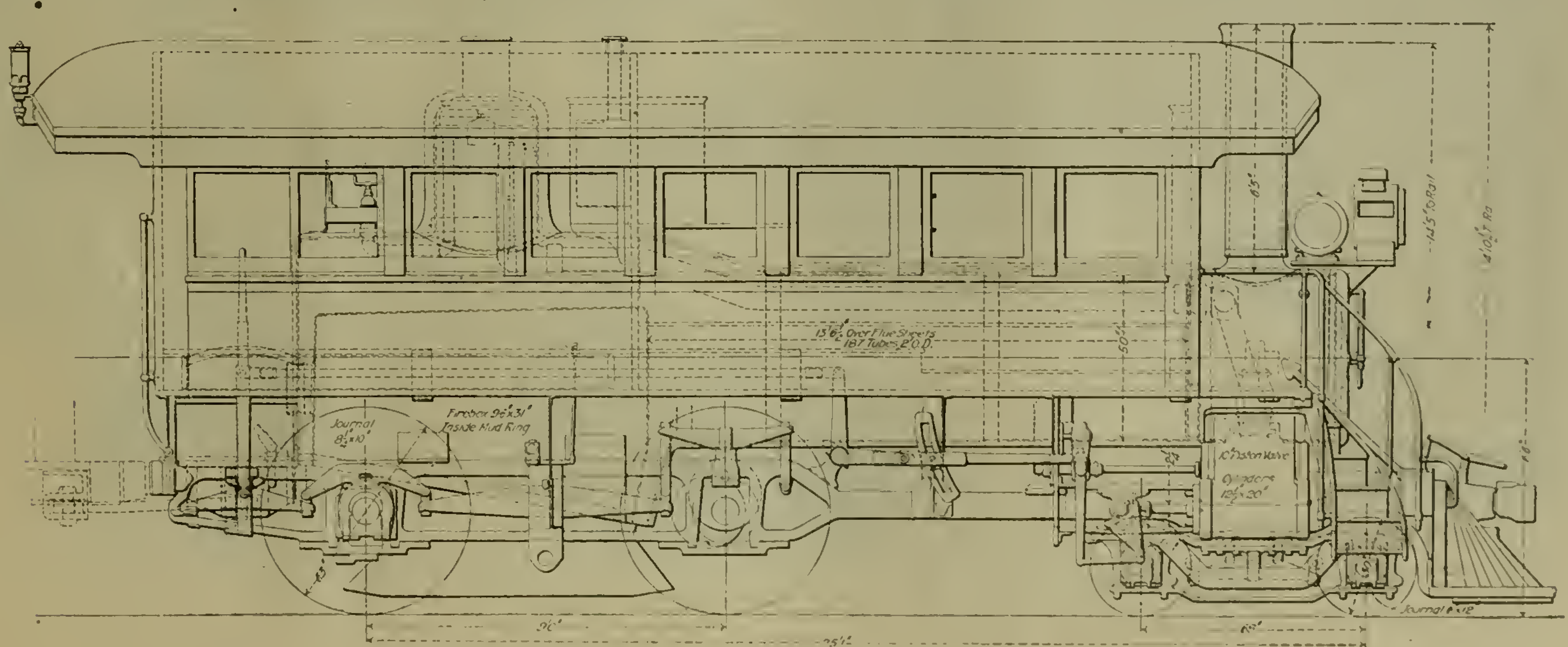
We are indebted to Mr. W. F. Ackerman, superintendent of shops at Havelock for the illustration and information presented.

Four-Cylinder Simple Locomotive—L. S. & M. S. Ry.

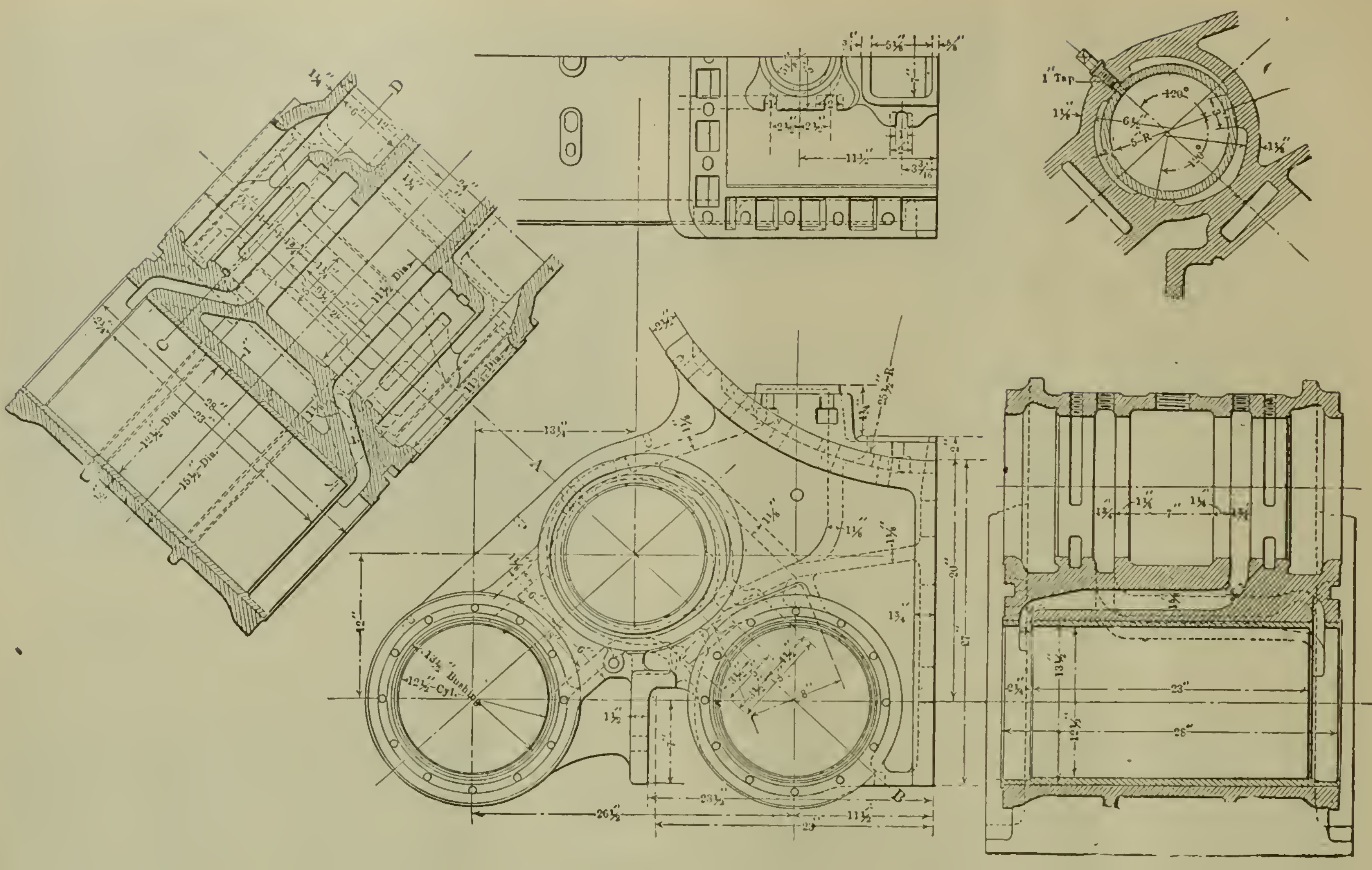
THE September issue of the Railway Master Mechanic, page 298, contained a brief description of the four cylinder simple balanced locomotive for inspection service, recently built by the Lake Shore and Michigan Southern Railway at its Collinwood shops, together with a half tone engraving and table of principal dimensions. We here reproduce the principal drawings in order to illustrate more clearly the chief features of interest embodied in the design of this unique locomotive.

The four single cylinders are arranged in the same horizontal plane; steam distribution of both cylinders on the same side is controlled by one piston valve; the pistons of all four cylinders are connected with the forward crank axle; the valves are operated by a special arrangement of the Walschaert valve gear, embodying a rocker arm from which the combining lever is supported.

The ports for one cylinder on each side are crossed in order to admit steam simultaneously to the opposite ends of the pair of cylinders on the same side of the engine. This arrangement was made with the ports of the inside cylinders in order to obtain the benefit of heat provided by the steam and exhaust passages and thus minimize the loss due to long ports. While the ports to the inside cylinders are thus larger than those to the outside cylinders, the areas of all ports are large with relation to the size of cylinders. At the same time the clearances are



SIDE ELEVATION, FOUR CYLINDER SIMPLE LOCOMOTIVE—L. S. & M. S. RY.



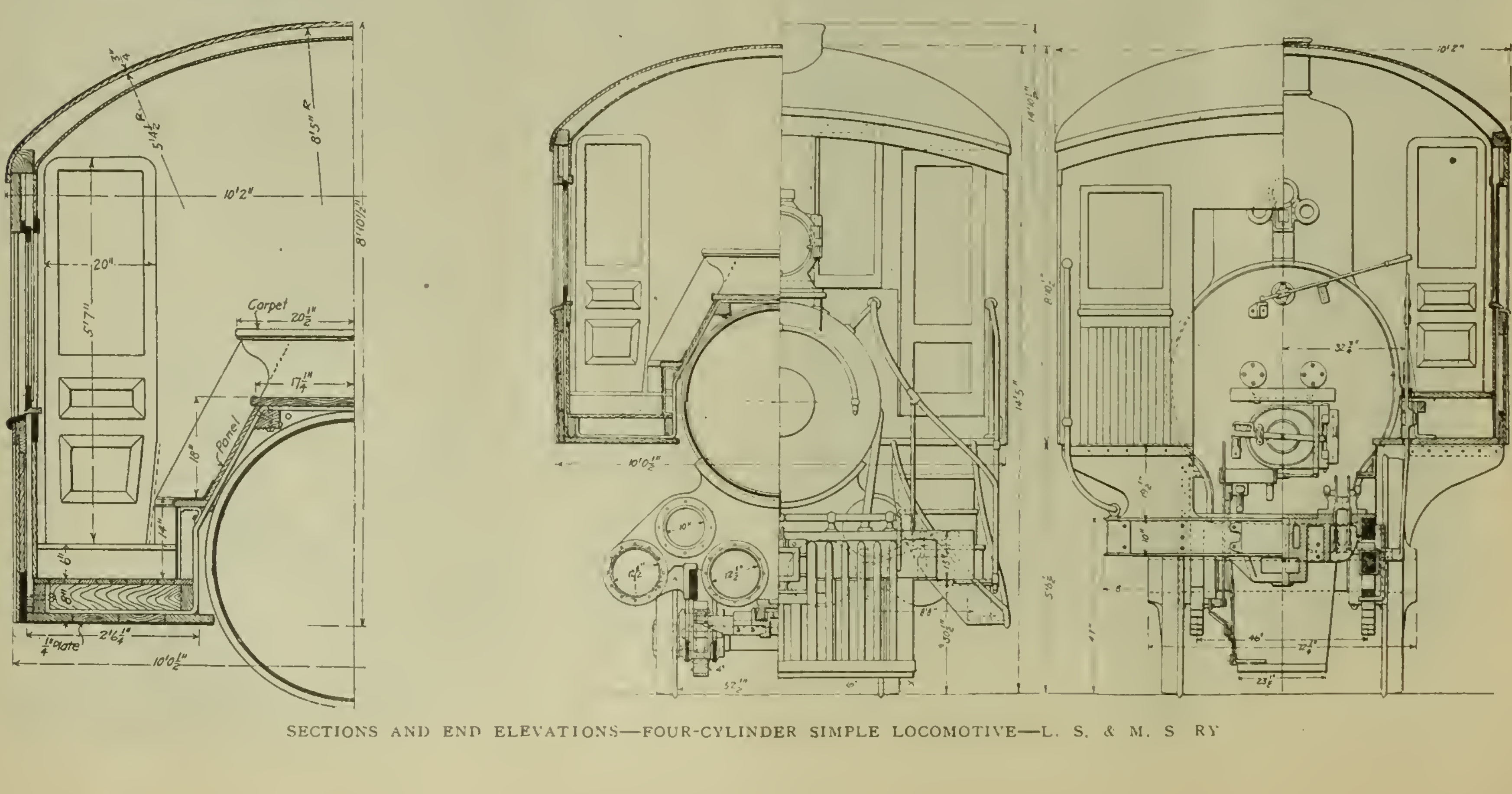
CYLINDERS FOR FOUR-CYLINDER SIMPLE LOCOMOTIVE—L. S. & M. S. RY.

practically no greater than with the ordinary type of slide valve engine.

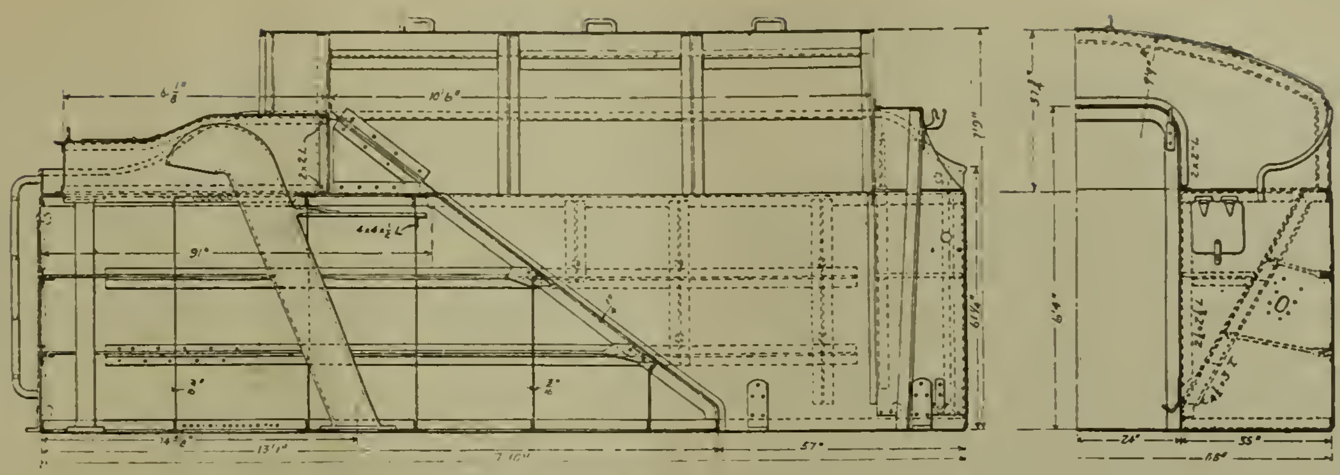
The crank axle is of the solid type similar to the crank axle on the Cole compound locomotive of the New York Central. The wheels and axles were made at the Schenectady works of the American Locomotive Company.

As explained before, the coal space of the tender is covered by a sheet iron hood. The tender has a capacity of ten tons of coal and 4,300 gallons of water. The tank is equipped with a water scoop.

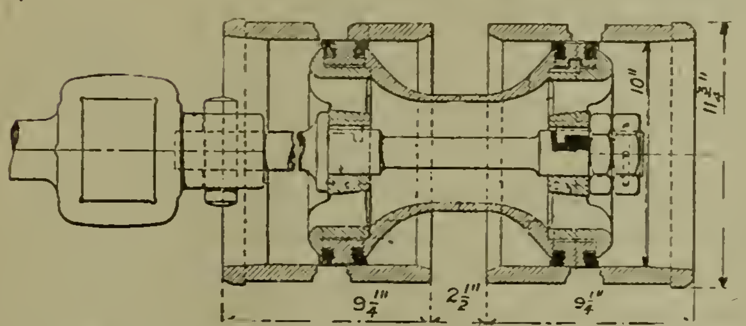
The interior of the cab is handsomely finished in mahogany, both in the observation compartment and the section for the crew. The observation compartment provides space for four easy chairs on each side of the boiler, and each chair is opposite to a window. Additional seating capacity is provided by a permanent platform above



SECTIONS AND END ELEVATIONS—FOUR-CYLINDER SIMPLE LOCOMOTIVE—L. S. & M. S RY

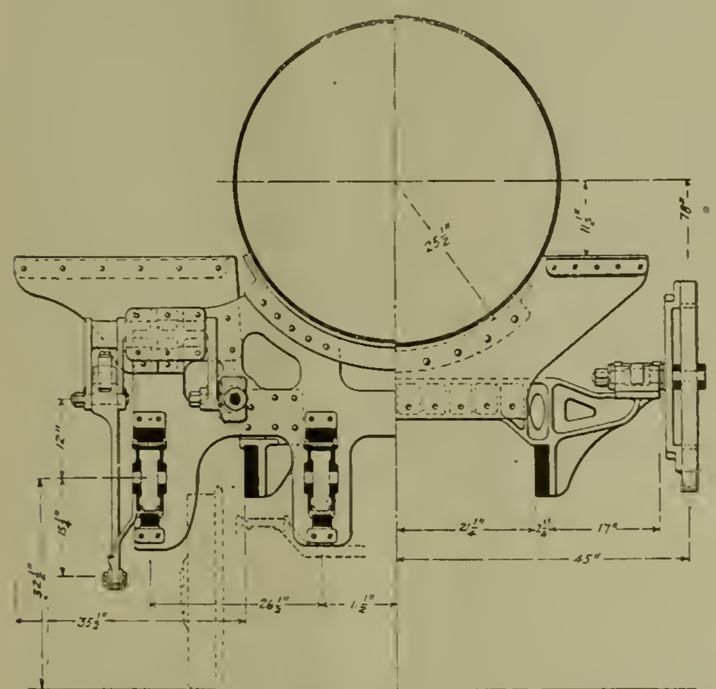


TANK—FOUR-CYLINDER SIMPLE LOCOMOTIVE—L. S. & M. S. RY



VALVE CHAMBER AND VALVE FOUR-CYLINDER SIMPLE LOCOMOTIVE L. S. & M. S. RY.

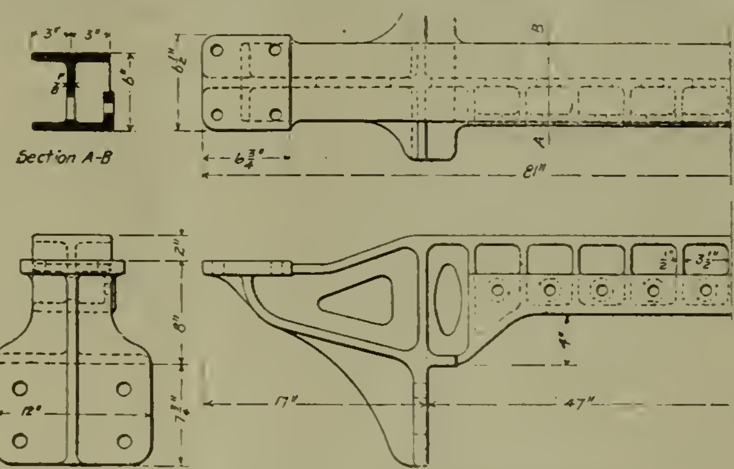
the boiler end of the observation room, so constructed that it may be used either as a seat or as a place for chairs. At the front end of the cab, between the windows, is a small locker containing writing material. Located conveniently to the forward right hand chair is a Pullman folding berth lamp, controlled by a push button, for read-



CROSS SECTION AND ELEVATION—FOUR-CYLINDER SIMPLE LOCOMOTIVE L. S. & M. S. RY.

ing messages and train orders at night. This light is used only as necessity requires and for a short space of time, in order to provide against interfering with the view of the engineer by a light in the forward portion of the cab. An air signal, conductor's brake valve, air operated valve for blowing the steam whistle and a system of signals to the engineer are also placed within convenient reach of the occupant of this seat. There is a Boyer speed recorder and a clock at the front of the cab.

The boiler is carefully lagged to provide for comfort within the cab. Steam heating connections are carried along both sides of the cab, protected by a grating, which



DETAILS OF FRAME CROSS BRACE—FOUR-CYLINDER SIMPLE LOCOMOTIVE, L. S. & M. S. RY.

forms a footrest. There is a large locker at the rear of the observation room and in the engineer's cab a clothes locker is attached to the partition between the two compartments.

The windows in the sides of the cab are equipped with balanced hangings and are arranged to drop below the sills. When the windows are open sill pieces slide over the openings through which the sashes drop and when closed the sashes are held by these pieces to prevent rattling.

Communications

Roundhouse Records

Editor Railway Master Mechanic:

I have under my jurisdiction, as night general foreman, what I consider the busiest terminal of one of the large railroads and in my opinion the night job is heavier than the day. We receive on an average of forty engines in twelve hours (not including eight yard engines) and we despatch on an average of thirty-five engines, this between the hours of 6 p. m. and 6 a. m.

At the time I took charge there was an entire absence of any form or method of keeping record of the movement of engines from the time they were received until they were despatched. All the information that could be had was by consulting the work book, or from the memory of the men who did the work.

I had not been in harness but a few nights until I saw the necessity of having at hand something to give prompt and accurate information, so I at once set to work and provided myself with a book in which at 6 p. m. I made a record of engines which were in at that time. From 6 p. m. until 6 a. m., I recorded all that came in and the time they came on roundhouse track. Then, as each engine was despatched I put down the time it was ordered, the train ordered for and the leaving time, as well as making notes of any irregularity between the roundhouse and the train.

In addition to this I started a book in which the man in charge of the turn table puts down the number of the engine on the cinder pit at 6 p. m., and the time the engine comes off the pit to go into the house. Each engine during the twelve hours is treated in the same way, as well as each engine that comes out, so that at 6 a. m. I can tell just when each engine came on the roundhouse track; at what time it went on the pit; what time it went into the house and what time it came out of the house, and from my own book I can tell what, if any, delay and the cause.

I can do this at the close of the night work, or can do it for the close of a night's work four years ago as I still have these records on file.

I was not long in finding that there were other things not outside of the roundhouse, but inside, that needed some attention along these lines. As there are only twenty stalls in which to place engines it can be seen readily that it is necessary to place engines on tracks provided for that purpose on the outside of the house and of course engines placed outside require some work to be done on them. Under these conditions I found machinists, boiler makers and helpers, wandering around looking for a certain engine to work on and much valuable time was lost in this way. To do away with this difficulty, a blackboard was installed in the roundhouse and also one at the turn table to show the exact location of any engine which had passed over the cinder pit so that the engine could be found at once, whether in or out of the house.

We have in the roundhouse a foreman who gives each man his work on a slip of paper. A man would take the slip, do the work and then throw the slip away and get another. I noticed in the morning that old slips would be scattered all over the place. I consulted the foreman and as a result of the consultation, the name of the man, or men, doing the work was marked on the slip and the slip was returned to the foreman. The foreman in turn brought the slips to the office each morning at 6 a. m. They were placed on file and if anything occurred so that the work proved unsatisfactory, we had the slip showing who the man was who did the job.

We have here a system of inspection which occupies the time of two men both day and night. Their duties are to inspect the engines carefully after arrival in the roundhouse. About seventy-five per cent of the work of these inspectors found would be work that was not reported by the engineer, hence it would not appear on the regular work book. The inspector would find work and report it to the roundhouse foreman. This foreman would delegate some one to do the work and that was the last of it. No record was kept and the roundhouse got no credit for the work. Each inspector was instructed to make his report and put the time of his discovery on his slip. Then the foreman gave the work out to his men and marked on the inspector's slip the name or names of the men doing the work, so that a careful record was kept on each move.

It was not long until the plans adopted at night were followed out during the day. For a short time we had a regular book for the purpose of keeping a record of the movement of engines but for some reason this was discontinued. Now all the record that is kept is the individual record of each foreman kept in his own way.

Fortunately, I have clung to my method all the time so that regardless of any other record, I still have mine complete and for my own satisfaction, I intend to keep it.

I am so satisfied that this is the only way to do business that I think instead of being simply a matter of choice, the management should compel it to be done and carefully done. It is of the utmost importance when it comes to placing responsibility for the prompt movement of trains.

It is no uncommon thing to get correspondence about a delay to a train, or to find a note from the yardmaster or conductor stating that the delay was caused by waiting for the engine. In this connection I want to say that my little book—carried in my inside pocket—has brought them to their knees more than once. The facts were there. Instead of these facts being carried around by me, they should be placed where any official interested could get them at any time. I might go fishing some day and take the book with me.

There is no money lost in keeping a record or statistics in any business, particularly in railway business. Every move should be recorded and kept in such a manner that it can be reached at any time. Correspondence should be cut as short as possible and attended to without delay. It looks bad to get a letter about some delay that occurred thirty days ago. That letter should have been put out at least the next day and the records should have been in such shape that a prompt and reliable answer could be given at once.

To make this a success heads of departments must get busy and arrange some form and insist on its being fulfilled and provide for the necessary clerical force to do it. The money spent will be a good investment.

Yours truly,

J. W. KNOWLTON.

From the Viewpoint of a Practical Mechanic

Mr. Editor:

I still have several points in mind of a nature similar to those which I discussed in my previous letter.

It has occurred to me on a number of occasions, as a result of sad experience, that the condition of the bottom of pits should be given close attention, not only in the matter of cleaning, but with regard to water standing in holes. The casual observer walking in the outer circle near the wall of the roundhouse does not appreciate the actual condition of the pits. However, the men at work have to contend with much inconvenience when it is necessary to dodge puddles and this is especially unpleasant during winter weather. Pits are occasionally found in such shape that the men have to bridge the water spaces with planks, blocks and anything available. This causes loss of time not only in looking up material on which to stand for protection against water, but also on account of the insecure footing provided by such makeshifts.

My experience is that pits which are built to drain the water off along the sides instead of along the center are more satisfactory to work in. When in good condition the water will at least drain from the portion on which a man is most likely to stand and when in poor condition, there is more of a tendency for the water to drain to the sides and then out of the pit; while if the drainage was down the middle the water would be led directly to all the holes that might form in the floor, or bottom of the pit.

When working on rods in the round house there is always a certain amount of cleaning necessary to be done before the strap, brasses, etc., can be handled conveniently. Where this cleaning is done by the old method with waste and oil, or with sawdust, much time is naturally wasted by the helper before the several parts are in shape to work on.

A great time saver would be a portable cleaning tank or lye vat, which could be transported readily from one engine to another. Such a device would be especially economical when a number of rods on the same engine require work and in view of the amount of rod work in the daily routine of roundhouse practice, such a cleaning tank would soon pay for its first cost and for the expense of caustic soda used in the cleaning liquid.

The entire appartaus would be inexpensive and could be made at the shop. Thus it would come under the head of home made appliances and its cost of construction might readily be included among repair costs. The dedevice would include a sheet steel box large enough to contain the main rod strap of the largest engine; a connection for the purpose of coupling to a blower hose in order to heat the cleaning solution, and a set of cast iron wheels, together with the necessary handle to haul the tank from place to place.

. Cleaning the parts by such a method would remove the dirt and grease more thoroughly and much more rapidly.

Whenever a valve stem or piston rod requires packing, it is necessary to caliper the rod and the inside of the gland to determine the size of packing rings necessary. A machinist does not always carry both inside and outside calipers in his pocket, as he carries a rule. By obviating the necessity of measuring the rod before ordering the packing, time could be saved in doing the work. The very nature of roundhouse work is such that every few minutes saved represents economy in time and money.

This saving could be made by stamping the size of the rod and gland on a brass plate and attaching the plate to the steam chest casing and to the cylinder head casing. In the event of the valve stem or piston rod being turned to a smaller diameter, it would not be expensive to apply a new plate or restamp the old one.

This merely represents a method of saving many of the unnecessary steps which enter into a day's work.

I would like to see some other letters of a similar nature written by several of your subscribers, for by securing opinion and developing discussion, you bring out many valuable features originated by some one, that might be used to advantage or modified to meet the conditions of others in the same line of work.

Yours truly, A. M.

Drop Grates

Editor, Railway Master Mechanic:

Several articles have appeared in your paper during the last few months dealing with the location of drop grates. This is a very important subject, and has been taken up in an interesting way, but I do not think the right location for these grates has yet been suggested.

It is practically the opinion of all, that drop grates should not be placed next to the flue sheet, as the fires are harder to clean and the effect on the flues and flue sheet is bad. The location in the center of the firebox offers some advantages over this, but there are several bad features to the central location. A drop grate cannot be rocked back and forth with the other grates, so fire is bound to accumulate deeper on them, than on the movable grates. The tendency of the draft in the firebox is to pull burning coal from the sides and corners, and pile it up in the center. It is readily seen that this will cause a deeper fire to be formed over the drop grate, and as there is no way to shake it down, a "hump" is formed and the engine quits steaming. The only way to level the fire while the engine is running is by the use of the ash hoe. Experience with drop grates located in the center of the firebox has not been entirely satisfactory.

The suggestion to place these grates in the two back corners of the firebox has been tried with varying success. With a sloping boiler head and small fire door it is a practical impossibility to clean a fire quickly with this arrangement. The opening formed when the grate is down is directly underneath the fire door and the ash hoe or slash bar cannot be used to advantage in punching large clinkers through. An engine with a large fire door and vertical boiler head may permit this plan to be used with some success but, it is a very poor arrangement to put in an engine with a wide fire box having a sloping boiler head and small fire doors.

The road with which I am connected has tried all of the above plans and has found them unsatisfactory for the reasons I have stated above. Experience finally led to placing the dead grates in the second section from the back and time has proved that this is the proper location for them as judged by the service of this road. The fireman has plenty of room to work his ash hoe and can always see what he is doing. The fire does not pile up on the dead grate as the draft carries it forward, and in case it does, through carelessness of the fireman, it can be readily leveled. The location is especially favorable for quick work on the clinker pit. The disadvantages that exist in the other plans have not been found in the one that I suggest.

Yours truly,

A Road Foreman.

Sixty Thousand Pounds Capacity Box Car

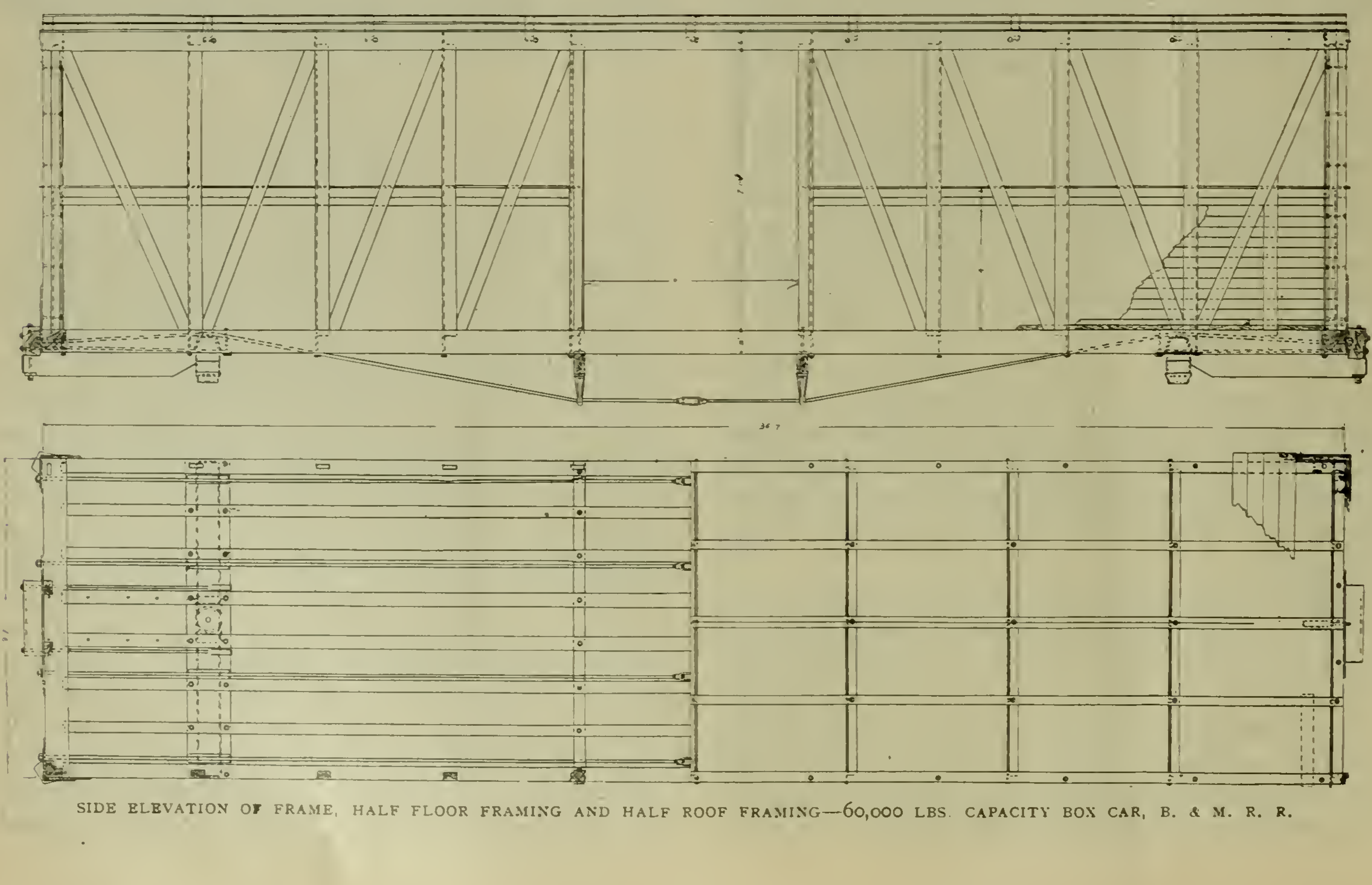
Boston & Maine R. R.

The Western Steel Car and Foundry Co., of Hegewisch, Ill., are building an order of 1,500 box cars for the Boston & Maine road. The principal point of interest at this time is that these cars are not of the composite type, but of wood throughout, except the body bolsters, which are of pressed steel, as in the old days before steel construction had reached its present favorable consideration for freight equipment.

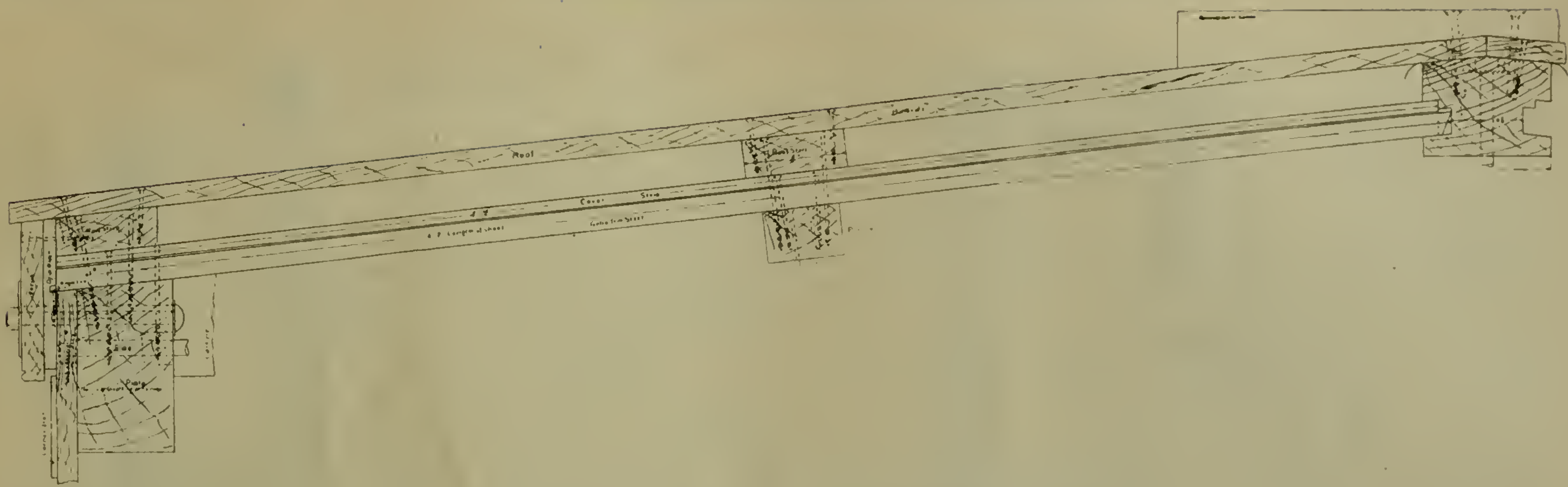
These cars are built to the dimensions recommended by the American Railway Association and are of 60,000 pounds capacity. They have a light weight of 32,700 pounds, while the body alone weighs 20,700 pounds. These values give a ratio of light weight to paying load equal to 54.5 per cent, while the weight of the body alone is only 34.5 per cent of the rated loading.

To produce these results the details have been carefully designed to give maximum strength for the least material. All post rods and framing rods are ⅝ inch in diameter and lag screws ⅜ and ½ inch, in accordance with the scheme for light weight. The four 1⅛ inch truss rods with enlarged ends, have a drop of 21 inches and pass over the pressed steel body bolster to the end sills.

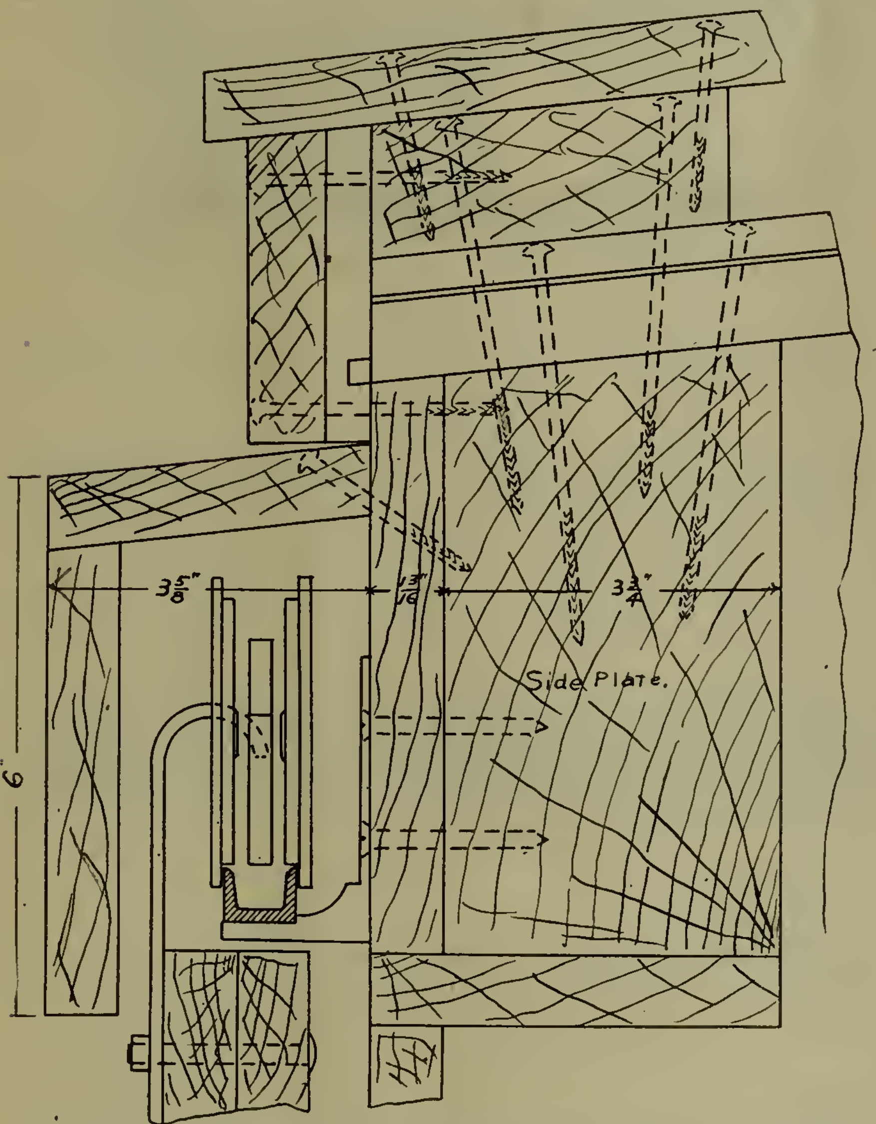
The end sills are exceptionally strong, being 8x8 inches and the corner posts also are of liberal size, in two pieces.



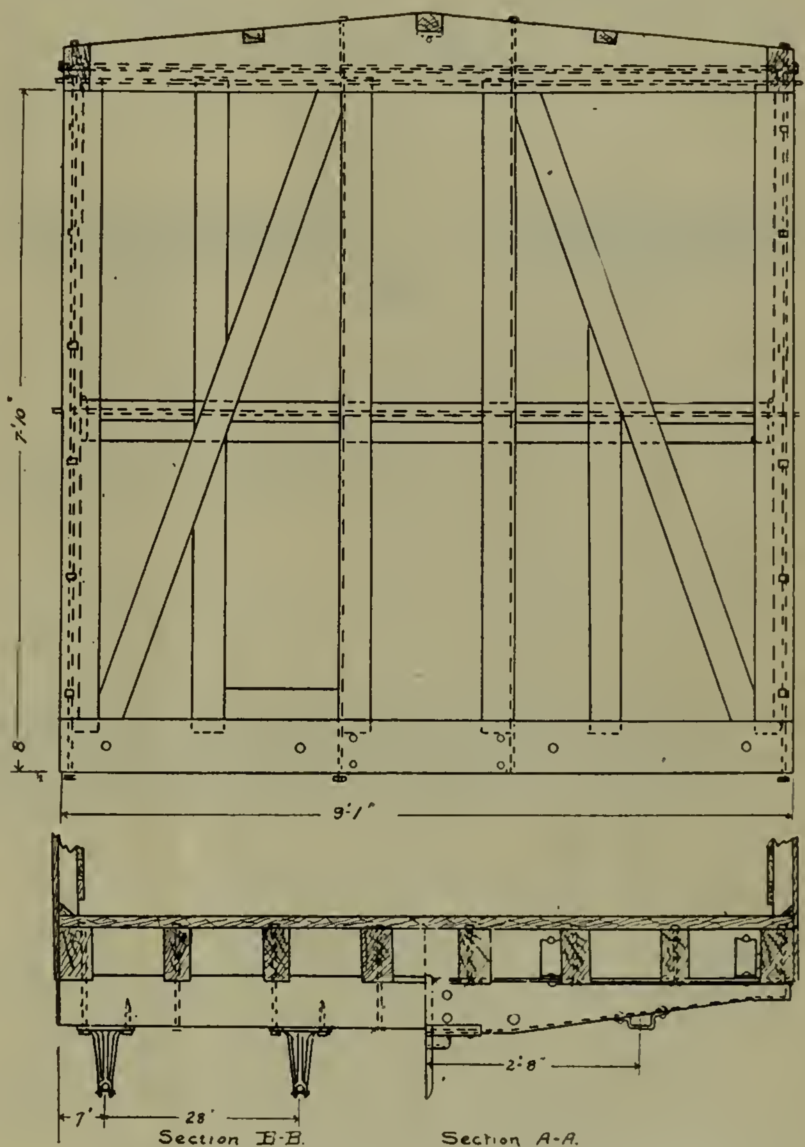
SIDE ELEVATION OF FRAME, HALF FLOOR FRAMING AND HALF ROOF FRAMING—60,000 LBS. CAPACITY BOX CAR, B. & M. R. R.



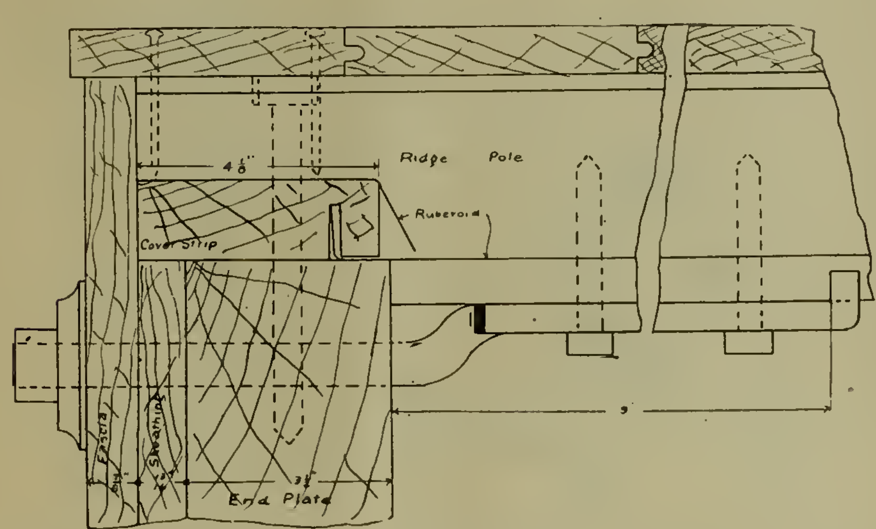
HALF SECTION THROUGH ROOF—60,000 LBS. CAPACITY BOX CAR, B. & M. R. R.



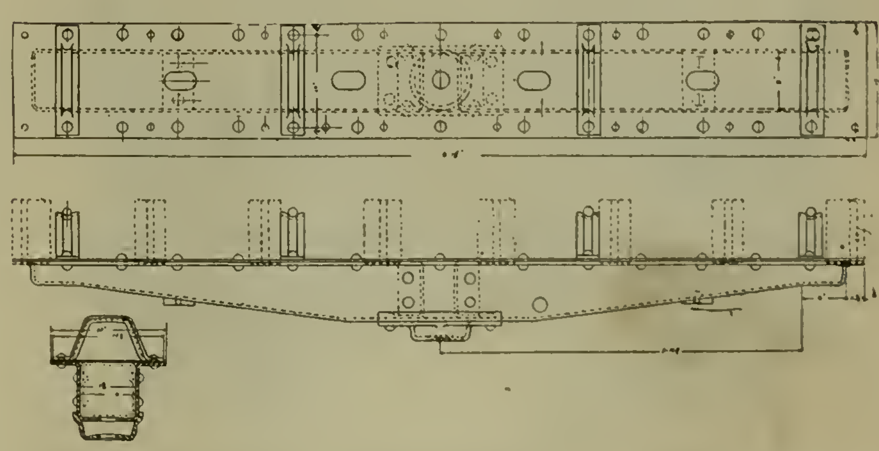
CROSS SECTION THROUGH DOOR CAP—60,000 LBS. CAPACITY BOX CAR, B. & M. R. R.



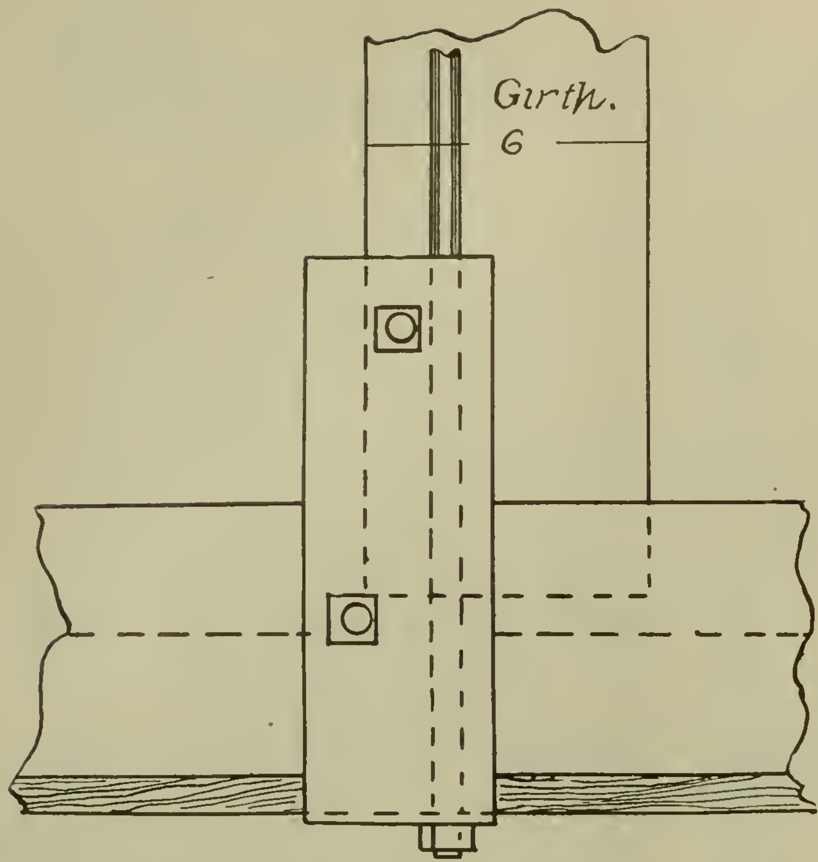
END ELEVATION OF FRAME—60,000 LBS. CAPACITY BOX CAR, B. & M R. R.



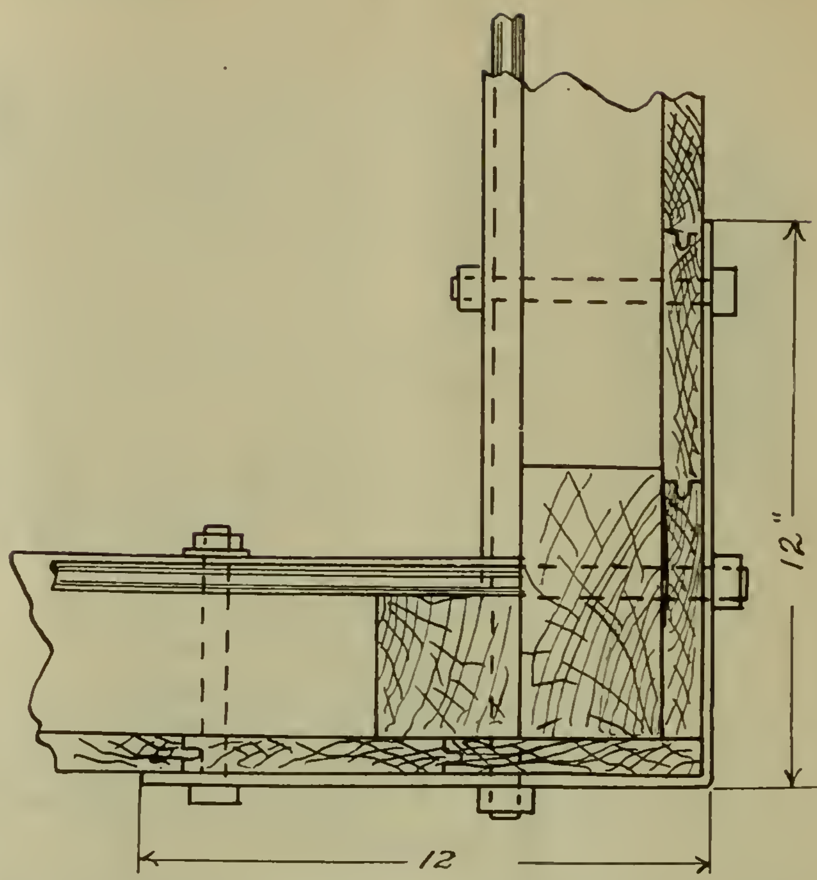
SECTION THROUGH END PLATE—60,000 LBS. CAPACITY BOX CAR, B. & M. R. R.



PRESSED STEEL BOLSTER—60,000 LBS. CAPACITY BOX CAR, B. & M. R. R.



ELEVATION OF GIRTH CONSTRUCTION—60,000 LBS. CAPACITY BOX CAR, B. & M. R. R.



SECTOIN OF GIRTH CONSTRUCTION—60,000 LBS. CAPACITY BOX CAR. B. & M R. R.

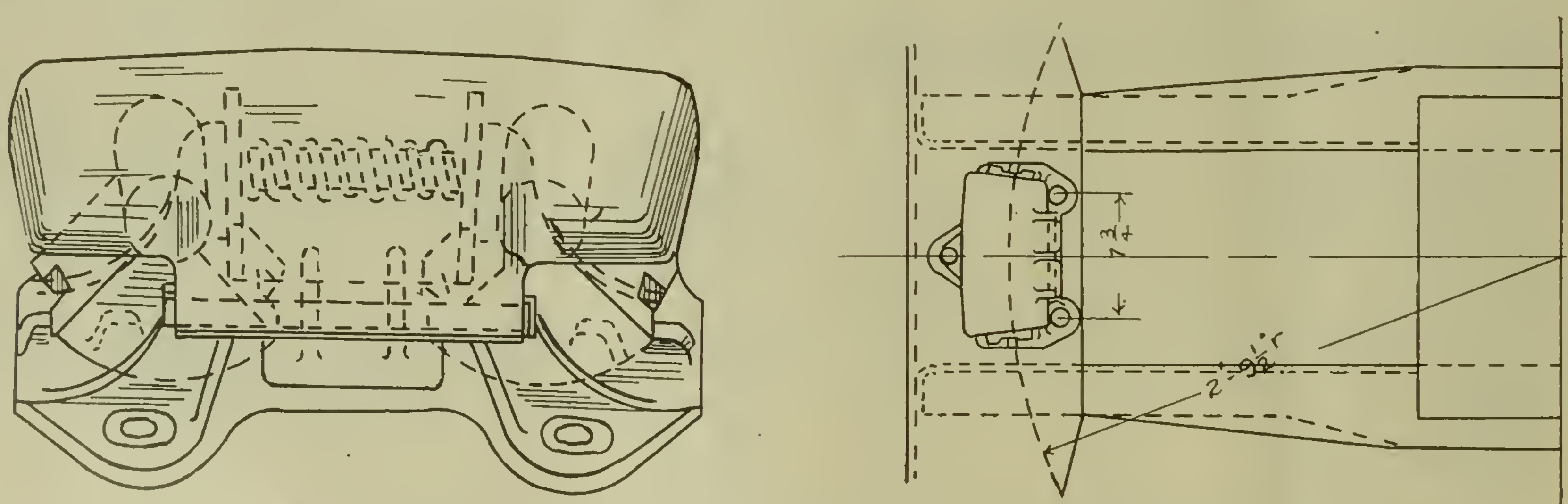
having a face of six inches at the outside and gained for the girths on the inside, making a solid construction to resist shocks and shifting loads.

The eight longitudinal sills are double tenoned into the end sills and have no joint bolts, the outside pair of truss rods performing that function. The door posts are 4¾ inches on face by 4⅝ inches thick and grooved for the framing rods, while the intermediate posts are 4¾ inches on face by 3 inches thick. All posts are tenoned into sills and plates. The braces which are also 4¾ inches by 3 inches, are without pockets.

The body is carried on Fox pressed steel trucks and is equipped with the Miner draft rigging and gravity side bearings. The general dimensions are given herewith, which taken in connection with the elevations and plan of framing furnish the means to an understanding of the general features of the design.

Mr. J. T. Chamberlain, master car builder of the Boston & Maine, to whom we are indebted for the illustrations, explains that there is a very good reason why this road continues the use of wood in freight car construction, namely, that it fills the requirements of the road better than any other type of car, even though steel may have points of superiority over wood on other roads.

Length over outside end sheathing..36 ft. 9 and one-fourth in.
Length over inside end sheathing.......................36 ft.
Width over outside side sheathing..9 ft. 3 and one-fourth in.
Width over inside sheathing ....8 ft. 6 in.
Width over eaves ....9 ft. 6 and seven-eights in.
Height, inside ....8 ft.
Height from top of rail to top of brake shaft..13 ft. 11 5-8 in.
Height from top of rail to top of running board..13 ft. 3 3-4 in.
Height from top of rail to top of eaves (Murphy roof) ....12 ft. 7 in.
Height from top of rail to top of floor.......4 ft. one-half in.
Height from top of rail to top of body bolster 39 in. with 1 and three-eighth in. spring caps.



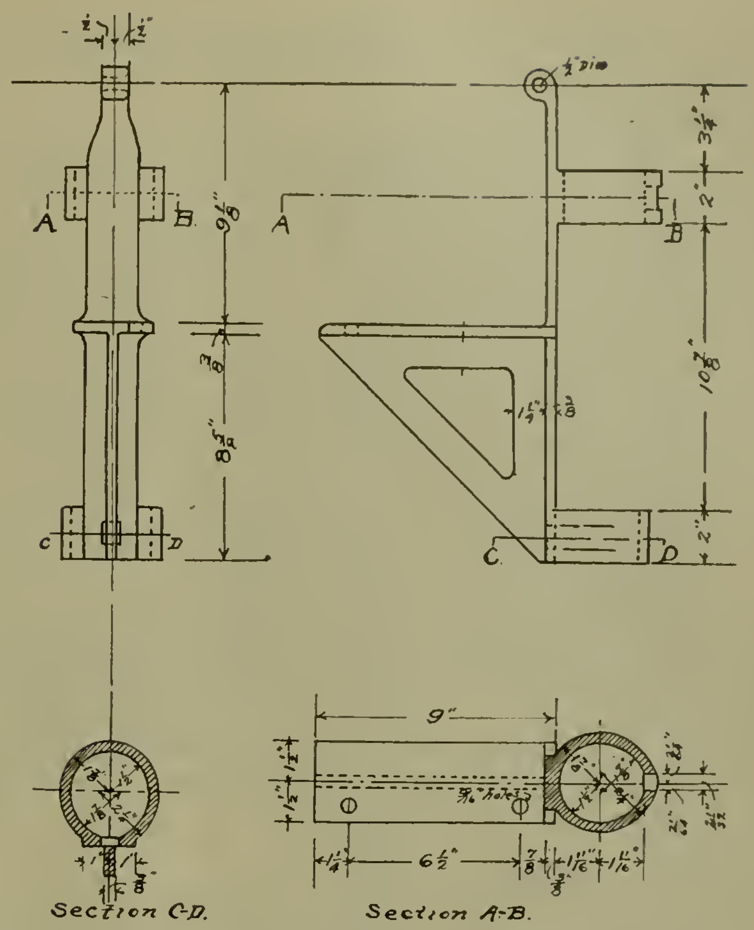
MINER GRAVITY SIDE BEARING — 60,000 LBS. CAPACITY BOX CAR, B. & M. R. R,

Scaffold for Locomotive Paint Shop D. L. & W. R. R.

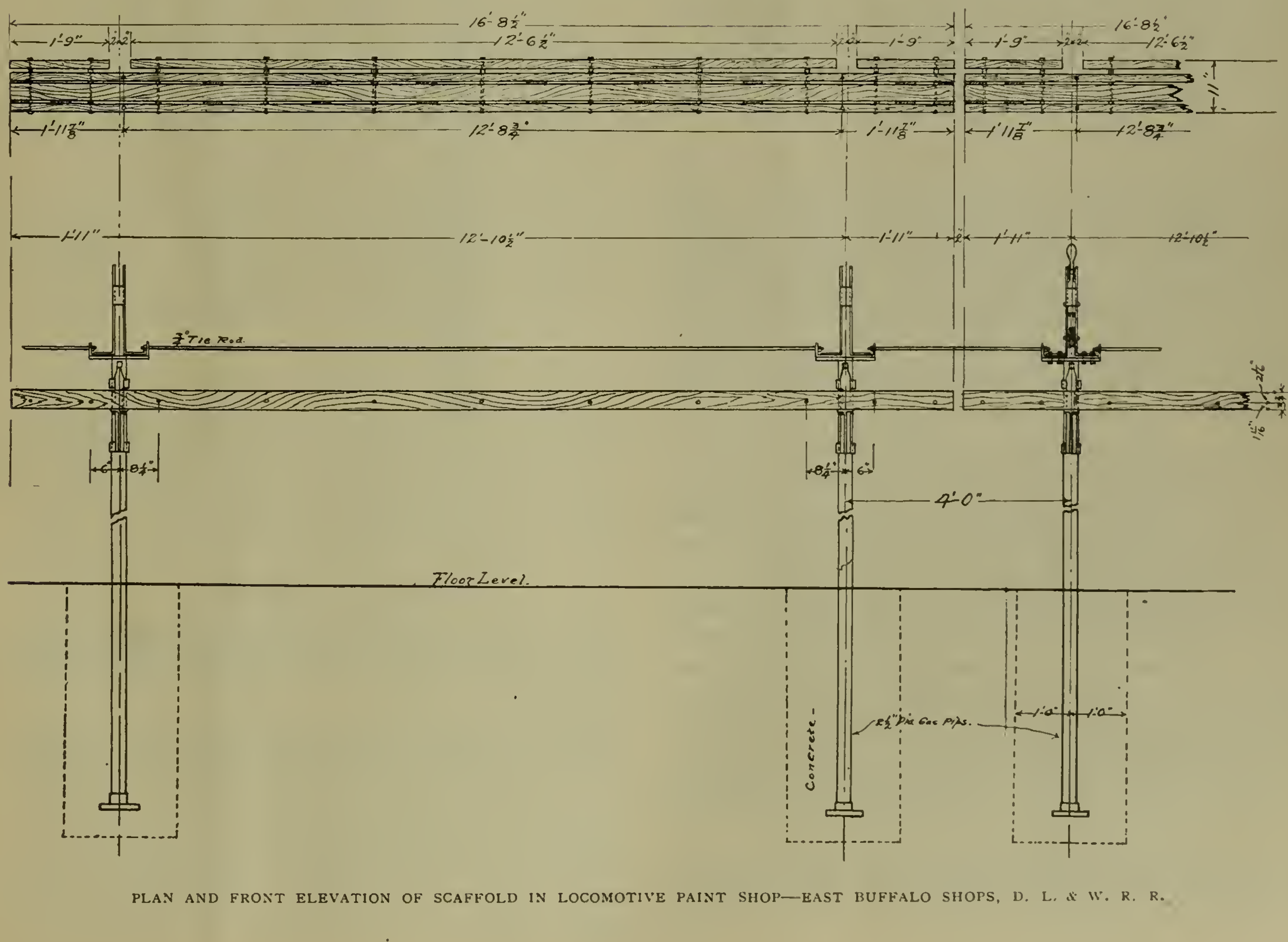
The Scaffold is a necessary feature of the modern paint shop, but its value depends largely on the way details have been worked out. The local conditions must be met and the operation made simple and positive. A scaffold of original design that meets these requirements has been erected in the locomotive paint shop of the D. L. & W. R. R., at East Buffalo.

The floor space taken up is small, but the novel features, combined with the practical design has resulted in a scaffold with an unlimited range and adaptability. All weights are hidden, and the planks are built without truss rods, yet in such manner that they cannot warp. Their movement is under almost absolute control of the operator, it being possible to stop, within a fraction of an inch, where wanted. The details of interest in the design of this scaffold are illustrated by the accompanying line drawings.

The locomotive paint shop in which these scaffolds are in service, is a building seventy-five feet wide and eighty-two feet long with five tracks arranged transversely. These tracks are spaced sixteen feet from center to center and extend the full width of the shop. Between these tracks and also spaced sixteen feet between centers, are constructed four lines of scaffolds which extend prac-



DETAILS OF BRACKET FOR SCAFFOLD IN LOCOMOTIVE PAINT SHOP—EAST BUFFALO SHOPS, D. L. & W. R. R.



PLAN AND FRONT ELEVATION OF SCAFFOLD IN LOCOMOTIVE PAINT SHOP—EAST BUFFALO SHOPS, D. L. & W. R. R.

tically the entire width of the shop. Each line is divided into four sections, the planks being sixteen feet eight and one-half inches long by eleven inches wide with two inches space between ends.

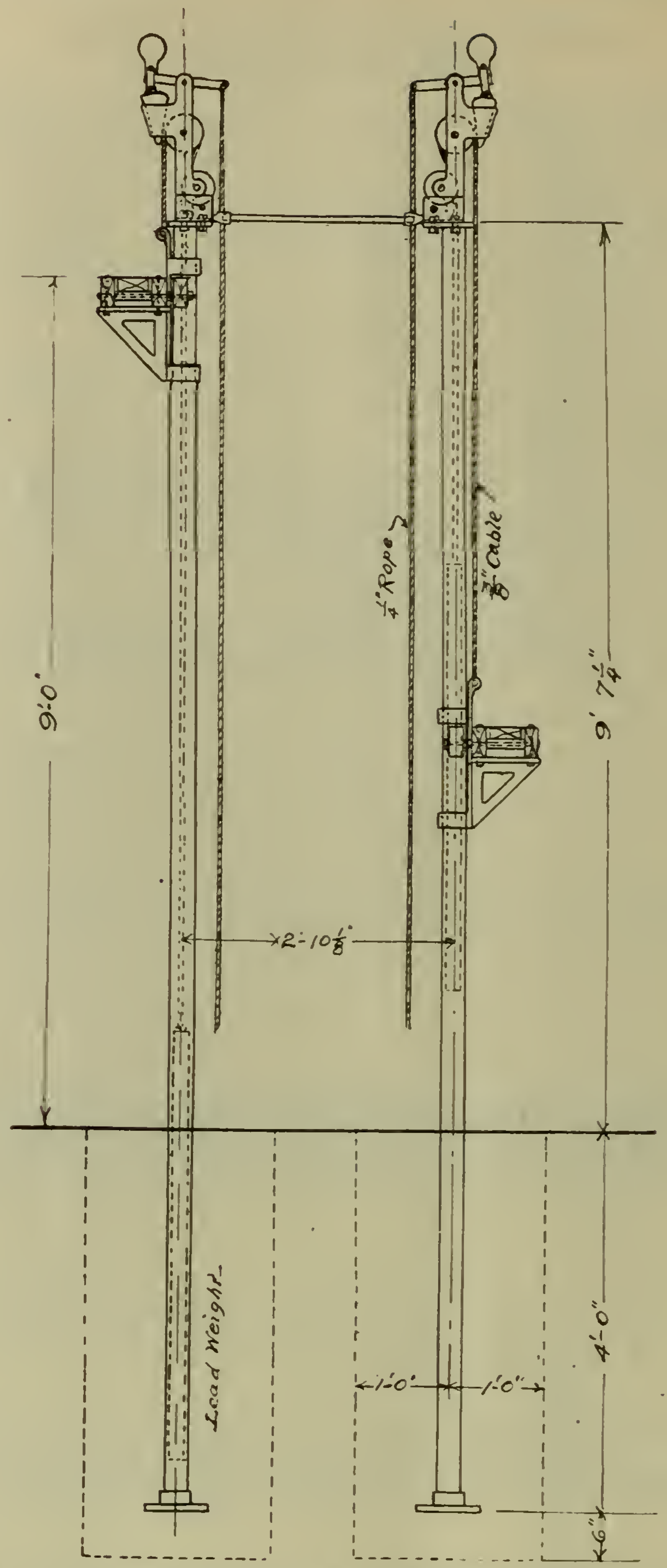
Each set of planks is supported by four, two and one-half-inch No. 12 gas pipe columns, thirteen feet seven and one-half inches long. The columns are imbedded in concrete foundations to a depth of four feet, leaving nine feet seven and one-half inches projecting above the floor. The columns are set in pairs, with two feet ten and one-eighth inches between columns, and are spaced twelve feet ten and one-half inches between centers with a distance of four feet to the centers of the columns of the next set of planks. The columns are securely braced against bending by a system of tie rods, in which each rod is made of three-fourths-inch iron and using one-inch gas pipe separators. A plate three-fourths inch thick and five and eleven-sixteenth inches wide by twelve and one-half inches long is tapped out and screwed on the end of each column which forms an anchor for the rods. While this construction is light the distribution of metal is such that sufficient strength is obtained.

Upon the top of each column and bolted to the plate mentioned above, is the carrying gear of the plank. It consists of two phosphor bronze self lubricating sheaves, over which the three-eights inch steel supporting cable runs. Above is located what might be termed the brake that controls the movement of the cable. The lead balance weight is placed inside of the column and is entirely out of the way. The brake, so called, is a wedge shaped casting faced with Babbitt metal, designed to grip or release the wire cable by manipulation of the operating rope. This rope is ¼ inch in diameter and hangs just back of the column.

The planks are 16 feet 8½ inches long, 11 inches wide and 3¾ inches thick, constructed of four strips of wood and separated by ½ and 1 inch filling blocks, the whole being bolted together by ½ inch bolts. The construction is strong and will effectually prevent warping and sagging. The bracket supporting the plank is a triangular-shaped malleable casting, to which are bolted two forgings made to slip over the end of the column to act as guides. In the outer face of the upper guide and the inner face of the lower guide a small brass roller is placed so that there will be free movement on the column when the plank is raised and lowered. On the upper end a lug is cast to which the wire cable is fastened. The planks can be raised to a height of 9 feet above the floor.

The operation of the scaffold is simple, direct and positive. To change the position of the plank it is only necessary to pull down the rope, which releases the brake and permits free movement of the plank. Simply letting go of the rope sets the brake and stops the plank. As the movement is not dependent upon holes in the columns, it is evident that the plank can be stopped at any point at the will of the operator.

In presenting the information and illustrations, we acknowledge the courtesy of Mr. F. J. Nies, architect of the D. L. & W. R. R.



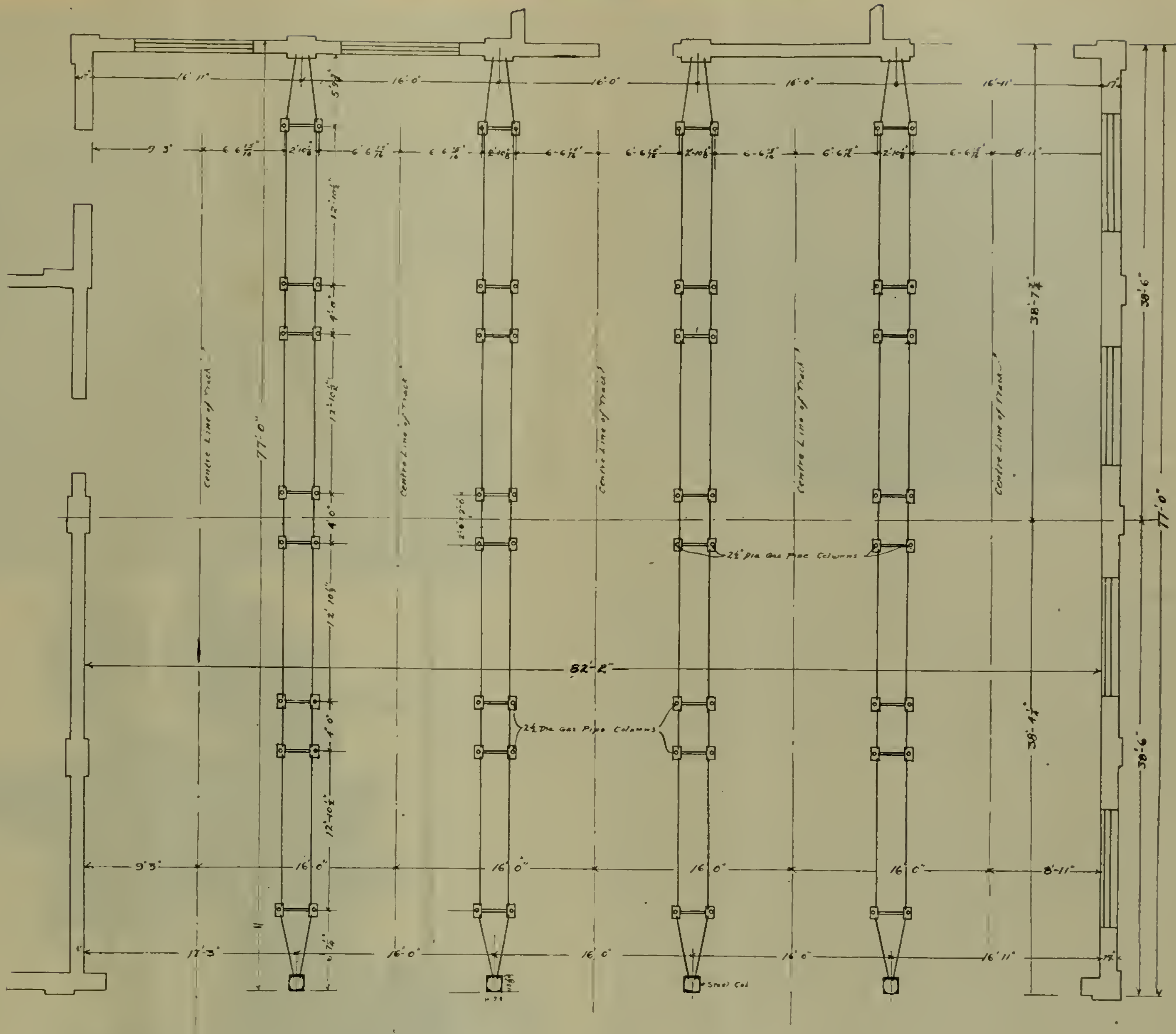
END ELEVATION OF SCAFFOLD IN LOCOMOTIVE PAINT SHOP—EAST BUFFALO SHOPS, D. L. & W. R. R.

Personal Mention

Mr. C. F. Rydberg has been appointed superintendent of the Angus car shops of the Canadian Pacific at Montreal, Que.

Mr. T. R. Shanks has been appointed master mechanic of the East Broad Top Railroad, with office at Orbisonia, Pa., vice Edgar Shellabarger, deceased.

Mr. W. W. Hamilton has been appointed road foreman of engines of the Atchison, Topeka & Santa Fe with headquarters at Newton, Kas., to succeed Mr. J. F. Roddy, resigned. Mr. Hamilton has heretofore been



LOCOMOTIVE PAINT SHOP, SHOWING GENERAL PLAN AND BRACING OF SCAFFOLDS—EAST BUFFALO SHOPS, D. L. & W. R. R.

an engineer on this system running out of Fort Madison, Ia.

The shops of the Atlanta Birmingham & Atlantic, of which Mr. J. E. Cameron is master mechanic, have been transferred from Waycross to Fitzgerald, Ga.

Mr. A. L. Beardsley, heretofore road foreman of engines, has been appointed division master mechanic of the Illinois Division, Atchison, Topeka & Santa Fe Railway, with headquarters at 18th Street, Chicago.

Mr. J. H. Green has been appointed master mechanic of the Norfolk & Southern, with headquarters at Newbern, N. C.

Mr. D. Anderson has been appointed master mechanic of the Chicago Union Transfer Railway, with office at Clearing, Ill., in place of Mr. E. Owen, resigned.

Mr. H. A. Coley has been appointed road foreman of engines of the Illinois Division, Atchison, Topeka & Santa Fe Railway.

Mr. J. G. Crawford has been appointed fuel engineer of the Chicago, Burlington & Quincy Railway, with headquarters at Chicago, Ill.

Mr. W. J. Crandall, road foreman of engines of the New York Central & Hudson River at Rochester, N. Y., has been appointed master mechanic of the territory east of and including Rochester, with office at Syracuse, N. Y. Mr. W. E. Elden has been appointed master mechanic of the territory west of Rochester. Mr. F. M. Steel has been appointed to succeed Mr. Crandall as road foreman of engines.

Mr. F. W. Williams has been appointed division master mechanic of the Chicago Rock Island & Pacific at Chickasha, I. T., in place of Mr. James McDonough, resigned.

Mr. W. A. Tribby has been appointed fuel inspector of the Baltimore & Ohio, with office at Baltimore, Md., succeeding Mr. J. F. Coniff, who has been appointed road foreman of engines at Cumberland, Md., in place of Mr. W. B. Blackwell, resigned.

Mr. O. A. Fisher, master mechanic of the Atchison Topeka & Santa Fe at Chanute, Kan., has been transferred to La Junta, Colo., in a similar capacity, succeeding Mr. R. Smith, resigned.

Mr. Herbert Riddle has been appointed roundhouse foreman of the Denver & Rio Grande at Salida, Colo., in place of Mr. W. C. Chambers, resigned.

Mr. F. F. Gaines has resigned as mechanical engineer of the Philadelphia & Reading to accept the position of superintendent of motive power of the Central of Georgia, with headquarters at Savannah, Ga.

Mr. J. A. MacNeill has been appointed chief inspector of the Union Pacific, with office at Omaha, Neb., vice Mr. F. Jerdone, Jr., resigned. He will have charge of inspection of passenger and freight cars and locomotives and all materials entering into their construction. Mr. MacNeill was formerly connected with the Atchison Topeka & Sant Fe in the inspection department.

Mr. James Hainen, heretofore general master mechanic of the Southern at Greensboro, N. C., has been appointed superintendent of motive power of the Northern and Eastern districts, with office at Greensboro. Mr. W. S. Murrian, heretofore master mechanic at Spencer, N. C., has been appointed superintendent of motive power of the Middle and Western districts, with headquarters at Knoxville, Tenn. Mr. F. P. Roesch, master mechanic at Birmingham, Ala., has been transferred to Spencer, N. C., succeeding Mr. Murrian. Mr. N. N. Boyden, master mechanic at Selma, Ala., has been appointed to succeed Mr. Roesch at Birmingham, and Mr. George Akans has been appointed master mechanic at Selma in place of Mr. Boyden.

Mr. William Schlafge, heretofore master mechanic of the New York division and branches of the Erie, has been appointed master car builder of that road, with headquarters at Meadville, Pa., vice Mr. R. W. Burnett, resigned. Mr. J. J. Dewey, master mechanic of the Cincinnati division, has been appointed master mechanic of the New York division and branches, with office at Jersey City, N. J., succeeding Mr. Schlafge. Mr. C. James, master mechanic of the Rochester division, has been transferred to Galion, O., as master mechanic of the Cincinnati division in place of Mr. Dewey. Mr. D. Van Riper, general foreman of the Meadville shops, has been appointed master mechanic of the Rochester division, with headquarters at Avon, N. Y., to succeed Mr. James. Mr. G. A. Moriarity, general foreman of the Port Jervis shops, has been appointed master mechanic of the Delaware division, with office at Port Jérvis, N. Y.

Tool Grinding by Machine

The matter of correctly grinding tools is one that is having more and more attention in the better organized shops where the importance of systematically caring for the cutting tools is fully appreciated. Tool grinding is considered just as much of a department or specialty as the operation of any machine or the maintenance of any department. To have the machine tool operators constantly leaving their machines to sharpen tools is no longer considered the best practice.

There are a good many excellent reasons for making a department for this class of work. In the first place, the matter of establishing and maintaining correct grinding angles for the various tools is of the utmost importance in order to get the maximum work out of any cutting tool. It is a well known fact that there are certain angles for every tool that will produce the best results and it is practically impossible to maintain these angles unless some method is followed in grinding the tools and whereby a department is made responsible for the maintenance of such angles. Tools cannot be ground and the best results obtained by the old method of every operator doing his own grinding. While many operators are very skillful in shaping cutting tools, yet the time of such men is considered much more valuable in operating the machine tool than in grinding, especially where the cutting tool can be correctly ground by machine. Tool grinding does not call for the most expert work when done on a tool grinder that is simple in its operation.

Another reason for machine ground tools lies in the matter of wasting time by the machine tool operator. As above stated, the time of a good machine tool operator is much better occupied while on his machine than while grinding tools. Under the old system there is the further difficulty of his not being able to use the grinder immediately, but will oftentimes have to stand in line waiting for two or three others to finish with the grinder before he can use it.

GISHOLT UNIVERSAL TOOL GRINDER.

There are many more excellent reasons for the establishment of a tool grinding system, but briefly they may be enumerated as follows:

1. Will grind tools more quickly.
2. Gives tools that are correctly ground.
3. Tools cut better—faster.
4. Increases the output of machine tools.
5. Saves the time of men and employs it to better advantage.
6. Machine ground tools are easier to sharpen.
7. Comparatively cheap labor may be used for the work.
8. Makes a systematic method of handling this important factor in the shop.
9. Does away with having a lot of unused tools lying about and getting lost.
10. Makes it so simple to get sharp tools that there is no excuse for the workmen to use dull ones and consequently injure the output.
11. Makes an annual saving in dollars and cents that will cover the cost of the grinder in a surprisingly short time.

To meet the requirements for a moderate priced tool grinder and a machine that will grind lathe and planer tools

FIRST OPERATION—MACHINE TOOL GRINDING.

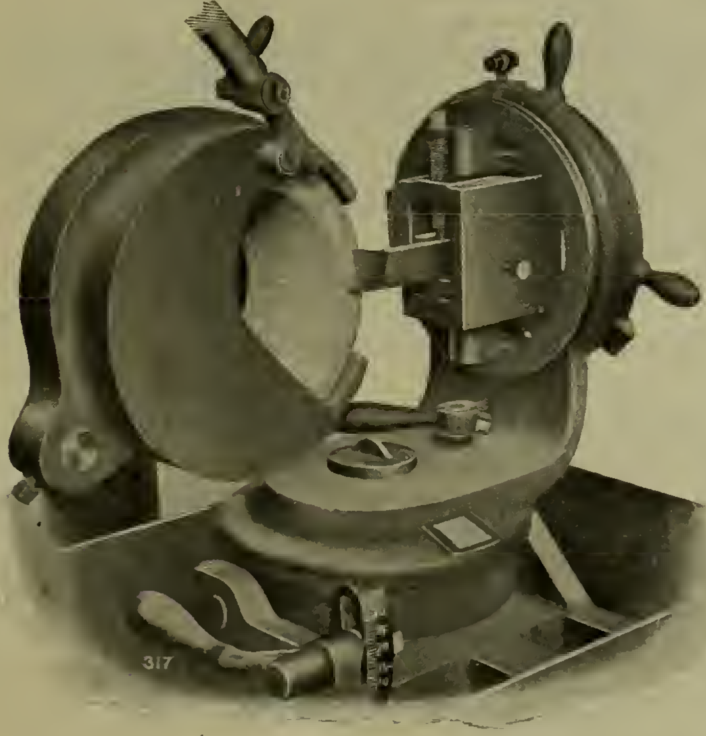
THIRD OPERATION—MACHINE TOOL GRINDING

quickly and accurately, the Gisholt Machine Co., of Madison, Wis., has placed on the market the machine illustrated by the accompanying engravings. Figure 1 shows the complete machine, while figures 2, 3, 4 and 5 show the successive steps in grinding a tool. This grinder is not a new machine, but a large number of them are now in operation both in this country and Europe.

The machine is a very simple one to operate. Briefly described, there is a cup emery wheel mounted directly on the spindle of the machine. Just below this is a large pan. Mounted in the pan is a tool holder in which the tool is clamped the same as it would be in the lathe or planer. This pan has two movements: one to and from the main column of the machine and acctuated by a hand wheel; the other an oscillating motion of the pan about the axis of the hand wheel, for traversing the tool across the face of the wheel. This motion is obtained by an up-and-down movement of the handle shown to the right of the pan. In order to obtain the correct angles for a considerable number of the standard lathe and planer tools, the Gisholt Company has prepared a chart which is sent out with each tool grinder, giving the correct angles for grinding the various tools illustrated on the chart. The company also provides, when desired, a set of fifty-seven sample tools correctly ground, for guidance in grinding and in forging. To illustrate the method of grinding the tool shown herewith, Figure 2 is the first operation. The tool is first clamped in the tool holder as shown. This tool holder has a universal movement so that the tool may be set to get the proper angle on the side, end, top or face as the case may be. There are four graduated scales. Reference to the chart gives the various angles required for a given side and upon being set to these angles the tool is traversed up to the wheel by means of the hand wheel which is operated by the left hand. The tool is traversed across the face of the wheel by means of the lever operated by the right hand. The tool is not removed from the tool holder until all faces are ground.

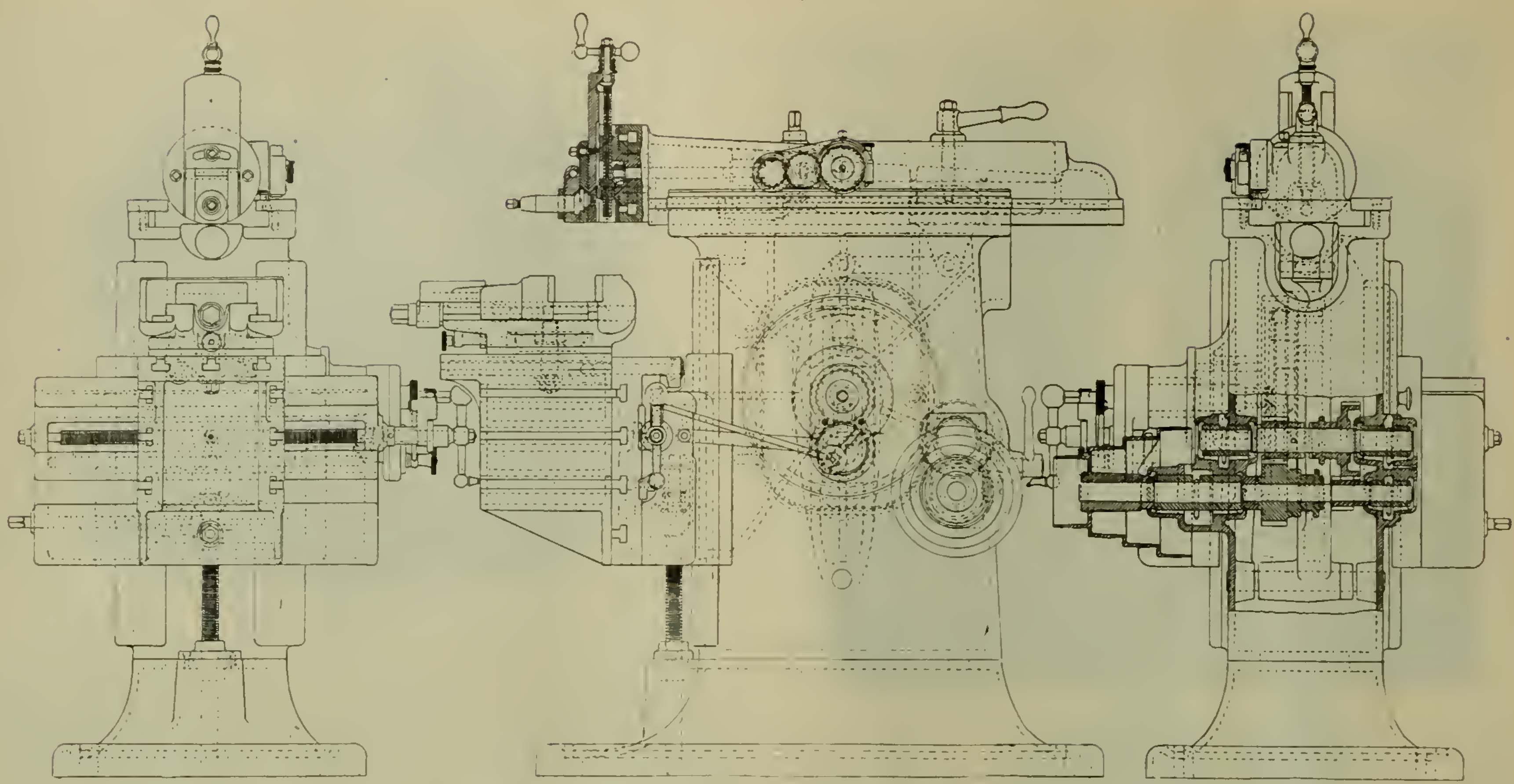
Another matter that is of importance in handling the tool problem is the question of correct forging of the tools. In order to assist the smith in getting the correct shapes, a set of blocks known as formers are furnished with each Gisholt grinder. By the use of these, nearly all of the usual shapes of lathe and planer tools may be attained; thus the minimum time would be required in forging.

A new catalog has recently been issued on this machine by the Gisholt Machine Company, which goes into the details of the tool grinding problem and the Gisholt grinder in a very thorough manner.



SECOND OPERATION—MACHINE TOOL GRINDING

FOURTH OPERATION—MACHINE TOOL GRINDING



SIDE AND END ELEVATIONS—SPRINGFIELD SHAPER.

Springfield Back Geared Crank Shaper

There is a class of work in the railroad shop that lends itself more readily to the shaper than any other style of machine. The shaper is in almost universal use and is generally recognized as a quick and economical machine for small work. A machine which fulfills many of the requirements of this class of work is the Springfield back geared shaper, illustrations of which accompany this article.

The column of this machine is of the usual box section, with large, round corners. The ways for the cross rail are unusually deep. The flange to which the crank or bull gear bearing bolts, has been extended. It is of large diameter, and connected to the column, by a bell-shaped form. This throws the strains as near the front and rear end of the column as possible, without detracting anything from its appearance. This flange is bored out, and the bull gear sleeve or gearing is forced into this bored seat and rigdly supported close to the gear. This outward form is reinforced on the inside by large ribs radiating from the several bearings to the points where the greatest strains are set up. This makes a rigid unit against all strains of either a tensile or torsional nature.

The lever for changing the back gears is located at the rear end of the column out of the way, and convenient to the operator.

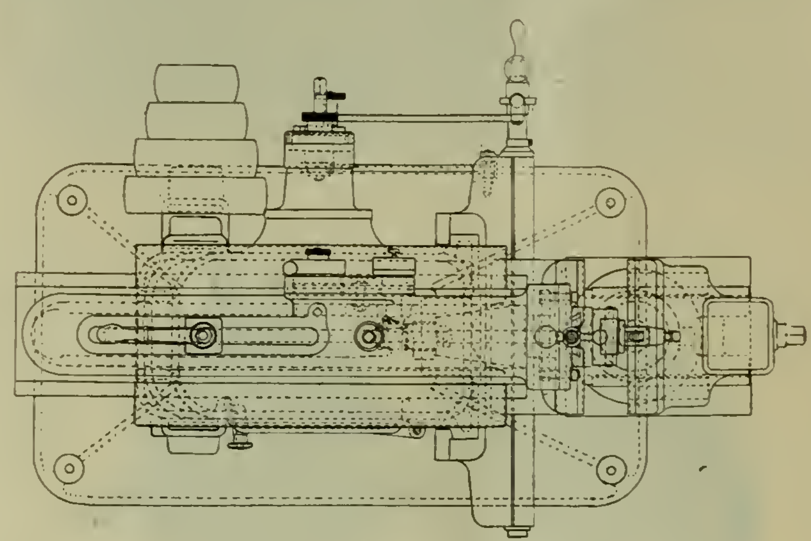
The crank or bull wheel is constructed in such a way that the adjustable crank or wrist block does not overhang; but has its seat set deep in a channel-shaped bearing with heavy ribs on either side, passing entirely across the face of the bull wheel. Further care is taken to make the bearing upon which the bull or crank wheel revolves very large in diameter at the point where it attaches to the gear.

The rocker arm is of a solid non-adjusting form, having very heavy ribs, with the deepest cross section at the point of greatest strain and supported at the bottom by a large shaft. All the bearing surfaces are unusually large and well fitted.

The ram has a ratio of two to one and receives its motion from the rocker arm through an adjustable yoke on its under side. The adjustable yoke on the under side of the ram has a hole through it sufficiently large to allow the largest shaft specified to pass freely through it. The appearance of the ram is not sacrificed as the reinforcing members are placed inside of its circular cross section. The fact that a shaper ram is subjected to its most severe strains when on the greatest outward position, has been cared for by placing two large ribs lengthwise and having their greatest section at this point on the under side of the same.

The position of the ram may be changed by loosening the clamp handle seen on the ram, which is connected with the yoke by a stud. This yoke is provided with a nut through which a screw passes, having a miter gear on its end nearest the head, which engages with another miter on the squared shaft. This is seen protruding through the ram just back of head. The swivel tool head is fastened to the ram by two bolts, with nuts in T slots.

These shapers are designed with a view to produce an ac-



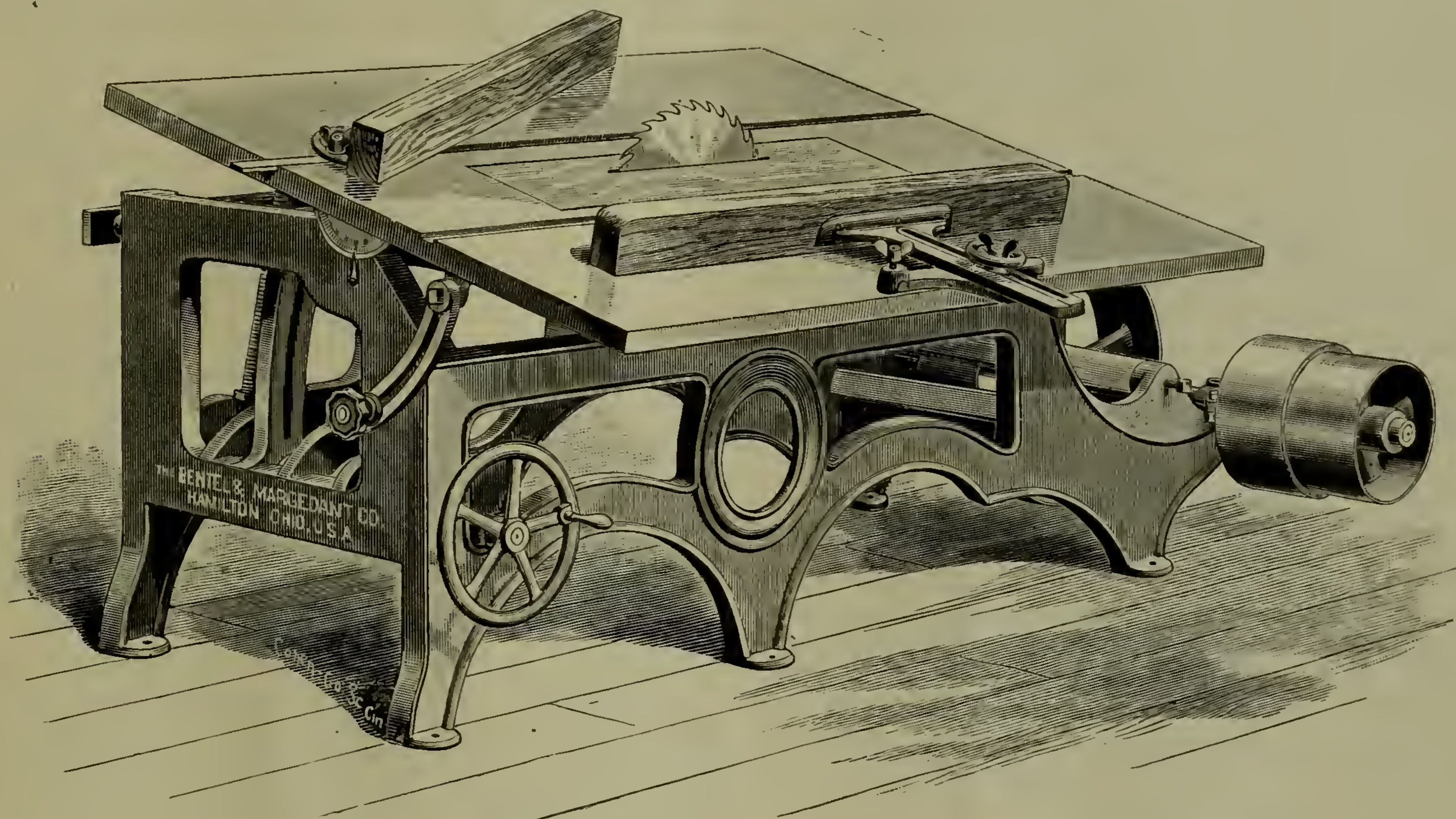
PLAN—SPRINGFIELD SHAPER

curate machine, and as rigid as any on the market. Therefore the table support extending down to the base has been eliminated entirely. In its stead all members upon which rigidity depends, have been strengthened. Starting with the first point of weakness, commonly noticed, the ways on the column for the cross rail, as stated before, are unusually heavy, followed with a cross rail in keeping. Its ways will be noticed to have an unusual long bearing upon the column. The cross rail in turn has a large support for the cross slide, which is not only deep, but long.

The method of fastening the box table to the cross slide has been improved in that the T slots are not depended upon to carry the load, and thrust of cut. Three large studs are tapped into the back of the box table passing entirely through the cross slide just above the way upon which it moves, and fastened with a nut and washer. The depth of the box table is much greater than usual practice by an amount that will be noticed in the form of the rib at the bottom.

The telescopic screw for raising and lowering the table is as far out from the column as depth of cross rail will permit. The feeding device is of the well known adjustable ratchet and pawl form, which is automatically adjusted to position for different positions of the table.

All gibs entering in the construction are of the straight variety, backed up by large screws.



"HAMILTON" HEAVY UNIVERSAL SAW—BENTEL & MARGEDANT CO.

The vise is of unusually heavy design, having an improved indexing device, in the form of a plunger, with a taper end, entering into the indexing, which is solid in the base. The movable jaw entirely covers the screw thus protecting it from dirt.

This machine is manufactured by the Springfield Machine Tool Company, of Springfield, Ohio.

"Hamilton" Heavy Universal Saw

This machine embraces in its construction all the improved features found in the medium universal saw and is similar in general design, but is larger and heavier throughout, and intended for work of a heaver character.

The frame is of a heavy ribbed pattern, strongly connected and braced. The swinging housing carrying the saw mandrel pivots near the countershaft, is adjusted up and down by means of two vertical screws geared together, and operated by one hand wheel.

The iron table is of extra large dimensions—sixty inches long by forty-two inches wide. It can be tipped from a horizontal position up to an angle of forty-five degrees, or any intermediate angle, and is firmly held at any angle by the radial lock-clamp shown. An accurate graduated index scale cut on the circular guide upon which the table rests, fixes the table quickly at the required angle without remeasurement.

Two sliding ways are planed in the table, one on each side of the saw, for the reception of a cross-cut gauge. The gauge can be quickly set at any angle for angular cutting, by the accurate graduated scale which is cut deeply in the table top. The ripping gauge moves easily forward and back over the surface of the table by a rack and pinion feed, and can be removed quickly from the table.

A sixteen-inch saw is furnished with the machine, although saws up to thirty inches in diameter can be used.

Gaining, grooving, etc., can be done on this machine by special arrangement for it, at small advance in price. An extra cross-cutting table for the sawing and gaining of long heavy work is also provided on special orders. This machine is manufactured and marketed by The Bentel & Margedant Co., Manufacturers of wood-working machinery of all kinds, Hamilton, Ohio.

Technical Publications

"Proceedings of the Fourteenth Annual Convention of the National Railroad Master Blacksmith's Association." Held at Chicago, Ill., August 21, 22 and 23, 1906. Edited by A. L. Woodworth, Lima, Ohio. 6 in. by 9 in. 203 pages.

This volume of the Proceedings is of the same form and general arrangement as previous years and contains all of the committee reports and discussions of the convention. A number of interesting and important reports were discussed among which may be mentioned, Frogs and Crossings, Flue Welding, Piece Work, Making Locomotive Frames, Best Method of Annealing and Tempering High Speed Steel. The association now has 316 members.

"Railway Storekeepers' Association." Proceedings of the Third Annual Convention. The proceedings of the third annual convention of this association, held at Chicago in May, 1906, include reports on the storehouse as a factor in economy; tidiness in the storage of material; forms of requisitions and systems of recording; methods of checking shop material; ordering and receiving manufactured material; checking receipt of oils and paints; allowing scrap credit; and stock records. In addition to the regular reports and discussions during the convention, the book contains the paper presented before the Western Railway Club on the true perspective of the supply department, by Mr. George Yoemans, and the paper presented before the Canadian Railway Club concerning the railway stores department and its relation to other departments.

Published by the association, J. P. Murphy, president, Collinwood, Ohio.

"American Stationary Engineering." The Derry-Collard Company, New York. Price, $2.00.—This book which is bound in cloth and containing 285 pages, is the most recent of the educational series issued by the above well-known publishers. The name of the author, W. F. Crane, is a sufficient guarantee of the value of the contents to the stationary engineer and fireman. The information contained in this work is not copied from other sources, but is gathered from the experience of a practical man with a technical training who has the faculty of putting the science of engine-room practice in language easily understood. The scope of the work embraces engines, boilers, valves and valve setting, pumps, etc., and the necessary mathematics simplified, besides innumerable engine-room kinks. This book, like all others of the Derry-Collard publications, is sent on approval.

Notices of Catalogues

The first number of the Santa Fe Employes' Magazine has made its appearance under the December issue. It is an attractive magazine published monthly in the interests of the employes of the Santa Fe Railroad. Albert Mac Rae is the managing editor with offices in the Railway Exchange, Chicago.

The Joseph Dixon Crucible Co., Jersey City, N. J., has sent out a bulletin in regard to its air brake and triple valve grease. It is shown that the grease is a superior article for lubricating triple valves and general use in air brake systems.

The Globe Ventilator Co., Troy, N. Y., has been distributing a pamphlet illustrating and describing the Globe ventilators for cars, depots, shops, roundhouses, freight houses, etc., and the Globe lamp jacks for passenger cars. These devices are in use on many of the railroads, and the pamphlet gives a list of quite a number of those companies using them.

A consideration of the merits of the friction draft gear for use on cars and locomotives is taken up in a pamphlet entitled "The Draft Gear Problem." The pamphlet is published by the Frost Railway Supply Co., Detroit, Mich., with the idea of contributing more information on the subject of improved draft practice and will be mailed to any railroad man making request to the company named.

"Steam Traps,' by W. H. Wakeman, is the title of a pamphlet which is being distributed by the Joseph Dixon Crucible Co., Jersey City, N. J. It is an illustrated description of the several varieties, with valuable suggestions by Mr. Wakeman, expert steam engineer and author of well-known books on steam engineering. Some steam users seem to think that a steam trap is only a luxury to be enjoyed by those who have expensive plants in operation and wish to show many extra appliances which might be dispensed with, and not be missed. This is a great mistake, as a trap is valuable according to the cost of fuel that must be burned to make the steam.

This pamphlet is well worth most careful reading, for it is instructive as well as interesting.

The Detroit Graphite Manufacturing Co., Detroit, Mich., is sending out a neat little pamphlet calling attention to the "Superior Graphite Paint," and "D. G. M." paints manufactured by the company. The pamphlet contains half-tone illustrations of various places where these products have been used. Graphite paint is a well-known preventive of rust and the company's "Superior Graphite Paint" is standard on many large railroads for painting bridges, viaducts, and other places subject to the sulphur fumes, cinders and steam from locomotives. The company manufactures a full line of station paints, freight car paints, special paints for trucks, car roofs, locomotive cab roofs, underframes, coal space for tenders, hand rails, signal and interlocking apparatus, and special steel car colors.

Notes of the Month

The Refined Iron & Steel Co., Pittsburg, Pa., recently placed its new plant in operation for the manufacture of high-grade puddled iron, for the various uses to which iron is put. One of the company's specialties is staybolt iron, which is manufactured under the process invented by Mr. William Stubblefine, who is manager of the plant, and has had many years experience in the manufacture of iron. Mr. J. C. De Noon is president of the company, Mr. I. N. De Noon is treasurer, and Mr. Henry F. Gilg, secretary, the latter having charge of the sales department.

Mr. George A. Berry, until recently engineer of company forces of the New York Central & Hudson River, has been elected vice-president and general manager of the Hicks Locomotive & Car Works, with office at Chicago. Mr. Berry will have charge of the plants and business of the company.

The firm of John F. Allen, 370,372 Gerard Avenue, New York City, is in receipt of an order from the American Car & Foundry Company for six Allen compression lever riveters to be used in its new plant in St. Louis, Mo. This is part of an equipment of 15 riveters for the same plant, the balance of which will be ready for shipment by the first of January.

Mr. W. H. Garrett who recently resigned as manager of the railroad department of Fairbanks, Morse & Co., has become connected with the Buds Foundry & Manufacturing Co., of Chicago, in charge of special construction.

The Ryan Car Co., has been organized by Mr. W. M. Ryan, formerly manager of the Western Steel Car & Foundry Co., and Mr. J. M. Hopkins, who has for some time been connected with the Camel Co. The Ryan Car Co., has been formed for the purpose of engaging in the business of repairing and rebuilding cars and locomotives, and dealing in second hand equipment. This company has purchased the plant of the Northwestern Car & Locomotive Co., at Hegewisch, Ill.

Mr. Albert A. Taylor has been appointed manager of the railroad department of Fairbanks, Morse & Co., Chicago, to succeed Mr. M. A. Garrett. Mr. Taylor has been connected with the company since 1898, having started with them as traveling representative in the south. Later he represented them in the Middle States and Canada, and was for more than a year located in New York City. For three years past Mr. Taylor has been salesman in the Chicago territory and has also been assigned to considerable special work.

The Ralston Steel Car Company, Columbus, Ohio, is doubling the capacity of its plant. At the present time it is turning out 10 cars a day. By the first of the year it is expected to have an output of 20 cars daily. In addition the plant is turning out 20 to 25 steel underframes a day. Orders booked are sufficient to keep the plant busy for some time.

A Chicago office has been established by Adreon & Co., of St. Louis, Mo., which will be in charge of Mr. Edw. W. Hodgkins, vice-president of the company, with headquarters at 208 Western Union Building. Mr. Hodgkins is also vice-president of the L. J. Bordo Co., manufacturers of the Bordo blow-off valves and swing joints, and the latter company has established an office in Chicago, which will also be under the charge of Mr. Hodgkins.

Railroad Paint Shop

Edited by
J. H. PITARD
M. C. Painter, M. & O. R. R.

Devoted to the Interests of
Master Car and
Locomotive Painters

Official Organ of the Master Car and Locomotive Painters' Association

Advisory Committee Meeting.

The annual meeting of the Advisory Committee of The Master Car and Locomotive Painters' Association of the United States and Canada, will be held at the Grand Hotel, Cincinnati, Ohio, on Friday, February 22, 1907. A cordial invitation is hereby extended to all members of the Association who can be present.

The committee are willing to receive and will appreciate any suggestions as to subjects for discussion at the next annual convention.

JOHN F. LANFERSIEK,
Chairman.

Pullman Body Color

An Analysis of the Ingredients that Compose it.

The Pullman body color which varies in shade from a light olive to a dark olive, is commonly composed of drop black, Indian red, and medium chrome yellow. Although ivory black and stone ocher is sometimes used in lieu of drop black and chrome yellow. That which contains chrome yellow is preferrable, on account of its extra strength, as it will admit of being used much thinner, which is a decided advantage in all colors.

Drop black, also called Frankfort black, taking its name from the German town in which it was first manufactured, and is called drop black on account of the shape in which it is prepared for sale. It is made from a variety of materials of organic character, such as vine twigs, peach stones, hop vine, bone shavings, ivory cuttings, etc. They are calcined in a closed vessel until they are thoroughly charred. The black thus obtained is ground as fine as possible with water, the mass is next lixiviated to free it from soluble matters and then dried. It is then mixed with a little glue water and made up into small pear shaped drops for sale. Drop black is of fine texture, varying in hue from blueish black to reddish black, which is due to the different materials of which it is made, vegetable matters yield a black of a blueish hue, and animal matters a greyish hue.

Drop black owes its color to carbon, the amount of which varies in different samples. The following is an analysis of a sample of drop black.

Water, 2.333 per cent.
Carbon, 65.742.
Mineral matter, 31.925.

The mineral matter contained phosphate of lime, an evidence of the use of bones in the composition.

A Color of Medium Shade for Car Bodies

According to papers read at the recent Master Car Painters' Convention, it was very clearly demonstrated that the injury to paint and varnish resulting from the sun, was in proportion to the depth of the shade of color. Therefore in order to profit by this fact, in such manner as to prolong the life of paint and varnish, a lighter shade than those commonly used seems to be necessary, and since the general tendency is to abolish all ornamentation on the exterior, a medium shade of color would meet all necessary requirements. There are two advantages to be gained in the use of such a color. First, it would absorb less of the suns rays, and therefore would in a large measure counteract the detrimental effect of the sun in burning up the paint and varnish. Second, it would form a slight contrast between the color and the dirt that forms on the body of the car, which in terminal cleaning would enable one to determine just where the greatest amount of rubbing was, or was not needed, and thus obviate the danger of rubbing all the varnish off in places, and leaving all the dirt on in other places as is often the case where the dirt and paint is of the same color, and after having been cleaned, it would appear worthy of the labor that had been expended upon it. Next to durability, the most essential point about a passenger car body color, is its contrasting effect with the gold ornamentation, but as all striping or other ornamentation has been generally abandoned, there is no longer any need for the darker shades of color, for this particular purpose, therefore a medium shade of color that would slightly contrast with the dirt would not only prove more durable, but would greatly facilitate the process of terminal cleaning.

Uses of Sawdust

Many are the uses of sawdust. In the days when the sawdust wagon made its lumbering rounds through the streets of most large cities two commercial uses of sawdust were to sprinkle floors and to shelter lead pipes from cold and glass bottles from breakage.

Near every sawmill was a vat for the sawdust and it was carted away free by any one who had any use for it. In this era of the use of by-products sawdust has a commercial value. It is no longer given away, but is sold.

One of the recent uses of sawdust is its distillation, resulting in acetic acid, wood naptha, wood alcohol and tar. Sawdust may also be burned in special furnaces or mixed with other material for fuel.

Sawdust, when saturated with chemicals, can be effectively used in the manufacture of explosives, but it is more particularly in demand in paper making than for any other purpose. Such a thing as sawdust on the floor of a room as substitute for a rug or carpet is now practically unknown. Sawdust has joined sand in this respect.

Cotton felt has been substituted for sawdust as a non-conductor of cold in winter. Gas can be made from sawdust. It is also used for briquettes, i. e., blocks of compressed sawdust and wood chips burned for fuel. Even in the protection of glassware against breakage sawdust has been superseded by excelsior, sawdust being regarded as too valuable for such use.

Non-Inflamable Wood

Consul D. I. Murphy reports from Bordeaux interesting experiments on the great public square, the "Quincoces," where is to be held from May to October next the International Maritime Exposition in commemoration of the hundredth anniversary of Fulton's successful application of steam to navigation. The consul writes:

"Warned by the great damage caused by the recent fire at the Milan Exposition, in which valuable tapestries and other works of art were destroyed, the deputy commissioner-general devoted much of his time to the study and investigation of the different methods of rendering wood, paper, silk, cotton and woolen stuffs non-inflammable. Of all the formulae submitted he decided to experiment with the following: Sulphate of ammonia, 135 grams; borate of soda, 15 grams; boric acid, 5 grams, and water, 1,000 grams. The exhibition consisted of treating pine shavings, wood, paper and cotton fiber with this preparation and, after a thorough drying, applying the fire test,

A huge pile of shavings, pine kindlings and wood was set on fire, and in the blaze were thrown shavings and sticks of wood impregnated with this 'ignifuge.' When the fire had exhausted itself the impregnated shavings and wood were found to be simply blackened and charred; they gave out no flame. Paper and cotton fiber treated with the same solution when exposed to the flames consumed very slowly without a blaze. So successful and conclusive seemed the demonstration that Mr. Morlot gave orders that all wood and timber used in the construction of the exposition buildings and all cotton, canvas and linen stuffs, carpets and rugs employed in the furnishing thereof should be treated with the 'ignifuge.'

The Paint shop and Terminal—Their Relation to Each Other

In the economy of the organization of the various railway departments, that of terminal cleaning is sometimes neglected, or if not neglected entirely, does not receive the consideration that its importance entitles it to. Possibly in many instances the foreman in charge of terminal work has been selected on account of his ability as an inspector or as a general all-round hustler, but possibly has had no previous training in car cleaning, and probably has never considered the chemical relationship existing between a bar of lye soap and a piano polished surface. Possibly no questions were asked as to his knowledge along this line, and possibly no instructions given him as to the correct method of terminal cleaning. But he is left to pursue such a course as his own sweet will may suggest. Just here is a large leak through which many dollars of the company's earnings are wasted that might be saved. Anything that is as essential to the appearance and preservation of passenger equipment as paint and varnish, certainly deserves to be taken care of by those into whose hands it falls after it enters service. It is work that calls for special training and fitness, which cannot be given by any one better than by the foreman painter, who has made a life study of the nature of paint and varnish.

If a man is taken sick, he does not send for a tailor or a shoemaker to cure him, but he places himself in the hands of a physician, a man who has had special training in the curing of human ills. Does it not then appear absurd to place a fine passenger or dining car, upon which time and money has been expended, in the hands of some one who does not appreciate its value, and without any conception of the proper care of it.

It can not be doubted that the life of paint and varnish can be either materially curtailed or prolonged by the treatment given it in terminal cleaning. The terminal bears a very close and a very important relationship to the paint shop, for the reason that any or all injury resulting to paint or varnish as a result of improper or negligent cleaning, falls directly on the paint department. This is an unnecessary burden that is sometimes increased by a disregard of scientific methods, and by pursuing such methods of cleaning, which although they do no perceptible injury, are not used with a view to prolonging the lift of paint and varnish.

In the absence of an established terminal cleaning system, no uniform results from paint and varnish can be expected. If bar soap is used for cleaning one car, and a hose and clear water only for another, and an emulsion cleaner for another, naturally the results will vary as widely as do the various methods of cleaning, and possibly each car will require a different treatment when it reaches the shop after a twelve months' service. These are not suppositions merely, but are instances that are happening every day, and can only be obviated by establishing and maintaining an up-to-date system of terminal cleaning. The continuance of such a system after being established requires the watchful eye and practical care of the foreman painter, as any laxity in pursuing established rules must necessarily result detrimentally to paint and varnish.

While no iron clad rules can be laid down for terminal cleaning, except only in a general way, yet when it becomes necessary to depart from such rules in particular cases, as circumstances may determine, such departure can only be wisely decided by a practical painter. Give the foreman painter something to say as to how his work shall be taken care of after it leaves his hands, and thus not only increase his responsibility but increase his interest as well.

Varnish Pitting, Blotching and Pocking

These troubles are of the "atmospheric" kind, although they can also be classed in the second division as often due to unskilled or careless workmanship, as it is certainly a piece of carelessness to permit some of the conditions which produce these deviltries.

It is to arrange a uniform and proper temperature in the finishing room during the drying process; to so arrange the heat from stove or steam pipes that any sudden change during the day or night shall not affect the temperature of the finishing room. Such changes, if not guarded against, will surely produce these and other troubles.

Pitting is one of the most frequently met of varnish troubles, and may arise from the use of too much oil in the under-coatings. It may occur when the rubbing varnish has a hard or glossy surface, which is apt to repel the finishing coat, forming pits, globes or runs; when the last under-coat is of a mixture of color and varnish, or of two imperfectly mixed body varnishes, or of turpentine and varnish, or of Japan drier and varnish, or anything else mixed with the body varnish. When the last coat of rubbing varnish has been rubbed through, and the next under coat is of a different varnish or composition, pits may appear at the rubbed through places. It may occur from the use of a greasy or dirty chamois skin, or sponge, used to wipe off the surface when the finishing coat is applied. Also from soap, or grease from the hands of the operator, where they may at any point touch the work. A varnisher, who at his work sings, sneezes, talks, or breathes heavily, is apt to impair the surface by a deposit of moisture from the breath, distributed over the work, which is sure to cause pitting. Pitting, may be the fault of the finishing varnish, if it contains undissolved gum, dust or other foreign matters; if there is too much essential oil or spirit in the varnish, it may evaporate unequally and break the surface, thereby forming pits; if the varnish brush has not been thoroughly cleaned, the particles left are apt to form pits, and in any event are certain to form specks. It may also result, and most frequently does, from a damp atmosphere in connection with a slight draught, which does the damage in the first few hours after the coat is applied, or by dampness in the varnish room, due either to a foggy or rainy atmosphere, or to a wet floor in the room. This practice of wetting down the floor, is fraught with danger and should be avoided. A safe way to clean a varnish floor, is to sprinkle it well with damp sawdust, and at once sweep clean. This raises no dust, and obviates the danger of a wet floor.

Too much draught may easily exist from a stove drawing air through crevices in the sides of a room, and thereby creating too much circulation; injurious draughts may also occur by opening a ventilator by opening and shutting a door for ingress and exit, by the varnisher or other person walking swiftly through the room, or by the varnisher's breath coming in contact with the varnished job. It may also occur by reason of crowding the varnish room with too many jobs in course of finishing, which saturates the air with turpentine fumes before the setting of the varnish coat is completed. This also prevents the varnish hardening readily, and has a tendency to form holes and pits, by reason of minute matter being always contained in the varnish and flying into it during the time of setting. The slow setting of sensitive finishing varnish is also the cause of small runs in forms of something like an inverted comma, which shows its worst feature on a much hardened under surface, particularly on an old job revarnished, and is analogous to pitting. By overheating the varnish room or by letting it cool down too near the freezing point, pitting is encouraged. It is recommended, to avoid pitting as much as possible, that all under coats of paints should be laid on flat, that is, without gloss. The painting must not contain any red lead or sugar of lead, and there should be at least two coats of first class rubbing varnish over the color.

Another cause of pitting is the practice of mixing two kinds of varnish of different grades, especially of different makers. Another cause is varnishing over color or varnish which has not become sufficiently dry, or which is sweaty. If a case of pitting is observed just as the varnish is about to set arising from a sudden fall of temperature in the varnish room, due to sudden atmospheric change, the damage may be repaired if a fire is at once made in the varnish room stove. In cases where the varnish has not gone too far in drying, it will flow out perfectly, and the pits entirely disappear.

The position of work in the varnish room, sometimes, influences and modifies the drying of freshly spread coats. If a carriage body or panel is placed close to and facing a side wall of the room, just after laying the varnish, it will invariably happen that such a surface will dry more slowly than one with a free space or some distance all around it. If the finishing varnish used is very susceptible to adverse influences, such treatment will favor development of pitting, crawling, and all other that are more inclined to show themselves in every case where drying is retarded. When varnish rooms are filled with green work, it may sometimes prove disastrous because of the reason just described. Adding the oil to the varnish to make it work easy, is another cause. This practice, not common we are sure is worse than carelessness. Any varnish sent out by a reputable house, is fit for its intended use as received from the maker, and needs no additions or alterations. If it fails to do what the maker claims for it with fair and proper use, send it back. Or, if a painter thinks he knows more than the varnish maker, let him change his trade.

Scientific and skilled men can always find a good berth in a paint or varnish factory.—Selected.

Painting Giant Signs

How is it possible in painting a picture of a man, say, thirty, fifty or a hundred feet tall, on the side of a blank wall, to make the figure come out all right in form and life-like and natural?

The artist can't see the whole figure in its true proportions as he paints on it, but only a part of it. He may be painting at this minute on an ear or a nose or a chin or on one of the figure's hands, and he can see that; but how does he know that he is getting that in proportion with the other features and the entire figure? Why doesn't he get the head too broad or too narrow and the whole business out of skew?

He is standing as he paints close to the wall and on a scaffolding hanging may be forty feet from the ground. He can't jump down every few minutes and run off fifty or a hundred feet and take a squint at the picture to see how he's getting on, and as a matter of fact he doesn't; he stays right there, up in the air, and slaps on the paint boldly and with confidence, and the picture comes out all right.

But how does he manage it? Really in the simplest way in the world.

As a model or pattern for the great picture there is first drawn a life size portrait of the person whose figure is to be thus, reproduced, and this life size portrait is then painted precisely as it is desired to have it appear in the giant production. Then over the entire front of the painted portrait figure are drawn equidistant vertical and horizontal lines, dividing the painting into squares, like those on a checker board.

Then the checker board that has thus been drawn on the pattern picture is reproduced on an enlarged scale on the wall to be painted by drawing there a corresponding number of vertical and horizontal chalk lines, dividing the wall space off into the same number of squares with those on the portrait painting.

Suppose the original portrait painting was six feet in height; in which case the vertical and horizontal lines on it might be four inches apart, dividing the painting into four-inch squares. Suppose the painting on the wall was to be thirty-six feet in height, or six times as big as the original. In such a case, with the same number of lines drawn there, the squares would be just six times as large as those on the original—they would be twenty-four inch squares.

But all over the great wall surface the enlarged squares would correspond exactly with the smaller squares in position and relation, and so with the lines of the squares for a guide the work of painting the great picture is easy—for the man that knows how.

Even with the wall so prepared not every man can paint one of those big pictures. To do this work successfully the painter must be himself a good freehand artist, with knowledge of his art and facility with the brush; but with those lines on the wall and the lined-off original conveniently beside him on the scaffolding, the expert goes at it with dash and vigor, and with certainty of result.

For illustration:

On the original lined-off figure the slope of a shoulder may enter a certain four inch square and at such a point and at such an angle and sweep through that square with such and such a curve; and all these things the painter reproduces, in their same relative positions, but enlarged to their due proportions, in the corresponding twenty-four inch square on the wall.

The artist might be able to paint through two vertical squares at once, sweeping from one into the other when he could, and painting up and down, so through two he might sweep from side to side of a head as he progressed, getting the top of one ear and the eyes and the bridge of the nose and finishing that course with the top of the other ear on the other side before he lowered his scaffolding. And at that stage of its development the face may present a strange appearance.

But though he must thus paint two pictures, so to speak, in patches, there is no danger that the painter will get lost lower down. It will come out all right. The artist has always the squares to guide him, and in due time the wall picture appears complete in every detail, a reproduction of the original on a giant scale.

If a number of giant figures of the same sort are to be painted in different places at the same time, copies of the original portrait painting are made and duly lined off for the use of the several painters of the big pictures.

Sometimes these big wall figures have been the work of two men, one starting on the head of the figure and the other on the feet. And these two men, one painting downward from the sky and the other pointing upward from the earth, would meet somewhere about the middle of the figure, and their work would meet there as accurately as do, for instance, the midends of a tunnel built out from either side of a river. But while these two painters might be of equal skill, there might be a difference in their touch. So now, for the sake of unity of effect, it is the practice to have the entire figure done by one man.

But that doesn't necessarily mean much delay, for a skilled expert in this work can paint a giant thirty or forty feet high in one day.—New York Sun.

Indian Red

Indian red is a red oxide of iron, and is a member of the oxide family of reds, such as rouge, light red, red oxide, Venetian red, purple oxide, scarlet red etc., which are all red pigments of varying shades of color. Indian red was once found native, but is now mostly of artificial manufacture. The preparation of oxide reds from natural iron minerals is very simple. The mineral is first ground in paint mills in order to reduce the mass to very fine particles. These are reground in a roller mill until sufficiently fine and then levigated, the levigated material is dried and is then ready for market in dry form.

The artificial process of producing Indian red is as follows:

Dry process—The principal material used is copperas, ferrous sulphate. The iron salt is made in large quantities by exposing iron pyrites to the oxidizing action of the air, neutralizing the acid solution of sulphate thus obtained by means of scrap iron and then crystalizing out the ferrous sulphate thus formed. Copperas ferrous sulphate forms large, pale green crystals, which, on exposure to air, is liable to oxidize and form a brown crust of ferric oxide. Heated at about 120° C. they lose 6 of the 7 molecules of water they contain, falling to a white powder in so doing. At a higher temperature they lose the seventh molecule of water. Partially dried copperas when heated to a white heat, or even to a lower temperature, is decomposed; it loses its sulphur trioxide, while a residue of ferric oxide remains; some of the sulphur trioxide is, however, decomposed into sulphur dioxide, the oxygen it loses going to iron.

Chrome Yellow—There are a large variety of chrome yellows, and a variety of methods of producing them. White lead forms the base of a large group of chrome yellows. A common method of making them is as follows: Take 200 lbs. of white lead, mix with water to a fine paste, and then add 40 lbs. of nitric acid of 142 specific gravity (841°). When all effervesence has ceased, more water is added, and then a solution of 35 lbs. of bichromate of potash; the yellow thus formed is finished in the usual way.

For a deep lemon chrome take 300 lbs. of white lead, treat with water and 40 lbs. of nitric acid as before and precipitate with 35 lbs. of bichromate.

Testing Paint Materials

There are various ways of testing paints and varnishes other than by the exposure test, in order to determine their durability.

The exposure test is undoubtedly the best of all tests, but as this is entirely too slow to match the American pace, a resort to acids and etc., is resorted to by some manufacturers in testing their goods, a report of such tests are then used for advertising purposes, the following is a specimen of such tests which is here presented for the purpose of making some comments thereon.

"Below we give you report of tests on a sample of——— special structural iron and steel paint," received from you. Strips of sheet steel, No. 20 gauge, about 12 feet long and 2 feet wide, were given 2 coats of the ———, applied with a brush, sufficient time having been allowed between coats for drying. These strips were subjected to various tests with the following result:

Sample No. 1.—Immersed in 10 per cent solution of sulphuric acid for 24 hours. Effect, very slight.

Sample No. 2.—Immersed in 10 per cent solution of nitric acid for 24 hours. Effect, very slight.

Sample No. 3.—Immersed in 10 per cent solution of Hydrochloric acid for 24 hours. Effect, practically none.

Sample No. 4.—Subjected to strong sulphuric acid fumes for 3 to 4 hours. Effect, none. This test was repeated several times but no effect was perceptible.

Sample No. 5.—Subjected to strong sulphurous acid fumes for 3 to 4 hours. Effect, none. This test was repeated several times with no effect.

Sample No. 6.—Exposed to a temperature approximately 300° F., eight hours a day, for about a week. Effect, practically no tendency to blister or scale, and apparently no lessening of the adhesive power of the paint. You no doubt will appreciate that nearly all of the above tests were much more severe than any paint would be called upon to stand, and in our opinion the ——— showed up well. It is easy of application, dries readily and adheres well to steel and iron. It should, therefore, when applied to clean metal surfaces, make an excellent preservative paint."

To the practical painter, and especially one having a theoretical knowledge of his business, tests of this character are entirely meaningless, for the reason that paints of the class that have for a base, coal tar and asphaltum, and into which no linseed oil enters, will stand the effect of acid solutions much better than it will resist the action of sun and rain, and in the case of the paint referred to in the above report, a coal tar base was clearly indicated.

In making artificial tests of paint, and varnish, such means should be employed that will produce in a short time, precisely the same effect that the elements produce by slow degrees How can this be done?

Prepare a panel of wood or iron with paint or varnish as the case may be, and when dry, place it near a furnace, and with the aid of a thermometer acquire about the same temperature as the sun at first, gradually moving nearer each day to the furnace until a very high temperature is reached. Next arrange a water pipe or spray above the test panel, and allow it to discharge on the panel at night while furnace is not in operation.

This is a practical test, and is in every way analogous to an exposed sun and rain test. But an acid test is in no wise analogous to a weather test, and nothing of practical value can be ascertained by this means of testing paint or varnish.

The nearest approach to any analogy between the acid and weather test is in the fact that coal smoke contains sulphur fumes, which of course is in the form of gas, and not in the form of an acid solution with which such tests are made. There are also other gases that exercise in some degree, a deleterious effect on paint and varnish which are entirely lost sight of in the acid test, but which in the test suggested play equally as important a part as in a weather test.

Personal

From a Fort Wayne, Ind., paper of the 7th inst., and which also contains a picture of our veteran member, Mr. T. J. Rodabaugh, we learn of his retirement after fifty years service as master painter. The event was a very auspicious one by reasor of a presentation to their retiring foreman by the employes of the paint department, of a handsome buggy, and by the foremen of the various departments, of an electric lamp stand and a gold headed cane. Mr. Rodabaugh is well and popularly known to the members of the Master Car Painters' Association in which he has always taken an active interest. We wish Mr. Rodabaugh much joy in his retirement, and trust he will have a well earned rest after his long and active service.

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CONTENTS

More Rigid Inspection.

OUR attention has been directed recently to several accidents, which on investigation were found to have been caused by the axle breaking, due to the top brake rod resting on the axle for such length of time as to have resulted in cutting into the axle 5-16 of an inch or more. Accidents of this kind would indicate a lack of proper inspection not only on the part of one man, but of several, as an axle would not have been worn to such an extent as to cause it to break, within a few miles, or a few days.

This matter is one that cannot be considered too carefully by car men. Unless the probability of such defects developing is borne in mind and the eye of the inspector is trained to look for a defect of the nature of that described it is easy for an inspector or car repairer to overlook it. The attention of all car men might well be directed to the possibility of serious accidents from such a cause, in order to bring about a more rigid inspection of the parts apt to be affected.

Care of Switch Chains.

THE number of switch chains for which requisitions are made sometimes impels the chief of the mechanical department to inquire into the necessity for the extraordinarily large number being furnished to the different divisions. Unless switch chains are properly looked after and duly cared for by trainmen and car repairers, many of them will be lost by being allowed to remain on cars delivered to connecting lines. It is perfectly proper to allow a chain to remain on a car delivered to a connecting line, but care should be exercised to determine that the delivering road secures a defect card, or another chain, for each one delivered.

Where such points are not carefully followed a road is made liable to a large expense and it is in watchfulness of matters of this nature that car repairers may save to the company the expense of maintaining them at the various interchange points. Unless a defect card is issued by the road receiving a chained up car, the chain should be removed in order to protect the delivering road.

The practice of allowing switch chains to lay around the yards in bad order instead of having them repaired as soon as they become defective, also represents a form of extravagance. A little care in this direction on the part of repairmen and inspectors will result in considerable saving. Defective switch chains should be sent to the shops for repairs at once.

The small leaks caused by carelessness in these seemingly minor details result in the expenditure of large sums of money, and gleanings from the scrap heap often represent economy when systematically cared for.

THE two articles preceding might impress one as embodying nothing absolutely new or startling. Yet how often is it necessary for bulletins to be issued concerning the care of switch chains? How often is it necessary for bulletins to be issued concerning other matters on which car men are supposed to be well informed?

Is it not possible that by more careful instruction with regard to the loss entailed by disregarding the import of these bulletins, the men may be induced to realize the expense incurred by the company and not feel so free with the expression that "the company has lots of money?"

Concave Journals.

THE concave driving journal has been introduced generally into European locomotive practice, but has not entered into locomotive construction in this country. The merits of this journal and the satisfaction it is giving on the Continental railroads would seem to entitle it to the consideration of the American designer.

The principal point of superiority of the concave over the ordinary journal is greater strength. Driving journals of the usual type generally fail at the fillet, while the concave journal is designed to prevent failure at this point. The load on the journal is maintained in a constant position, the wear is more even and lateral motion of the bearing surfaces is reduced, with a consequent decrease in hub wear, and in the number of hot journals.

Among the disadvantages of the concave journal there would be a greater difficulty in turning the bearing surfaces and fitting driving box brasses. It would probably be necessary to cast heavier brasses, and there might be some trouble experienced in properly packing the cellars and lubricating the boxes. At the same time, however, it is obvious that the disadvantages of this type of journal have not been sufficient to condemn its use on European railroads.

The concavity of driving journals in European locomotives is from one-half to three-quarters of an inch on each side, making the center of the journal one or one and one-half inches smaller than the ends. While it may be necessary to modify this practice to suit American conditions, it is believed that this type of journal could be used to advantage on locomotives in this country. In the leading and trailing trucks the concave journal could be substituted for the ordinary journal with some confidence that it would reduce hot boxes from excessive side motion.

Superheated Steam.

THE properties of superheated steam offer possibilities in steam economy that have led to the introduction of the superheater in locomotive practice. The last five years marks the period of development of the superheater in this country, and while the theoretical advantages of superheated steam have not yet been fully realized, the merits of the principle have been demonstrated.

It is generally recognized that the use of superheated steam in locomotives will result in increasing their power and efficiency. The possibilities in the economy of fuel, of increasing the capacity of the boiler for steam making, in addition to obtaining an increased power from a given steam pressure have been fully shown. The absence of moisture and reduced condensation, with the fact that the force of steam increases with the temperature results in obtaining greater power from the cylinders. This, in addition to the greater economy of superheated steam, makes it possible to continue the use of old locomotives which would otherwise be out of date.

These advantages have been demonstrated by experience, but the results have been modified by a number of weaknesses which have developed in the application of superheated steam to locomotives. It is found that some difficulty is experienced in lubricating the valves and cylinders, even though an excess of oil is used. There is also an increased cost of repairs to valves, valve gear and pistons, due to defective lubrication. The large flues that contain the superheating pipes give some trouble from leaking and stopping up, which have a bad effect on the steaming power of the engine.

While it must be admitted that these disadvantages exist, there are examples of locomotive performance which show a remarkable increase in efficiency by the use of the superheater, without signs of the weaknesses mentioned. The superheater is yet in the experimental stage and although its theoretical advantages have not yet been fully realized, there are many indications that further development will overcome the present weaknesses and render the superheater an efficient factor in locomotive economy.

The Engineer's Work Report.

THE necessity of clear and precise reports of work required during the lay over of a locomotive at a terminal would seem to be a sufficient argument in favor of educating engineers to investigate carefully and determine the actual location of defects before reporting them. Ample evidence is available of many cases where precise reports would have facilitated roundhouse work. A single case in point, however, will serve to illustrate the manner in which the roundhouse force sometimes receives information of repairs supposed to be necessary, without being really informed of the actual seat of the trouble.

In writing out his list of troubles on the work report book, an engineer reported "reduce brass in back end of right main rod. It is pounding." Upon investigation it was found that the brass reported did not need to be reduced. When properly keyed up, the brass was found to fit the pin nicely and the key had not been driven down so far as to require new liners. However, a pound was located at the front end of the rod.

This instance came to the attention of the master mechanic, and sending for the engineer who made out the work report, took a walk with him through the roundhouse. On coming to the engine in question the engineer was requested to examine the brass and express his opinion as to whether or not it should be reduced. His attention was then called to the pound in the forward brass and the case was so evident that the engineer had to acknowledge his mistake.

This incident proved to be a lesson which resulted beneficially, for not only did this engineer in particular show greater care in reporting his work, but is became noised around that the "old man was keeping his eye on the work report book," and some of the other men investigated their troubles more carefully before reporting them.

There is another side to this question—the personality of the master mechanic. The case in point was handled tactfully and without causing friction.

A Record in Locomotive General Repairs.

Elkhart Shops—L. S. & M. S. Ry.

A HEAVY consolidation locomotive was recently given general repairs at the Elkhart shops of the Lake Shore and Michigan Southern Railway, which for rapidity of output and expedition in returning the locomotive to service in minimum time, is the best record which has come under our observation.

This locomotive is number 5787, and was built at the Brooks Works in 1901. Its total weight is 180,000 lbs., with 158,000 lbs. on drivers in working order. The driving wheel centers are 56 inches in diameter and the wheels are 63 inches in diameter over tires. The cylinders are 21 inches by 30 inches. The boiler is of the wide firebox type; contains 344 tubes and carries 200 pounds pressure. The area of the grate is 43 square feet.

On Sunday this engine left Chicago with a train and arrived at Elkhart Sunday P. M., where it was put in the shop and received general, or heavy repairs, considered in the classification of the L. S. & M. S. Railway as 1-F repairs, and was in service again by the end of the same week. In short, engine 5787 appears on the train sheet with a train of cars east bound on Sunday, and west bound the following Saturday, having received general repairs in the meantime.

Repairs to machinery included new shoes and wedges; two new driving box brasses and remaining driving box brasses rebored; one new driving box; valve chambers rebored; new packing rings in valves; valve stems turned; new pistons and piston packing applied; guides closed; cross head shoes rebabbitted and planed; eccentric straps closed and refitted; full set of tires applied to driving wheel centers; new bushings for all side rods; front and back end main rod brasses renewed; all valve motion work repaired.

Boiler work included all boiler trimmings repaired; two new side sheets; new back flue sheet; new door sheet; flues removed, cleaned, pieced out and replaced.

The boiler was tested with 230 pounds pressure on Friday evening and left the shop at 8:30 Saturday morning. After being fired up, the air tested and pops set, the engine was delivered to the roundhouse at 12:30 P. M. This engine left Elkhart at 4:00 P. M., with a freight train for Chicago, where it arrived Sunday A. M. in good shape.

In considering this record in repair work it is interesting to note that no preparations were made for any extraordinary performance. The engine was put in the shop after the whistle blew on Monday morning. At this time all of the sheets applied to the firebox were in stock and the flue sheet and other sheets were laid out and flanged from the old sheets removed.

When it is known that material necessary to the repair of this locomotive was not previously assembled and held in readiness for the express purpose of making a record-breaking performance, the results obtained are such as to warrant the shop management in feeling justly

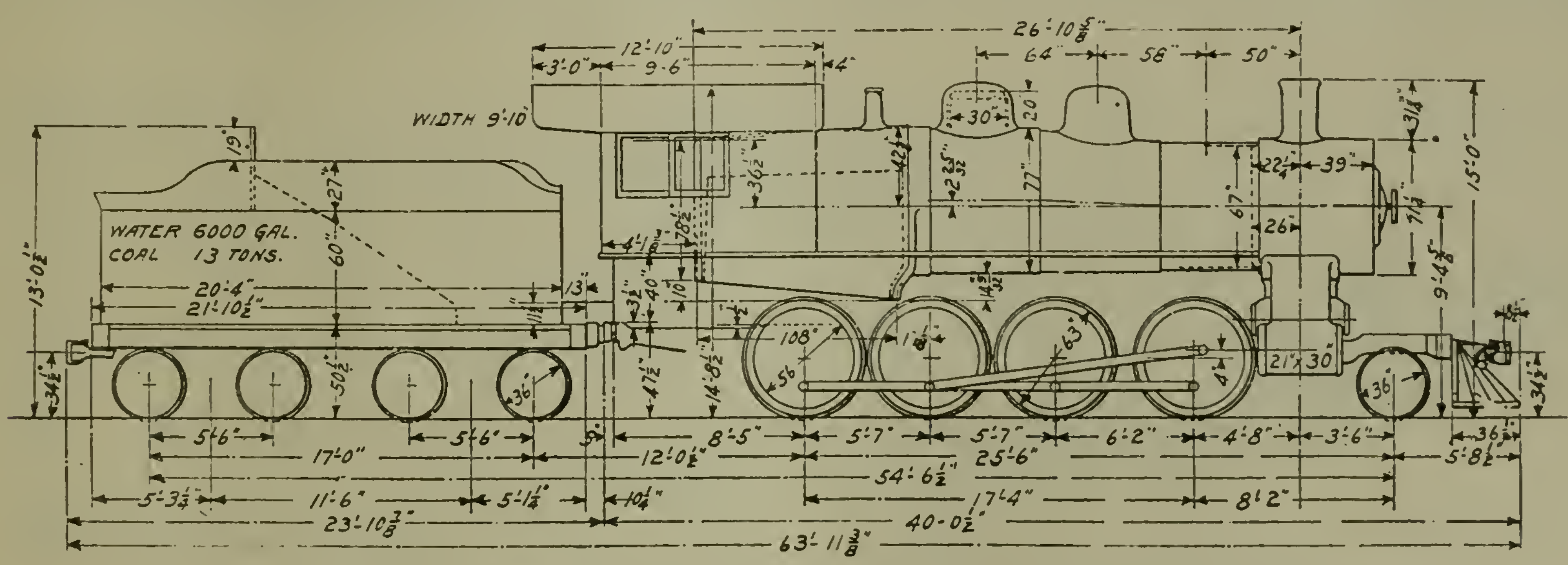


DIAGRAM OF CONSOLIDATION LOCOMOTIVE ON WHICH RECORD WAS MADE AT ELKHART SHOPS OF THE LAKE SHORE AND MICHIGAN SOUTHERN RAILWAY.

proud, and even if everything had been lined up especially for a record test, the results would indicate exceptionally good work. This is especially so when it is realized that it was necessary to tear the engine apart, drill out staybolts, pull out rivets, pull out side sheets and flue sheet, dismantle boiler head—leaving the crown sheet in place—and remove and replace the flues.

When it is borne in mind that the Elkhart shop is an old time plant, that the erecting and machine shop is an old building with a low roof, and is not provided with crane service, the performance represented by the work on this locomotive—especially on the boiler—reflects great credit to the management and indicates efficient organization.

The information presented concerning this work is known to be correct and this description is absolutely free from any exaggeration of facts tending to overestimate the capacity of the Elkhart shop. No claim is made that it is the regular performance of this shop to turn out each engine within the same week in which it was shopped, and the work on engine 5787 is clearly the result of concentration. The boiler work left by the day force was carried on each night by the regular night force, and the work on machinery was handled by the usual day shift. As before stated, this shop is an old one and in this connection it is pertinent to say that the machinery is old and the list of machine tools and equipmet includes very little that is considered modern in the most up to date sense. The performance on this engine therefore indicates the effect of good organization and the careful utilization of shop kinks and methods which increase output and maintains efficient operation.

The Elkhart shops are under the management of Mr. M. J. McCarthy, master mechanic, who, in following the system of organization instituted throughout the L. S. & M. S. Railway system by Mr. Le Grand Parish, superintendent of motive power, has demonstrated what can be accomplished by organization and method where facilities are lacking.

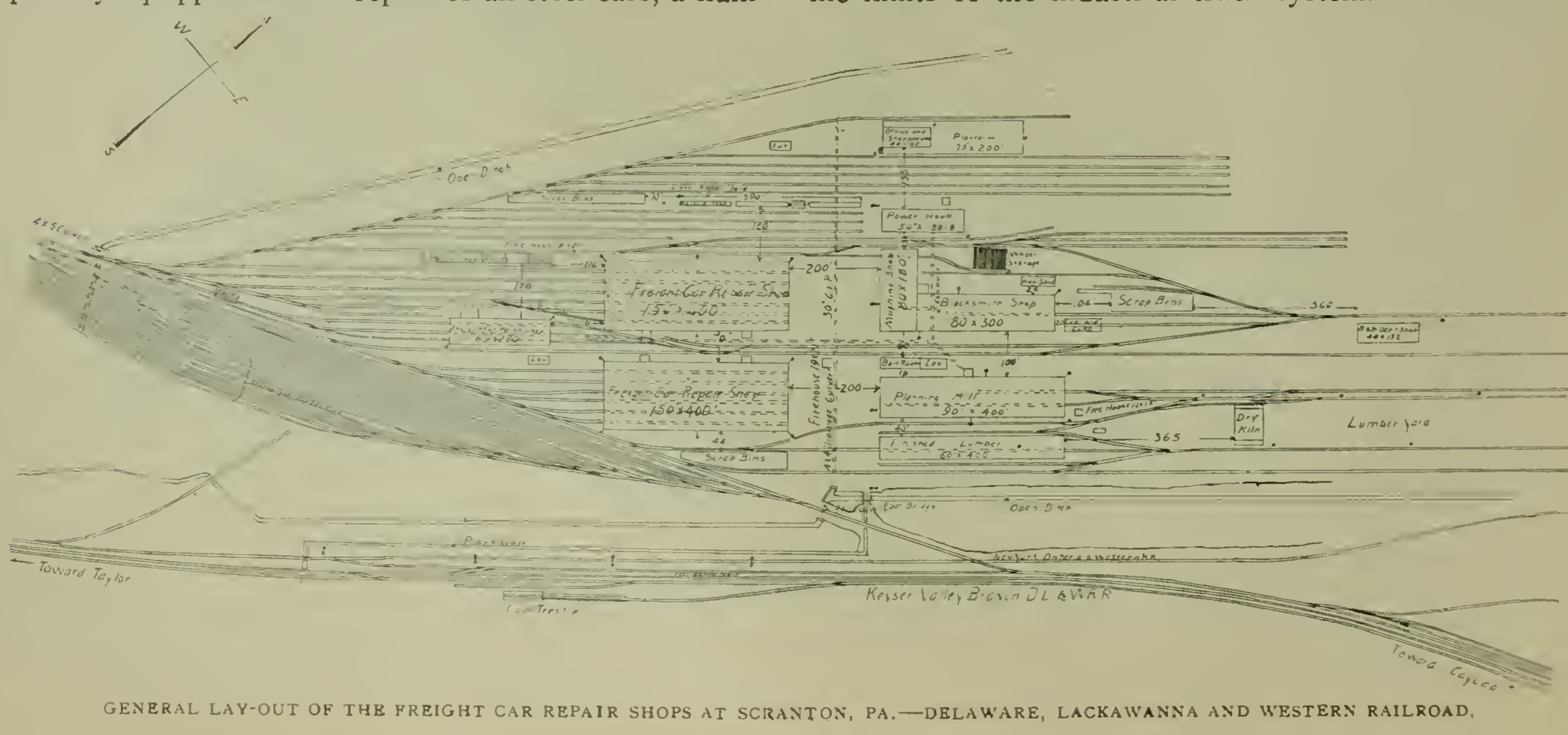
Freight Car Shops at Scranton.

Delaware Lackawanna and Western Railroad.

First Installment

THE freight car building and repair shops of Delaware, Lackawanna & Western Railroad, located in the Keyser Valley, near Scranton, Pa., have now been running for a little more than a year and it is interesting to to look into the arrangement and organization of this plant after it has been working successfully for some time and the machinery of operation and management has been worn down to a good bearing, so to speak. The road maintains about 29,000 freight cars and the Keyser Valley plant is principally for the construction and repair of such equipment. Practically no passenger work is done here save for the construction of a few baggage and milk cars. While the plant contains no shop building especially equipped for the repair of all steel cars, a number of steel hopper cars have been repaired very successfully, on which the principal work has been done in the blacksmith shop.

The general ground plan lay out includes no transfer table service and the buildings are arranged according to a longitudinal system of tracks, the stall tracks of the various buildings and light repair yard, being approached by leads connecting with the yard system of transfer tracks. Track approach to the shop yard is from one end only and there is no belt line encircling the yard. The shop buildings are between the point of approach and the principal storage yard and all cars loaded with raw iron. lumber, etc., to be delivered to the yard must traverse the length of the shop yards and are delivered over tracks passing between the buildings and within the limits of the industrial track system.



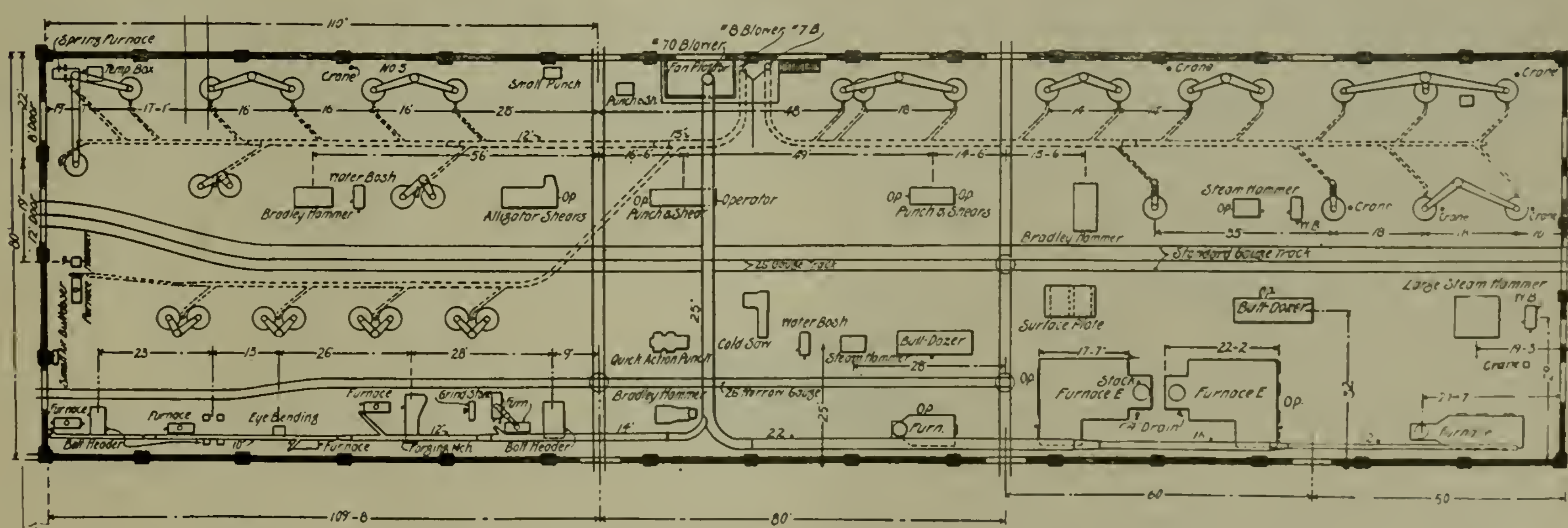
GENERAL LAY-OUT OF THE FREIGHT CAR REPAIR SHOPS AT SCRANTON, PA.—DELAWARE, LACKAWANNA AND WESTERN RAILROAD.

END AND SIDE ELEVATION OF THE BLACKSMITH SHOP.—FREIGHT CAR SHOPS, D. L. & W. R. R.

The principal buildings are arranged along both sides of a wide thoroughfare, toward the south end of which the store house and office building is located. They are placed at such distances as to provide ample room for yard storage of material, to allow for extension of all buildings and to insure against fire risks. They are arranged in such a manner as to provide for the progressive movement of material from the iron and lumber storage yard at the east end of the plant through the several shops and stages without doubling. There is ample yard space around each building to provide for storage of material which is to be used in that particular shop. Intercommunication among the shop buildings for the distribution of material is provided for by a narrow gauge industrial track system. At the intersections of industrial tracks are turn tables which permit of transverse as well as longitudinal traffic and all industrial tracks through the various buildings are tributary to the transverse tracks through the principal yard thoroughfare.

The principal buildings are of brick supported by structural steel frame work, and while they are plain as regards architectural embellishment, they present a very neat appearance. The buildings are extremely well lighted by natural light, the space between the buildings aiding in this particular. In addition to the ordinary windows which are large, much of the wall space above is fitted with window sashes, which adds much to the diffusion of light throughout the interior. Above the centers of the roofs are monitors which extend nearly the full length of the buildings and the sides of these monitors are equipped with glass lanterns. Some of the buildings have saw tooth skylights at intervals above the roof. All glass surfaces are vertical with the exception of that in the skylights, so that there is very little opportunity for discomfort to be caused by direct rays of the sun pouring down upon the floor beneath.

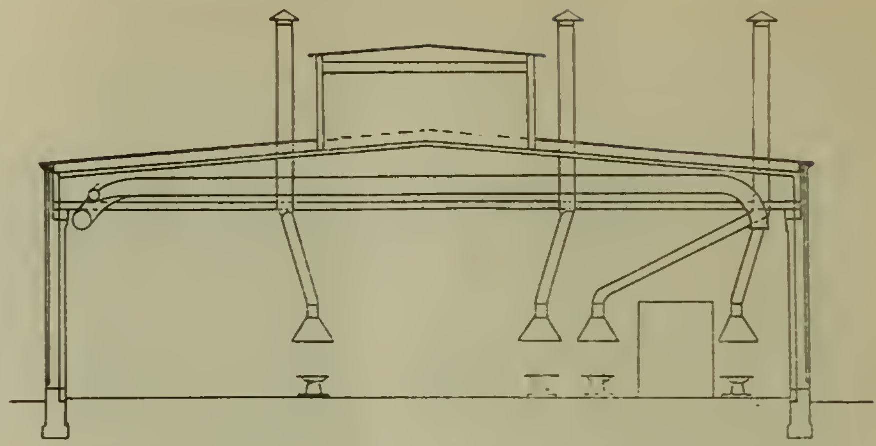
The plant includes the following principal buildings: Two freight car repair shops, each 400 feet by 150 feet, with a capacity of forty-eight cars, one being used for the construction of new equipment and the other for heavy freight car repairs. On the side of the main thoroughfare opposite to the car repair shops are the mill, blacksmith and machine shops, all of which are of comparatively easy access from the repair shops. The mill is 400 feet by 90 feet and on the same center line as the shop for heavy freight repairs, near the mill is the lumber shed, 175 feet by 50 feet, with open sides, for the storage of finished lumber. The blacksmith shop is 300 feet by 80 feet and the machine shop is 180 feet by 80 feet. These shops form the two wings of an L, this arrangement providing for quick and convenient movement of material from the blacksmith shop, through the various machines on its way to the car shops, and provides a storage space for wheels and axles, from which they



PLAN OF BLACKSMITH SHOP, INCLUDING LAY-OUT AND ARRANGEMENT OF MACHINES AND FORGES.—FREIGHT CAR SHOPS, D. L. & W. R. R.

pass through the machine shop to cars on a depressed track, by which they are delivered either to the car erecting shop or to the line, as needed. Just outside of the blacksmith shop is an iron shed 50 feet by 25 feet and beyond the blacksmith shop is a coal house for the storage of coal used in this shop. The coal house is served by a trestle to facilitate delivery and unloading. The power house is 150 feet by 75 feet, the engine and boiler room each being 75 feet long. The store house is 150 feet by 44 feet, entirely surrounded by a platform the height of a car floor. The basement, first floor and portion of the second floor is occupied by the stores department, while the offices of the master car builder and his staff and a drawing room for the car department, occupy a portion of the second floor. The oil house, and paint shop annex, occupy a long, narrow building 280 feet by 20 feet. The freight car paint shop is 400 feet by 60 feet and has a standing capacity of 60 cars.

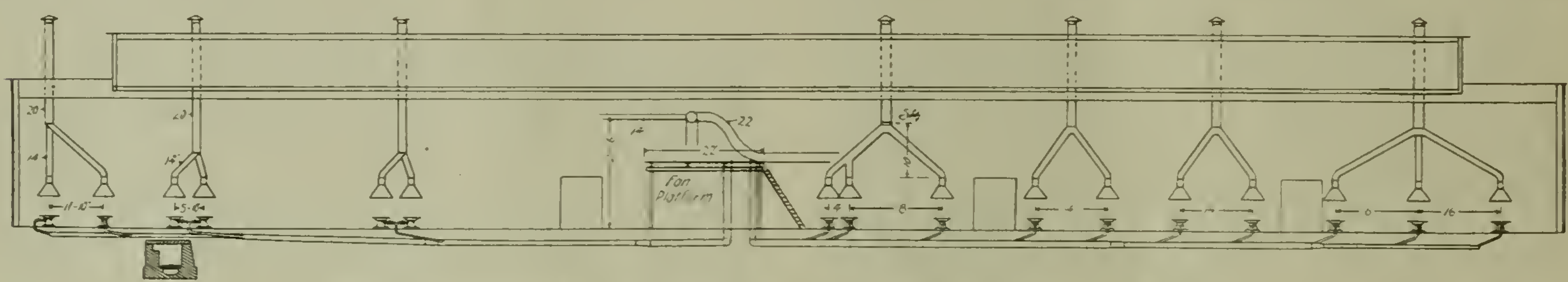
Directly in front of the store house and office building is the yard for light repairs, in which about 250 or 300 cars are repaired per day. This yard contains eight tracks arranged on twenty foot centers and between every alternate pair of tracks is a narrow gauge track of the industrial system. In this yard one track is reserved for the repairs of steel cars.



TRANSVERSE SECTION OF BLACKSMITH SHOP.—FREIGHT CAR SHOPS, D. L. & W. R. R.

drill is practiced regularly each week and unusual interest is manifested in the fire squad and equipment. A reservoir is maintained by the company on a hill near the shop plant, and an underwriter's fire pump is located in the power house. Water plugs are situated throughout the plant and pressure capable of throwing a stream of water over the power house smoke stack, a height of 175 feet, is available at all times.

The lumber yard is located at the west end of the plant and as the movement of most material entering into the construction of wooden cars begins at this point, it is pertinent to take up the various features of the plant



LONGITUDINAL SECTION OF BLACKSMITH SHOP.—FREIGHT CAR SHOPS, D. L. & W. R. R.

For convenience in storage and delivery of material this yard contains a series of long, narrow material sheds in which are kept bolts, nuts, finished lumber, sheathing, car doors, couplers, etc.

There are three scrap platforms, or docks, in the yards, one of which is near the blacksmith shop and the other two near the light repair tracks. Each one is equipped with air operated shears, and the various kinds of scrap are sorted into classified bins. The platforms are level with a car floor and industrial tracks traverse the length of each platform.

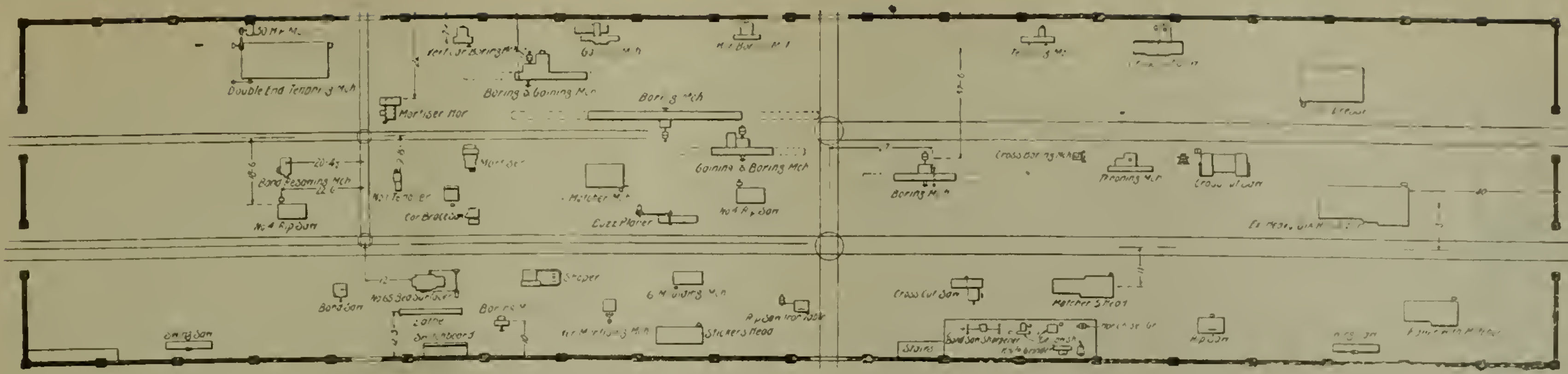
All lavatories are outside of the buildings. There are four of these located at various points of convenience, each 50 feet by 25 feet. They are well equipped and carefully looked after. Each lavatory is in the care of an attendant who is on duty all day.

Good fire protection is provided by proper fire fighting equipment, including hose, hose reels and chemical engines. Two fire engine houses are located near the center of the plant and all roadways are kept open in order that, in case of an outbreak of fire, the fire fighting apparatus might be hastened to the seat of the conflagration. The fire department is under the guidance of a fire chief employed by the company and the shop property is always under the observation of the chief or his assistant. Fire

from here. The lumber yard is connected with the mill and with the finished lumber shed by standard gauge tracks. The dry kiln, located at about the center of the lumber yard, is in close communication with the mill and shed by standard tracks.

So far as consistent with the demands of the mill and the promptness with which orders are filled by outside concerns, lumber is delivered directly to the mill by car load lots. In such cases cars are switched direct to the mill and unloaded near the machine through which it will pass first when its progress begins. Such unloading is usually done at night in order that it will not interfere with the routine work of the day. Lumber not so delivered is piled in the yards, being transferred from cars to piles by skids. It is put on industrial cars in a similar manner when being loaded for delivery to the mill.

Lumber entering the mill from the lumber yard passes through doors at the end of the mill building, while lumber from the finished lumber sheds passes through a side door conveniently located. From these entrances lumber follows paths of progressive movement through the various machines until finally loaded for delivery to the car erecting shops. While much material is delivered from the mill on cars traveling over the industrial tracks,



PLAN OF MILL BUILDING, INCLUDING LAY-OUT AND ARRANGEMENT OF MACHINES.—FREIGHT CAR SHOPS, D. L. & W. R. R.

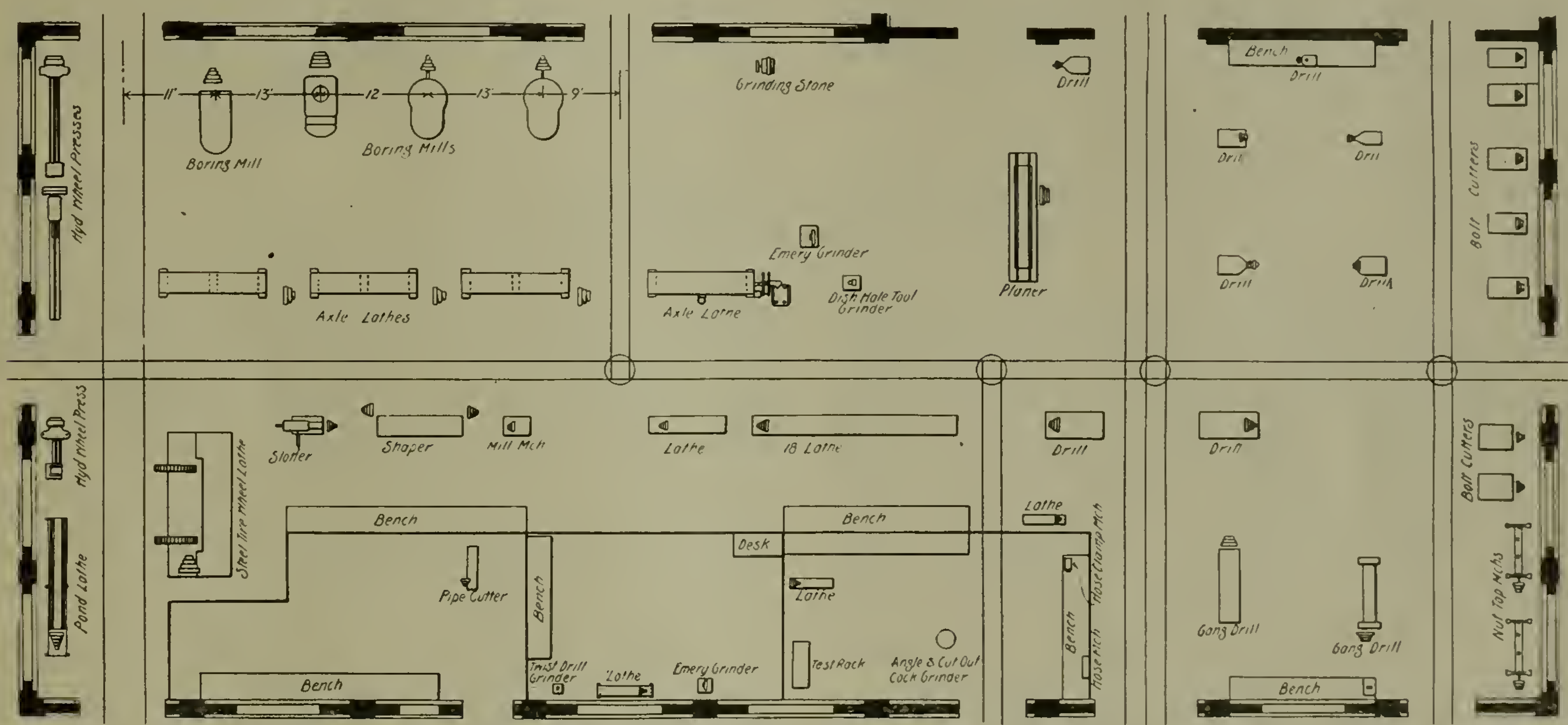
a great deal of it is transferred to the car building shop in box cars. Scrap pieces, shavings, etc., are loaded into special cars for delivery to the boiler room.

The path for sills is arranged along one side of the building over which they pass in the usual manner, beginning with the planer near the door. Machines in the other side of the building are arranged for lighter and smaller work. Material passes from one machine to another over wooden horses properly placed or are loaded direct from machine tables to buggies or trucks for further distribution.

Much work is done according to gauges or forms thereby minimizing the labor of laying out. Sheathing is sawed to length by gauge and delivered to the car building shop in car load lots. Material for girts is planed to size, sawed according to standards and assembled on forms, the pieces being nailed to strips before leaving the mill.

Raw iron for the blacksmith shop is stored nearby in order to facilitate quick delivery to the machine and hand forges. Progressive movement carries material through the machine shop, and onward to the car building shop or freight car repair shop.

Wheels and axles are stored near the machine shop and traverse but a short distance in moving to the machines. From the boring mills and axle lathes they pass to the wheel press and are delivered across the main thoroughfare, where they are loaded on cars placed on a depressed track.



PLAN OF MACHINE SHOP, INCLUDING LAY-OUT AND ARRANGEMENT OF MACHINES.—FREIGHT CAR SHOPS, D. L. & W. R. R.

Transfer Tables for Locomotive Shops.

THE fact that few transfer tables have been installed in connection with the most recently constructed locomotive shops and that plans for contemplated shops do not include provision for transfer tables, would lead to the conclusion that present popular opinion does not favor the transfer table as an adjunct of a large modern locomotive shop.

That the experience of some shop managers is contrary to this opinion led to a discussion on the subject of transfer tables for locomotive shops, in the January issue of the Railway Master Mechanic. When this article was in preparation opinions were solicited from several sources and the ideas of one shop superintendent were expressed very simply and briefly by his saying "transfer table and crane and transverse shop for me."

Other opinions not so briefly expressed are of interest in this connection and are given herewith:—

Editor Railway Master Mechanic:

There are several criticisms to be made of your article "Transfer Tables for Locomotive Shops." First and foremost, do not forget that "circumstances alter cases." Few officials of a generation or two ago could foresee the vast growth of commerce, or, if they did expect it. failed to secure enough land for terminals and the attendant facilities. Therefore, under present conditions. we are in most cases overcrowded. This particular question of room and shape of space has more to do with shop arrangement and shop type than any other thing, after the location and capacity have been decided upon.

Congestion is possible with transfer tables, even more possible in some cases.

However, the correspondent believes that each type of machine shop, viz., those with longitudinal and those with transverse pits, has its own place, has its own advantages and disadvantages. Congestion is possible, probable and a certainty at times with a transfer table, unless the approach tracks at either end represent the incoming and the outgoing respectively. This cannot always be done and if done takes up considerable space and introduces an element of no little import as regards its influence upon the general plan, execution of the general plan, operation and future extension of a shop plant consisting of a system of buildings for maintaining equipment and rolling stock.

The question of obviating the transfer table between the boiler and blacksmith shop building and the machine shop is interesting. It is an expensive proposition to have men carrying small material such a great distance, back and forth over the table pit between machine shop and blacksmith shop. I favor the longitudinal pits. where the output is large. For small, isolated division shops, transverse pits are all right, but there should be no more between the machine shop and the boiler and blacksmith shops than *walls*—in other words, there should be no transfer table for men with loaded warehouse trucks to wait for, or space for men to traverse, or in which they can loiter. Several very nice compact arrangements can be worked out on this basis. The plans involve two transfer tables instead of one. It also involves double handling of locomotive for firebox or other very heavy boiler repairs, but if the matter is studied minutely it will be found to have more than virtue, for the simple reason that we have brought the shops closer together and not interferred with future expansion, either.

Referring to another paragraph in your article: The new boiler shop at Burnside Shops, Illinois Central Railroad, was located where it is because there was no other place to put it. Adapting the old building to modern requirements would have been a waste of money and then there would have been no room for future expansion. With but few changes, the old boiler shop was converted into an extension of the blacksmith shop, such space being greatly needed. The new boiler shop transfer table will serve not only its shop, but also a space on the opposite side convenient for storing parts, etc.

Yours very truly,

JOHN H. WYNNE.

Chicago, Ill.

Editor Railway Master Mechanic:

Referring to the article in your January issue, relative to the necessity of transfer tables in connection with the modern railway shop; It has been a surprise to me to note that some of the later shops have been laid out omitting the transfer table.

Where the longitudinal or herringbone arrangement is determined upon, a transfer table cannot be employed to a very great advantage. or where the shop is small and there are only a few cross pits; provided the yard room is available, house tracks from a lead may be used to good advantage, as they give both a convenient entrance to the shop and a storage place for engines waiting for shops.

The expense of installing a transfer table is nominal as compared with an additional crane in the shops for lifting an engine off the incoming track and carrying it off to some track to which it is assigned.

The expense of operating a transfer table is less than that of operating the shop crane, for locating the engine on the desired pits in shops, as the transfer table does not require the lifting of the engine.

The system of stripping an engine on any particular pit in the shop cannot very well be put forth as an argument against the use of the transfer table, as the material has to be carried away, while with a properly designed shop, storage space can better be provided between each pit near where it will be required when putting it back in place, as all parts stripped do not necessarily have to be distributed about the shop.

The use of cranes in a railroad shop has become indispensable, but aside from a heavy crane in the boiler shop, is it a good investment to put $150,000 to $200,000 additional into heavy overhead cranes for a railroad shop when lighter cranes, judiciously arranged, will do all the work required except to lift the engine bodily and parade with it across the shop? The drop table or overhead crane at a single pit does all the work of taking away the wheels and putting the engine on shop trucks—does it economically and in less than thirty minutes' time; and either arrangement is inexpensive to install.

The transfer table makes a convenient passage way into the shop for locomotives, steam shovels, pile drivers, cars loaded with wheels, or other material; and when carefully designed, is not hard to maintain.

The pit requires some attention in parts of the country where the snowfall is great, but in a busy shop it will shove the snow up into piles when it can be conveniently gotten at to shovel out.

I consider a transfer table is an essential part of the railroad shop, with cross pits, and is the means of decreasing the cost of a large, modern shop which would otherwise call for a larger expenditure for heavy cranes.

A shop once equipped with a transfer table would certainly be at a great loss without it, as there is much material that can be transferred with a table when not in use, bringing in and taking out locomotives.

Where the shop is large and yards employ the use of a locomotive crane, it is not uncommon to transfer the crane and its load from one part of the yard to another, saving considerable time in this way.

Yours truly,

R. D. HAWKINS,

Mechanical Engineer, Great Northern Ry.

St. Paul, Minn.

Editor Railway Master Mechanic:

With respect to the relative merits of longitudinal versus transverse pits and transfer tables in connection with locomotive repair shops, discussed in an article which I noticed in the January issue of the Railway Master Mechanic: This question is an extremely easy one to decide when considered in connection either with a small shop doing light repairs on a limited number of engines per month, and one of the larger modern plants, many of which compare more favorably to a large locomotive works: The answer is, "Yes," with respect to the latter, and emphatically "No" to the former.

To find, or determine correctly the line of demarkation as between the two above conditions, however, is not considered an easy problem by the writer, in fact, I am inclined to the belief that for the modern size shop of doubtful capacity and output, that possibly handles overflow work at certain periods, that a transfer table with transfer pits would prove the more economical, if considered in a general way, and for a sufficient period of time to give a fairly accurate average of value; many local conditions in connection with each case have much bearing upon, and should be considered carefully before reaching a conclusion, which otherwise might be favorable to the adoption of expensive facilities, which had proved of great commercial value to some, while under different circumstances, the same facilities, system, or equipment, might be of doubtful value, if not the source of much loss.

Very truly yours,

W. E. SYMONS.

Chicago, Ill.

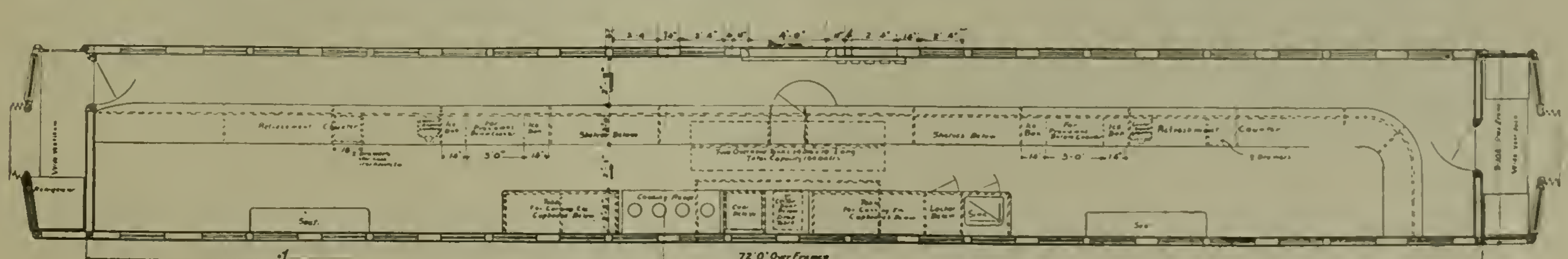
Refreshment Car.

Canadian Pacific Railway.

SEVERAL cars have been arranged for serving lunch on a small scale, at various times by different railroads, but the Canadian Pacific Railway has recently enlarged on the idea by transforming a standard dining car body into a refreshment car. The distinctive feature of this car is the long counter with a range and appliances for preparing and serving quick lunches. The demand for such a car was created by the necessity of providing satisfactory meals at reasonable prices for the number of parties making the long trip across the continent. While the car has been in service a short time only, the reception it has received would indicate that it meets the conditions and will hereafter be a factor in transporting parties over long distances.

The standard dining car body, with a length of 72 feet over frames and a width of 9 feet 1 inch inside, was remodelled according to the illustrations shown. A counter 24 inches wide extends almost the entire length of the car, leaving an aisle 2 feet 9 inches wide for passengers and a space 4 feet 4 inches behind the counter for the kitchen. In the center of the kitchen and extending for 26 feet along the side of the car are arranged the work tables, cooking range, sink, etc. Below the counter are placed shelves and bins for provisions, with drawers for table silver and dishes.

Above, on the deck, are fastened two tanks 14 inches in diameter, 10 feet long, having a combined capacity of 160 gallons. The coffee urn is placed on one of the tables and a hot water tank beside the range. Below the car are located the refrigerator and cold storage vaults and compartments for supplies of all kinds, having a storage capacity sufficient for a trip across the continent.



PLAN OF REFRESHMENT CAR.—CANADIAN PACIFIC RAILWAY.

INTERIOR OF REFRESHMENT CAR. —CANADIAN PACIFIC RAILWAY. VIEW SHOWS SERVING COUNTER, TABLE, RANGE, STORAGE RESERVOIRS, ETC.

INTERIOR VIEW OF REFRESHMENT CAR. — CANADIAN PACIFIC RAILWAY. VIEW SHOWS GENERAL ARRANGEMENT OF THE CAR, WITH SERVING COUNTER AND COFFEE URN IN THE FOREGROUND.

The arrangement of the car is excellent and is admirably adapted to the purpose for which it was designed. As the pioneer car of this type it represents an interesting development in design to meet existing conditions and offers advantages that will no doubt lead to its wider adoption. The car was built at the Angus shops under the direction of Mr. W. E. Fowler, Master Car Builder, to whom we are indebted for the illustrations presented.

Freight Car Repair Facilities.

SEVERAL communications appeared in the January issue of the RAILWAY MASTER MECHANIC discussing an editorial contained in the previous number concerning freight car repair facilities. Since the publication of the last issue, several other communications have been received commenting upon this subject, and in one of them the following is suggested as covering the situation:

First—The car represents largely the earning power of the road.

Second—It earns nothing when in an unserviceable condition, and is in consequence an expense, as money is invested which is bringing no return.

Third—The quicker a car is repaired, the quicker it becomes an earning power again.

Fourth—The better the repair facilities, the quicker the car can be repaired.

Other opinions are expressed thus:

Editor Railway Master Mechanic:

I have read your editorial on the freight car facilities and endorse your views and the comments made by the gentlemen in the January number of the RAILWAY MASTER MECHANIC. My position brings me in close contact with freight car repairs, so I am in a position to know what facilities are needed to equip a yard of this kind. I find in my travels among different railroad yards that very few of them are equipped to make the repairs that should be made. The proper place for locating good repair plants should be at the yards and especially at terminal points, where most of the damage to cars is done. This will save the additional cost of transferring the contents of bad order cars in order to release the lading and will prevent delays from these causes. The damaged car can be repaired and forwarded without the necessity of transferring, which will greatly facilitate the movement of freight.

The empty bad order car from which the lading has been transferred is generally thrown on some side track until a few more accumulate, when they will be chained up and taken to the nearest repair shop. In many cases shops are anywhere from ten to seventy-five miles away and taking cars this distance under chain is risky and dangerous. Cars in transit to shops under chain generally receive considerable additional damage. This condition should be enough to convince our officials of the necessity of good repair plants in our freight yards, and especially at terminals.

The Central Railroad of New Jersey has recently installed a car repair plant at the Jersey City Terminal that has given splendid results. With a few car carpenters and a number of up-to-date devices, a saving has been made in the handling of crippled cars, the repair shop has been relieved of a large amount of work, and the movement of both loaded and empty cars materially increased.

Our repair tracks were provided for air and we have the latest tools to work with, such as air boring machines, both for iron and wood, and a blacksmith forge of good size, which is quite an item for repairs of various kinds. For our own equipment, all the timber and sills, draft timbers, body and truck bolsters, head blocks, etc., are supplied from the main shops in a finished condition, so that very little has to be done except applying them. For foreign equipment we keep plenty of timber on hand and work up the different parts as required. I think it is important that facilities be provided at all yards, especially terminals, for the handling of repairs to freight cars, and I believe experience will prove it a great time and money saver in the movement of freight cars.

Yours truly,

W. H. Hall, Chief Car Inspector,

Central Railroad of New Jersey.

Jersey City, N. J.

Editor Railway Master Mechanic:

Your December editorial on "Freight Car Repair Facilities" and the comments thereon by your correspondents in the January number were very interesting and should be productive of much good.

There is one feature, however, that has not been sufficiently emphasized, which, in the opinion of the writer, is of sufficient importance to claim the attention of railway officials, and that is: The better protection of the freight car repairers from the inclemency of the weather.

Master car builders and foremen know the disadvantages and costliness of repairing cars out in the snow, with the mercury down in the neighborhood of zero, but their predecessors got along somehow under like conditions, and they are expected, by the management, to do the same.

But in these days of car shortage, when the loss of even a few hours' service of each single car means a loss of revenue to the road, they should be alive to the fact that workmen with numbed fingers and limbs are not able to keep up the pace required.

Of course loaded cars will have to be taken care of largely out on the track, but for the men employed on "heavy" repairs, a comfortable shelter should be provided.

On our road, before the days of air brakes, there was a rule on the back of the time card requiring a brakeman to be on top of freight trains at all times the train was in motion. The writer recalls one bitter cold winter morning, when the superintendent came down to the yard just before leaving time for the fast freight, determined to see that this rule was obeyed. Dressed in heavy clothing and with fur gloves to protect his hands, he climbed to the top of the cars as the train pulled out. The cutting wind soon penetrated to the marrow of his bones—of course, he could not stand it many minutes; he was soon making his way back to the caboose and as he passed Brakeman O'Brien, he, in pity, pulled off his fur gloves and offering them to O'Brien, said: "Here, wear these while you are up here," but the brakeman replied: "Never mind, Mr. Robertson, I'll be in the caboose before yez," and he was, and no one was discharged, either. Therefore, it is possible that if managers were to make trips through repair yards during blizzard weather and note the disadvantages under which repairs are made, there would soon be something doing in the interests of the stockholders and for the sake of humanity.

Yours truly,

Ex-Master Car Builder.

Chicago, Ill.

Evolution of Flue Cleaning.

The removal of scale deposit from boiler tubes was one of the slowest items in the care of locomotives to develop into a rational operation in keeping with its importance, for the reason that the cheapest way out of it was always thought good enough.

A history of flue cleaning dates back to the time when scale was laboriously pecked off by chisels in the hands of the cheapest labor. The next stage witnessed what was thought to a remarkable improvement, in which two large half-round files were driven into the top of a wooden horse, leaving the edges in the form of an X. The tube rested in the angle thus formed and was pulled back and forth against the edges of the files until the scale was removed.

These two methods continued until a revolving drum of flue length and taking in a part of a set at one time, was brought out. Here the flues were rid if scale more thoroughly than by any other process, simply by friction and gravity, and this principle has been worked out in all the later devices of the kind, but with improvements in details that leave but little to be desired.

Later an attempt has been made to accomplish the same results by heating the tubes and afterward plunging them into a tank of cold water. This process removes scale very thoroughly, but has the disadvantage of leaving the tubes bent, which entails an expense for straightening.

All of the methods cited except that last mentioned have been accompanied by dust and a din that called down the execration of all in the vicinity. To eliminate these objectionable features, the whole device has in many cases been placed underground and made to revolve under a stream of water. One of the latest improvements in this line, is a brick structure erected especially for the purpose, of a size just large enough to take in the flue cleaner and its motor, which is separated from the cleaner by a partition. When the doors of the house are closed, all dirt and racket is confined within the walls of the building. The scheme is a revelation of refinement not often seen in rough work—and it pays.

Pacific Type Locomotives.

National Railway of Mexico.

An ORDER of five Pacific type locomotives has recently been completed at the Schenectady Works of the American Locomotive Company for the National Railway of Mexico. These are the first of their type to go into service on this road, up to the present time the ten-wheeler having been used in handling their passenger traffic. The order consists of three different classes as follows: Three simple engines with Richardson slide valves, one with Allfree-Hubbell valves and cylinders and one Cole four-cylinder balanced compound engine with Walschaert valve gear. As these three classes are of the same specifications except for the difference in cylinders and valve gear an exceptional opportunity is afforded for

PACIFIC TYPE BALANCED COMPOUND LOCOMOTIVE.— NATIONAL RAILWAY OF MEXICO.

comparison between them as regards cost of maintenance and operation.

The two classes of simple engines are built after the same design and are identical except in regard to changes in cylinders and valves made necessary by the different stlyes of valves used. Mention of the Richardson valve is sufficient as the type is well known, but as knowledge of the Allfree-Hubbell valve is more limited, a description of it is given later in the article.

The Cole four-cylinder balanced compound engine is the second instance of the application of this system of

PACIFIC TYPE LOCOMOTIVE WITH ALLFREE-HUBBELL VALVES.—NATIONAL RAILWAY OF MEXICO.

compounding to the Pacific type. The first Pacific engines with this arrangement of cylinders were built for the Northern Pacific Railway. These engines were recently illustrated and the particular features of this system of compounding fully described, so that it is not necessary in this article to go into a detailed description of the design. In order to provide a good length of high pressure main rod the cylinders have been moved 12 inches ahead and the forward pair of driving-wheels have been moved back 3 inches, thereby increasing the distance between the forward driving-wheels and the center of the cylinder 15 inches. The boiler is practically identical in design with that of the simple engine except for an increase of 12 inches in the length of the front barrel sheet as a result of the cylinders having been moved ahead that amount. The important feature of this design in which it differs from the Northern Pacific engines and all other previous Cole balanced compounds is that the high and low pressure cylinders have different lengths of stroke. The stroke of the high pressure cylinders is 26 inches, while that of the low pressure is 28 inches. This results in making the angularity of the high and low pressure rods more nearly equal.

A table of comparison between the principal dimensions and ratios of this design and the Northern Pacific engines is given.

	N. R. of Mex.	N. P. Ry.
Total Weight	240,000	241,000
Weight on Drivers	150,000	157,000
Size of Cylinder	16½x26 and 27x28	16½ and 27½x26
Diameter of Drivers	67	69
Steam Pressure	220	220
Tractive Effort Comp.	31,900	30,340
Total Heating Surface	3798.3	2908
Firebox Heating Surface	210.3	241.8
Length of Tubes	20 ft.	16 ft. 9 in.
Diameter of Tubes	2¼ in.	2 in.

Grate Area	51.6	43.5
$\frac{\text{Weight on Drivers}}{\text{Tractive Effort}}$	4.71	5.18
$\frac{\text{Total Weight}}{\text{Total Heating Surface}}$	63.5	82.5
$\frac{\text{Tractive Ed. x Dia. Drivers}}{\text{Total Heating Surface}}$	564	720
Vol. Equivalent Simple Cyle..	10.40	9.9
$\frac{\text{Total Heating Surface}}{\text{Vol. Equivalent Cyls.}}$	364	294
$\frac{\text{Grate Area}}{\text{Vol. Equivalent Cyls.}}$	4.95	5.3
$\frac{\text{Tube H. S.}}{\sqrt{\text{Length of tube}}} + \text{Firebox H.S. (Equated H,S)}$	1060	893.9

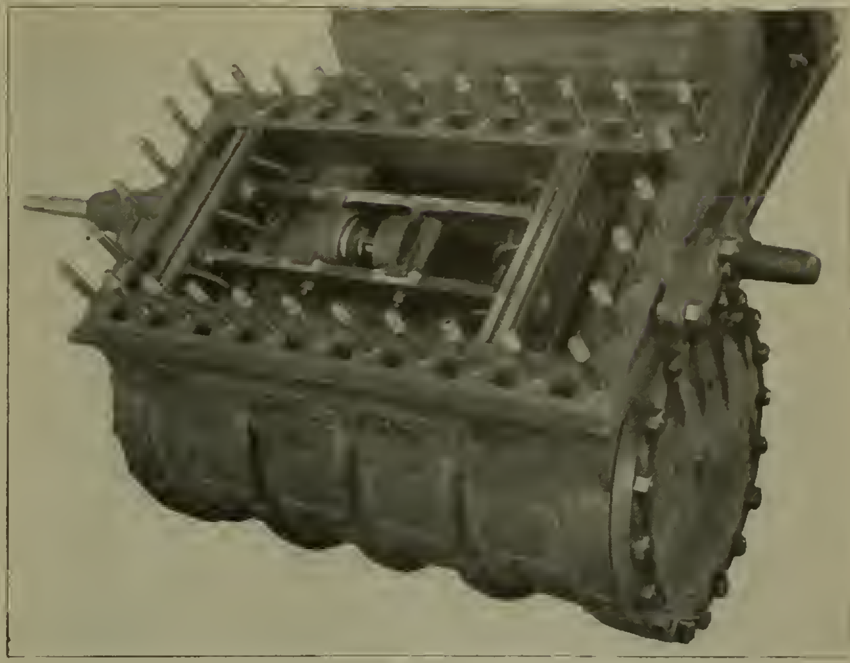


FIG. 2.—STEAM CHEST SHOWING VALVE IN PLACE ON SEAT.—ALLFREE -HUBBELL LOCOMOTIVE.

In applying the Allfree-Hubbell cylinders and valves to one of the engines an interesting comparison in steam economy will be made with the engines equipped with the Richardson balanced valves and the four cylinder balanced compound locomotives. The engines are built to the same plans and specifications except in regard to the cylinders and valves and are identical save in those respects.

FIG. I.—ALLFREE-HUBBELL MAIN STEAM VALVE.

The Allfree-Hubbell system of steam distribution includes not only a radical change in cylinder design but also provides a balanced slide valve, with inside admission and designed so that the wear is uniform regardless of the travel. These cylinders and valves may be used with any standard valve gear. In this application the usual Stephenson link is employed. The admission of steam to the cylinders and the cut-off is controlled by the main steam valve, shown in figure 1. Exhaust opening is governed by the main valve and the auxiliary compression controlling valves shown in figure 3. The compression valves are operated by the main valve and delays the final closure of the exhaust until the piston has completed 90 per cent. of its stroke at the short cut offs, thereby reducing the volume of exhaust steam in compression from about 10 inches in the usual practice to 2¾ inches in this system. The compression valves always open for exhaust simultaneously with the main valve thereby increasing the area of exhaust opening nineteen square inches which reduces back pressure to a marked degree.

FIG. 3.—PRESSURE CONTROLLING VALVE.—ALLFREE-HUBBELL LOCOMOTIVE.

The volume of each steam port is reduced over 70 per cent. in this design and makes possible short direct ports with flat surfaces which can be scraped. Because of the delayed exhaust closure which results in a decreased volume of steam in compression, the cylinder clearance is reduced from 8 per cent. and over in the usual cylinder design to 2½ per cent. and less in the Allfree-Hubbell designs and this also reduces the losses due to cylinder condensation.

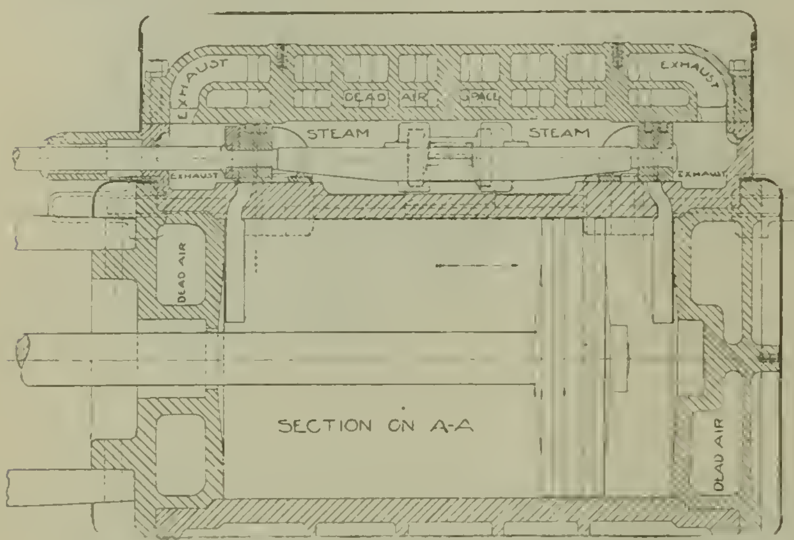


FIG. 4— LONGITUDINAL SECTION OF CYLINDER AND VALVE—ALLFREE-HUBBELL LOCOMOTIVE.

The main steam valve is shown in figure 1. It is rigidly constructed and balanced for all speeds and under all pressures, running or drifting, which is shown in the reduced wear found on valve faces, valve seats and in the valve motion. The valves are usually given 7-16 inches exhaust lap to secure increased expansion and there are no ill effects of this increased lap on back pressure or

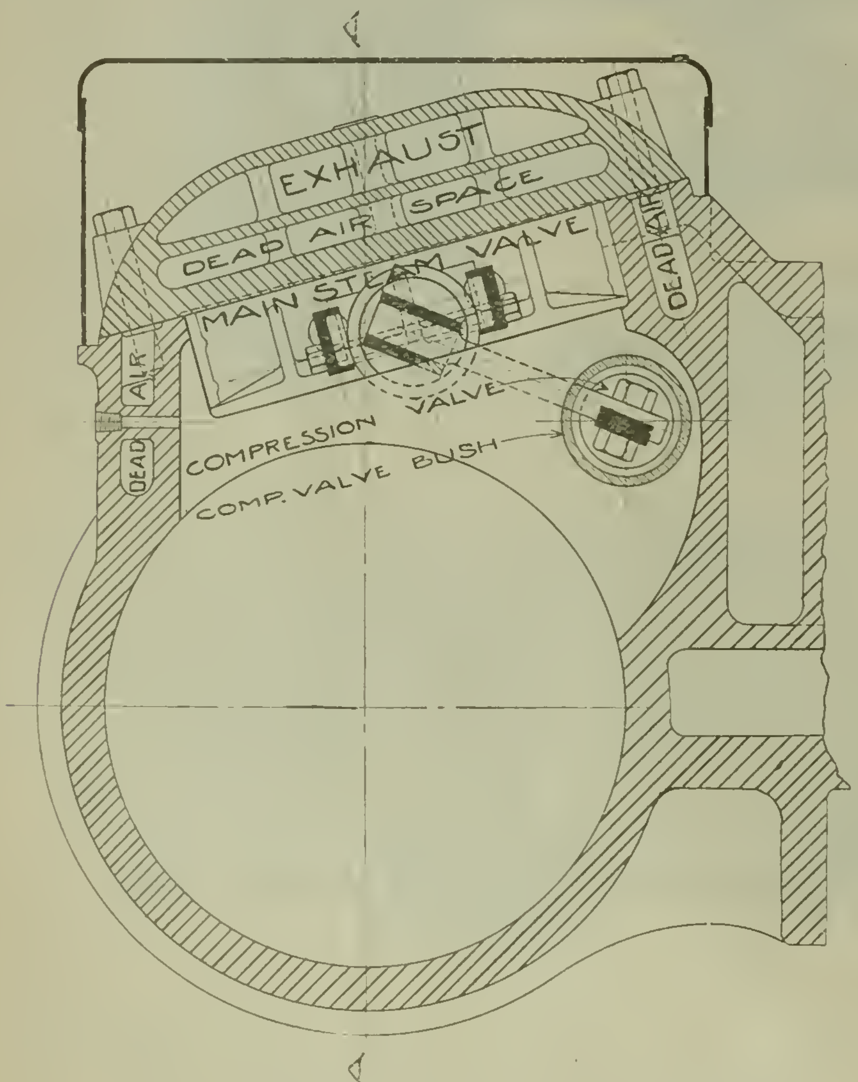


FIG. 5. CROSS SECTION THROUGH CYLINDER AND VALVE.—ALLFREE-HUBBELL LOCOMOTIVE.

compression due to the early closure of the main valve for the reason that the compression controlling valves govern the exhaust port final closure. The dash pot piston from which the compression controlling valve takes its motion is shown clearly. Fig. 2 shows the valve in position on its seat in the steam chest.

The compression controlling valves are illustrated in Fig. 3 and will be recognized as piston valves of the usual design but equipped with wide snap rings for protection against wear. The valves take their motion from an arm with a forked end which engages the dash pot piston carried in the main valves.

Figs. 4 and 5 give sections of the valve and cylinders and show the relation of parts and the special features of design. The valve seats are placed close to the bore of the cylinder and on an angle of 15 degrees from the horizontal to further reduce the cylinder clearance volumes, which comprise the volumes in port and in striking distance at each end of each cylinder.

The principal dimensions of the simple engines are included in the following table:

Gauge	4 ft. 8½ in.
Service	Passenger
Fuel	Bituminous Coal
Tractive force	34,400 lbs.
Weight in working order, with Richardson valves	222,500 lbs.
Weight in working order, with Alfree-Hubbell valves	223,500 lbs.
Weight on drivers, with Richardson valves	141,300 lbs.
Weight on drivers, with Allfree-Hubbell valves	142,000 lbs.
Weight of engine and tender, with Richardson valves	358,300 lbs.
Weight of engine and tender, with Allfree-Hubbell valves	359,000 lbs.
Wheel base, driving	12 ft. 3 in.
Wheel base, total engine	33 ft. 0 in.
Wheel base, engine and tender	63 ft. 3¼ in.

CYLINDERS.

Number	2
Kind	Simple
Diameter and stroke	22x28 in.

VALVES.

Kind	Richardson Balanced, Allfree-Hubbell
Greatest Travel	6 in.
Outside lap	1 in.
Valves set	Line and line in full gear F and B.

WHEELS.

Driving, diameter over tires	67 in.
Driving, thickness of tires	3½ in.
Driving journals, diameter and length, main	10x12 in.
Driving journals, diameter and length, others	9x12 in.

BOILER.

Style	Straight Top
Working pressure	200 lbs.
Outside diameter of first ring	74½ in.
Firebox, length and width	113⅛x65¼ in.
Firebox sheets	crown, sides, back, ⅜ in.; flue, ½ in.
Tubes	Number, 306; diameter, 2¼ in.
Tubes, length	20 ft.
Heating surface, tubes	3,588 sq. ft.
Heating surface, firebox	210.3 sq. ft.
Heating surface, total	3,789.3 sq. ft.
Grate area	51.6 sq. ft.
Center of boiler above rail	9 ft. 8 in.

TENDER.

Frame	Vanderbilt style, 6x4 in., angles and plates
Journals, diameter and length	5½x10 in.
Water capacity	7,500 gals.
Coal capacity	12 tons

Combustion of Fuel in Relation to Locomotive Firing.

(Fourth of a series of articles on this subject.)

IN MOST lines a large proportion of the number of engine failures is charged to "Not Steaming." While this report covers a multitude of sins, there is no question but that on many lines there is not sufficient care taken to insure the uniform good steaming of all locomotives. Yet the matter of good steaming is closely related to fuel economy, for there is a satisfaction and confidence in firing a good steaming locomotive which impels a man to show what he can do; while with a poor steamer the most expert and conscientious fireman will burn more coal in the endeavor to furnish steam than he would with a good steamer and in the disgust at the always doubtful success of his efforts, he loses interest.

Where engines are not steaming, it is always the fault of either the management or the crews, or both. Locomotives can be designed which will steam successfully with practically any quality of coal. A locomotive designed for the development of a practical maximum power with a grate area which involves the burning of 14,000 B. T. U. coal at the rate of over 180 lbs. per sq. ft. per hr., however, cannot be made to furnish steam for an equivalent rate of working with 10,000 B. T. U. coal. Equally, a locomotive designed for a certain rate of working with a grate area intended for the use of 10,000 B. T. U. coal at a combustion rate of 100 lbs. per sq. ft. per hr. will prove wasteful of fuel with 14,000 B. T. U. coal at this rate of working, because of the small nozzle which will be required to induce sufficient draft to overcome an impractically low rate of combustion when working at half maximum power. This latter is not generally appreciated by technical men, but firemen have well observed that below a combustion rate of 50 lbs. per sq. ft. of grate area per hr., the fire does not remain in that state of incandescence essential in locomotive practice. It bakes and lies dead on the surface.

It is not meant to imply that the ordinary locomotive is unduly restricted to the use of a certain quality of coal for the insurance of steaming well, for most locomotives are designed with a grate area (and a concomitant amount of heating surface) of an extent which lies so well between the limiting rates of combustion, that good steaming can be secured throughout a considerable range in coal quality—if the drafting arrangements are varied to correspond with the variations in the coals. And it is in the roundhouse reporting of matters in this regard that poor steaming locomotives are often the fault of the crews. How usual it is to note on the roundhouse work report book the simple statement "Not steaming!" The author thinks frankly that an engineer making such a report deserves discharge, for everyone connected knows that the poor steaming may be due to any one or all of a dozen causes, many of which cannot be located by the roundhouse foreman because it is necessary to observe the engine under steam and working in order to diagnose the trouble. The engine crew have had this opportunity and if the specific cause for the failure of the engine to steam (where others of the same class steam well with the same coal) is not reported by the engineer, he is either too ignorant or too careless to be retained in charge of a locomotive.

It being obvious that a locomotive must be in reasonable condition and reasonably run in order for a fireman to accomplish satisfactory results and, the running of a locomotive from the standpoints of both the engineer and the dispatcher being out of the province of these articles, we will hence concern ourselves solely with such aspects of the locomotive condition as the engine fireman is expected to deal with and hence have knowledge of.

The amount of ash pan opening, as well as grate opening between the fingers thereof, are matters of experiment which should be (and generally long since have been) established by the mechanical, or traveling engineer—and hence may ordinarily be neglected by the engine crew. The next point of observation is, logically, the state of the staybolts and boiler tubes with respect to leakage. In good water districts this is not so much a problem as is the case in districts where the water supply is more or less bad. Where staybolts and boiler tubes are addicted to leaking, the matter of fuel economy must be deferred until the management is able to provide a better water supply. For where a justifiable fear of leakage is in existence, the matter of fuel economy is considerably less important than the necessity insuring that the locomotive gets its train over the division.

With a locomotive addicted to leaking, the secret of success in getting over the road lies in "keeping her hot" —all the time—up hill—down hill—in side—tracks—while switching—every place and all the time—to keep her hot from the time she is first taken until landed at the other terminal. If, in reaching the locomotive for a trip, the tubes or staybolts are spurting, it had better be turned back to the roundhouse, for a trip would almost certainly result in failure. If, however, the tubes or staybolts are merely "seeping," a hot fire will generally cause an amount of sheet expansion that will stop the leakage—and the prevention of leakage again developing is merely a matter of constantly maintaining a temperature in the firebox which will prevent this sheet expansion from becoming reduced again.

This is easily understandable if we recollect that the tubes and staybolts are fitted to the firebox sheets when the metal is cold, or contracted. Good water lies up close to the sheets and thus abstracts the heat from the sheets as fast as evolved by the fire. Hence the sheets do not become heated much above the temperature equivalent of the water, and, therefore, the junctions of tubes and staybolts with the sheets are not distorted beyond a capacity to return to their original tightness when the temperature of the fire drops. Bad water, however, either deposits a heavy scale, or else boils away from the sheets (generally both). This results in the water not abstracting the heat from the sheets as rapidly as it is transmitted by the fire. Hence the temperature of the sheets rises considerably beyond that of the steam temperature equivalent and, the resulting expansion is so great that the junctions of the tubes and staybolts with the sheet are distorted beyond their ability to return to the original tightness and leakage results. The temperature of steam or water at 200 lbs. pressure is 387 degrees. D. K. Clark gives the temperature of 14,700 B. T. U. coal, as follows when burning at certain rates:

Lbs. of coal per sq. ft. of grate area per hr.	Temperature of surface of fire in degrees Fahr.
40	1,857
80	2,009
120	2,097
160	2,137*
200	2,157*

* Would be "about."

So that unless the water takes the heat away from the sheet as rapidly as delivered, the temperature (and the consequent expansion) of the sheet will rise very quickly above that of the surrounding water. Now in the table just quoted it will be noticed that the temperature of the fire does not drop very rapidly until we burn somewhat less than 80 lbs. of coal per sq. ft. of grate area per hr. As the blower will generally enable a combustion rate of more than 40 lbs. of coal per sq. ft. of grate area per hr., to be maintained, the drop in fire temperature, which will start a "tender" set of tubes to leaking, can be avoided—where merely getting over the road becomes more important than fuel economy. Firemen will readily remember the manifestations here explained in cases where an engine stops leaking when working hard, but starts leaking soon after shutting off unless the blower is put on.

Another difficulty encountered with some fuels is "honeycombing." The author confesses himself unable to say anything of particular value in regard to this difficulty. He has heard it said that a percentage of lime mixed in with the coal will obviate or considerably reduce the honeycombing, but he has never seen it tried and hence does not vouch for the suggestion. With some coals, honeycombing develops into a very serious matter, especially in passage service over long divisions. In freight service there is generally opportunity around stations to knock off the major portion of the clusters with a bar, while in passenger service such work must perforce be done while rolling down hill, which is consequently a very disagreeable job. The use of brick arches considerably reduce the tendency to honeycomb, and are hence advisable where such a coal is used in passenger service. But in freight service they block the efforts of the fireman to knock down the honeycombing so effectually that it is generally a better policy to leave them out where it is necessary to use a honeycombing coal. One thing is certain, however, in this connection, viz.: that the roundhouse force should be compelled to furnish the locomotive thoroughly free from honeycombing when delivered to the engine crew.

Mention of the brick arch suggests a few remarks in connection therewith. The arch has several functions. It is put in in order to retard the gases of combustion by compelling them to travel greater distance around it before reaching the boiler tubes. When once the gases have entered the tubes, no further progress of combustion is possible, hence the longer they remain in the firebox the greater opportunity there is for the combustion processes to complete themselves. Furthermore, when the arch has become heated, it affords a highly heated surface for the gases to impinge upon and thus be assisted in the completion of the process of combustion. The arch also heats the air entering through the firedoor and tends to deflect them downward toward the bed of the fire and, at the same time throw the air and gases into a more thorough mixture. The arch also protects the tube sheet from being directly struck by the cold air entering the firedoor, and also from the effects of letting the fire die down while drifting or lying around stations. In some road tests made by the author on an old style, 16 by 24 ins. eight-wheel locomotive, in passenger service, the locomotive evaporated 7.5 lbs. of water per lb. of coal, without an arch, and 8 lbs. with one. The arch increases the difficulty of firing to some extent in certain types of fireboxes, and, until one gets used to firing with the arch in place, considerable coal is landed on top of the arch, or the grate surface next the tube sheet allowed to become exposed. One soon becomes accustomed, however, to avoid these faults. The arch should be watched, however, and any symptom of its breaking down immediately reported in order to avoid trouble on the road.

Where the arch is used, the state of the tubes in regard to their being stopped up cannot be observed by the crew until the locomotive is started working. And even without the arch a considerably greater number of tubes may be choked than the few observable from the door. While a badly stopped up set of boiler tubes will cause remark from one who knows the engine, by the slow effect of the blower, yet one unfamiliar with the engine in its normal condition would be inclined to attribute such a symptom to a weakness of the blower. The most satisfactory specific way to observe the state of the tubes in this regard is by the lag in the appearance of black smoke after shutting off after the engine has been working hard. If the fire has not been prepared for shutting off and if the door is not then opened and the blower put on, a locomotive whose tubes are not stopped up to any extent, will almost instantly pour black smoke out of the stack. If the tubes are pretty well stopped up, however, there will be a more or less great lag in this appearance and volume of this smoke.

This matter of choked tubes is one of the most annoying, yet most common, occasions for controversies between the roundhouse and the engine crews that the author can cite. Obviously, every choked tube is that percentage of the boiler's tube heating surface out of commission. Any practical man will admit that the eye alone will point out 25 choked tubes in five locomotives out of 10 on practically any road in this country. If 25 tubes are choked to an extent which is visible at the tube sheet end, it would be a safe bet that there were anywhere from 50 to 75 more through which the gases could not pass; and if the gases cannot pass through a tube is useless. This would mean 100 useless tubes. In a locomotive with 2,500 sq. ft. of tube heating surface from 300 tubes, this would mean one-third of the heating surface rendered valueless, or, instead of the 2,500 sq. ft. of tube heating surface, the boiler has practically but 1,667 sq. ft. of tube heating surface. No wonder there are so many reports of engine failures because of not steaming.

There is much improvement to be desired in roundhouse methods on this point. The importance of clean tubes is not appreciated, the roundhouse facilities for the rapid and easy accomplishment of a thorough job of tube cleaning are hopelessly crude in nine out of ten roundhouses on every line in the United States, and the class of men assigned to these jobs are absolutely irresponsible in the absence of the checking up which is imperative, but not given. The result is that the tubes *are not cleaned* when reported. The author feels very strongly on this subject, as a result of several mortifying experiences, needless to relate here. It might be well, however, to point out the absurdity of the average roundhouse procedure on a report of "Flues are stopped up." If the arch is in good shape, the foreman is greatly averse to undertaking the job and will avoid it if possible, and hence orders the useless expedient of poking a rod through the top tubes which can be reached, and the insertion of a hammer handle in the lower tubes which are filled up. If the state of the locomotive as regards steaming, however, forces some action, the two least reliable laborers on the place are set at the job with "augers," which, being but half the diameter of the tube, merely half clean such tubes as are entered, and—as there is practically no attention given to their efforts they loaf on the job, skip all the "hard ones" and more than half the "easy" ones. Even if air, steam, or water is furnished for blowing out, instead of boring the tubes, the dirt of the job causes it to be scandalously slighted. The result is so perfunctory an accomplishment of this work as to greatly discourage engine crews in reporting it and often to incline them to merely ask instead for a smaller nozzle tip, or for a bridge therein.

Next to choked tubes, though not as often in evidence, the leaking of a steam pipe joint is the most absolute bar to a free-steaming engine. While standing still, the placing of the reverse lever on center and the opening of the throttle will enable the blow of the joint to be heard if the valves are tight enough to prevent the steam from blowing through them and thus drowning out the blow from the steam pipe joint. While working, a leaky steam pipe joint evidences itself to blocking the draft to an extent which causes the fire to burn as if the nozzle tip were too large, while the steam fails more rapidly in the presence of this defect than from any other. The location of the leak can only be securely placed by opening the front end door, while steam is given with the engine on center, when it can be heard and seen or located with a torch.

The deflection, diaphragm, or baffle plate, as variously called, controls the level burning of the fire on the grates. If the locomotive burns more coal at the rear of the grate surface than it does in the vicinity of the tube sheet, the deflector does not extend down far enogh and should be reported for lowering, say an inch. If, on the other hand, coal is burned more rapidly in front than in rear, it should be raised. The reason for this is simply that raising the deflector allows a greater amount of draft through the upper tubes, which have their effect chiefly over the rear of the grate surface, while lowering the plate decreases the draft through the upper tubes, and, therefore, the draft over this rear portion of the grate surface.

The size of the exhaust nozzle tip has been the subject of much investigation in its location as respects height, with regard to the size of the stack and the general arrangement of the front end. So far as the fireman is actually concerned in utilizing the arrangements furnished him, however, the proposition is simply that on the size of the nozzle tip depends the amount (or rather, intensity) of the draft. Since the force with which the steam passes through the nozzle tip depends on its size with relation to the volume of the cylinders, the pressure on the exhaust sides of the pistons will decrease as the size of the nozzle tip is increased. Naturally a large nozzle means low back pressure in the cylinders and a mild draft on the fire, which latter means, of course, a slower rate of combustion than where a smaller nozzle tip (or a bridge) is used. If, however, the nozzle tip is too large, enough draft will not be furnished to burn the coal fast enough to cause the engine to steam freely. Then the size of the tip must be decreased, regardless of the question of cylinder back pressure. A skilful and careful engine crew who are familiar with the locomotive can run with a larger nozzle tip than a less experienced or more careless crew, and get far better results both in the way the engine handles the train and in the amount of fuel consumed. This leads the officials and the more skilful engineers to have a great prejudice in favor of a large nozzle. Consequently, when a locomotive comes out of the back shop, or has been the regular engine of a skilful crew, it generally is equipped with nozzle tip larger than will provide sufficient steam for a less skilful crew, or possibly a poorer quality of coal than the size of the tip was intended for. Hence a report of poor steaming. Personally, the author goes against general practice by considering it a better policy to err on the side of too small a size of tip than in the direction of too large a tip—for the reason that a fireman will use more coal in endeavoring to force an engine to steam with insufficient draft than he will where the draft is so strong as to give him no fear of not being able to make plenty of steam whenever required. Certainly if a locomotive does not burn its fire freely and it is not a case of choked tubes or leaking steampipe joints, there should be no hesitancy in insisting on a reduction in the size of the nozzle tip. There is no use in fooling with an engine that does not burn its fire.

Heavy Tank Locomotive.

Nevada Northern Railway.

A POWERFUL tank engine of original design has been completed recently at the Brooks Works of the American Locomotive Company. The engine is of the 2-8-2 type and was especially designed for service between the mines and smelters of the Nevada Consolidated Copper Company.

In order to provide an engine that would move equally well both ways, the leading and trailing trucks were spaced the same distance from, and equalized with, the front and back drivers respectively. The center of the boiler is 9 feet 5 inches above the rail, which is considerably greater than usual, with the same diameter of boiler and driving wheels, but the center of gravity is kept down by the counteracting weight of the water in the tanks. The unusual space between the boiler and frames facilitates inspection and repairs to the interior machinery and is a feature not usually found in engines of this type.

In order to provide as much tank capacity as possible, the inside tank sheet follows the line of the boiler which made it necessary to pass the reach rod through the water space. This is accomplished by a pipe which acts as a conduit for the reach rod and a casting placed at the front end of the tank which is open at the lower end to permit movement of the tumbling shaft arm.

In order to provide sufficient room between the boiler head and coal box for convenience in firing, the front of the coal box is sloped downward toward the rear adding 30 inches more space to the cab.

Some of the principal ratios of the design are as follows:

$\frac{\text{Weight on Drivers}}{\text{Tractive Effort}}$ 5.18

$\frac{\text{Tractive Effort x Dia. Drivers}}{\text{Heating Surface}}$ 605

$\frac{\text{Total Heating Surface}}{\text{Grate Area}}$ 57.5

$\frac{\text{Total Frebox Heating Surface}}{\text{Total Heating Surface}}$ .063

$\frac{\text{Weight on Drivers}}{\text{Total Heating Surface}}$ 65

$\frac{\text{Total Weight}}{\text{Total Heating Surface}}$ 85

$\frac{\text{Volume of 2 Cylinders}}{}$ 8.52

$\frac{\text{Total Heating Surface}}{\text{Cylinder Volume}}$ 311

$\frac{\text{Grate Area}}{\text{Cylinder Volume}}$ 5.4

SPECIFICATIONS

Cylinder, type, simple; diam., 19 in.; stroke, 26 in.

Track gauge, 4 ft. 8½ in.; tractive power, 33,240 lbs.

Wheel base, driving, 15 ft.; rigid, 15 ft.; total, 34 ft.

Weight, in working order, 225,000 lbs.; on drivers, 172,000 lbs.

Heating surface, tubes, 2,477.6 sq. ft.; firebox, 166 sq. ft.; total, 2,643.6 sq. ft.

Grate area, 46 sq. ft.

Axles, driving journals, main, 8½x12 in.; others, 8½x12 in.

Axles, engine truck journals, diamater, 7 in.; length, 14 in.

Axles, trailing truck journals, diameter, 7 in.; length, 14 in.

Boiler, type, Radial Stay Straight Top; O. D. first ring, 66⅛ in.

Boiler, working pressure, 200 lbs.; fuel, soft coal.

Firebox, type, wide; length, 107⅛ in; width, 62¼ in.

Firebox, thickness of crown, ⅜ in.; tube, ½ in.; sides ⅜ in.; back, ⅜.

Firebox, water space, front, 4 in.; sides 3½ in; back 3½ in.

Crown staying, Radial, 1 in.

Tubes, material, charcoal, iron; No. 304; diam., 2 in.

Tubes, length, 15 ft. 8 in.; gauge, No. 11, B. W. G.

Air pump, 11 in.; 4 reservoirs, 16x74 in.

Trailing truck, radial inside journal.

Exhaust pipe, single.

Grate, style rocking.

Piston, rod diam. 3¾ in. piston packing, cast iron rings.

Smoke stack, diam. 14½ in. and 16⅞ in., top above rail, 15 ft. 2 in.

Tank, style 2 side.

Tank, capacity 2,500 gallons.

Tank, capacity fuel, 5 tons.

Valves, type, slide, travel 5 13-16 in.; steam lap, ⅞ in.

Valves, ex. lap, 0 in.

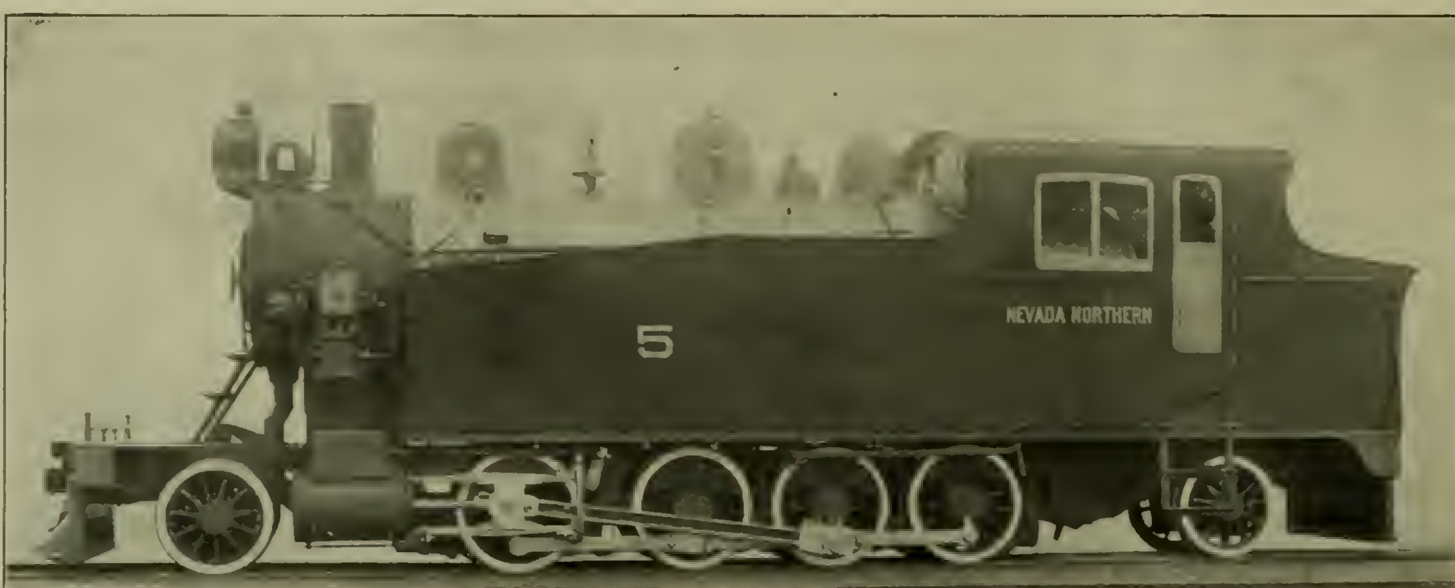
Setting, in full gear, line and line.

Wheels, driv. diam. outside tire, 48 in.; centers diam., 42 in.

Wheels, driv., main cast steel; others, cast steel.

Wheels, engine truck, diam., 42 in.; kind, cast iron spoke, steel tired.

Wheels, trailing truck, diam. 42 in.; kind, C. I. spoke, steel tired.



HEAVY TANK LOCOMOTIVE.—NEVADA NORTHERN RAILWAY.

Communications.

Why the Engineer Always has a Kick Coming.

Editor Railway Master Mechanic:

It may be a source of great annoyance to the foreman, as well as to shop men in general, to be compelled to listen to the old familiar story that the engineer has to tell on his return from nearly every trip over the road, concerning the very poor condition of his engine and the unsatisfactory manner in which the work previously reported had been done. It is equally annoying to the engineer, however, to find it necessary to report the same work after every trip and to tell of the trouble the engine gave him while on the road and the delays it caused to his own train as well as others over which he may have had right. Under such conditions the foreman knows just about what an engineer will have to say when he sees him coming, and the foreman braces himself to meet the engineer with seeming interest and words of encouragement, whether he really intends to make things right or not.

Now, we all realize in this day and age that it is the object of the master mechanic to keep the equipment up in first class condition with the least possible amount of expense, until in many instances the financial end has been cut so closely that it has been necessary from time to time to make a reduction in the shop force to the extent that the few machinists retained are unable to keep up with the work, and naturally being rushed and hurried from one job to another, it is nearly impossible for them to complete any one job satisfactorily, and patch work is resorted to. In many cases an apprentice or helper is put on a job and the work is done in a manner which would indicate the total lack of either theoretical or practical knowledge, and, even after inspection, such work is allowed to go out on the road.

To help matters along, the foreman will mark off work from the report book which would seem to him of small importance, and, worse than this, he lets weak parts go until they get in such condition as to be past repairing. Such methods, in course of time, cause many good machinists to become lax and indifferent and to scheme to get an engine out of the roundhouse and on the road with as little work as possible. This practice continues until an engine becomes a bunch of repairs, with nothing strong or substantial about it, and while such carelessness is being allowed to continue, no thought is given to the position in which it places the engineer.

From the standpoint of the engineer it does not seem out of place for me to make an effort to show the absolute necessity of doing all work reported and doing it well, even if it should be necessary to hold an engine in for it. In case it should be impossible to hold an engine because of rush of traffic, the necessary repairs should be made in such a substantial manner that in starting out the engineer will feel at ease concerning the work done and during the trip will not have to watch the repaired part more carefully than if it had been left untouched. Often before starting out it has been necessary for me to go over every part repaired and tighten nuts and bolts and put in cotter keys. In addition to this it has been necessary to do some sort of repair work at every stop during the trip in order to get over the road.

For example, I will mention a case in which it was necessary to have the guides closed on an engine I was running recently. The work was done and the engine was fired up and set out on the lead track, where I took charge of her preparatory to starting out on my run. As is my custom, I inspected this work and found the inside guides on both sides were just hanging by nuts barely started on the bolts and two of the bolts had no nuts on them. The guides were not drawn up to the guide blocks by one-quarter of an inch, while the outside guides on both sides were lined up and secured all right.

In another case, and on a different engine, I had a forward motion eccentric loose on the axle, which had been loose for several trips, and although reported each trip the work was not done right. Taking particular pains, I stated in my work report that the key in the stud bolt connecting the two parts of the eccentric was too small and would go up in the keyway to the shoulder of the key without drawing the eccentric tight. Besides this report I told the foreman personally of the conditions and next morning I was given a short call to take my run out on passenger and I merely glanced at the work, saw it had been worked upon and hurried up and coupled onto the train and started out. The reverse lever commenced to jerk and in a few minutes I had a hot eccentric. I then examined the eccentric and found that the machinist who worked on it did not put in a new key as I had requested, but simply set up the set screws tight, thereby forcing the parts of the eccentric open and out against the strap. I loosened up the set screws and the eccentric ran cool, but it had about three inches lateral on the axle.

And still another case. An engine had her tie-rods in the driver brake gear broken and this work was reported in the evening on her arrival. In the morning when the engineer took her to start on his run he found the expert machinist had fastened a heavy chain from one brake lever, across underneath the ash-pan, to the lever on the other side, and the chain sagged so that it would drag along on the ground and catch crossings planks, cattle-guards, etc. Of course this engineer did not start with the engine in that condition.

I could site a number of similar cases which would, no doubt, sound ridiculous. Nevertheless they are facts and I use them to verify my statement that all the roundhouse force seems to care is just to get the engine out of the house. Is it any wonder that the engineer gets mad and won't look at the foreman or anyone when he comes in?

The engineer is up against a hard proposition with such engines to handle the tonnage they are rated for and make a successful trip without having an engine failure. When the engineer is called to account for so many engine failures, it is hard for him to prove that he is not responsible, inasmuch as the work report book at the roundhouse shows the work to have been done, regardless of whether by lead-pencil or otherwise.

The engineer is expected to make a creditable showing, not only to maintain his own record, but to help the management continue its usual report of earnings, with a possible increase. To this end all is dependent upon the power of the locomotive and the man in charge. Consequently to cut down amounts set aside for special repair work seems to me to be very poor economy, to say nothing of the trials and extra trouble it gives the engineer, who expects at any moment to have some part give away, causing a breakdown or possibly a wreck.

Yours, hoping for an improvement.

An Engineer.

From the View Point of a Practical Mechanic

Mr. Editor:

In the previous papers I have dealt with the conditions and facilities provided in roundhouses that effect the machinist doing the work, and I now wish to make a few remarks in regard to some of the features in design of locomotives that I have noticed in my travels.

While there must have been a purpose in designing parts, as I have found them, there exists a wide variation in the way locomotives are designed. I have noticed that some roads pay particular attention to putting an engine together in such shape that it will not be easy for the roundhouse force to take the engine apart, or make repairs. In the effort to turn locomotives rapidly, the roundhouse is often handicapped by having to deal with improperly designed engines.

I will mention a few of the parts that are frequently handled, and which have been designed in a manner that does not permit the machinist to do rapid work. The side rod collar bolts on some roads have countersunk heads and are put through from the outside with a nut in a recessed socket on the inside of the hub. This necessitates spotting the engine on the lower quarter to remove this bolt, and it is not possible to inspect the nut without going under the engine. The cotter key can work out and the nut back off unless more than ordinary care is taken for inspection. On other roads I have seen this bolt put through from the inside with a thin nut and key on the outside, which makes a much better arrangement for both repairs and inspection.

Another thing that has appealed to me is the design of pedestal binders. With the style of binder that requires a pedestal bolt passing through the frame jaws, it is often impossible to take out the bolt without disconnecting the brake rigging. The bolt can be put up in one way only, and it is very inconvenient to remove the nuts, or to tighten them sufficiently in the small space there is to work. If the nuts are not tightened up properly the jaw of the frame spreads and sometimes the upper rail is cracked at the fillet of the jaw. Again, the pedestal bolt stretches with the same results—a broken frame. The use of the clip binder will do away with this trouble and is more easily taken down and put up than the thimble binder.

In my time I have had to take down a great many broken cylinder heads because of piston rods being loose in the cross head and also as a result of the end of the rod breaking through the keyway. I have noticed that these rods always break in the same place, which shows a weakness in design through the crosshead fit. I often wonder why the designer keeps on using this very expensive arrangement when the rods can be fitted up with a nut for holding the rod in a cross head arrangement, which provides a very strong construction. I have never seen a rod of this kind break in the crosshead fit and yet I do not see them adopted.

In bad water districts a great deal of trouble is experienced with boiler checks leaking, but I have noticed very little change in design on most of the roads. The old-fashioned check is still used, though it has been modified some and made a great deal larger. On the other hand, it has been my good fortune to work on checks that have a globe valve for cutting off the steam pressure so that the check can be ground in with steam on the boiler. This is a thing that seems to me should appeal to every road, and yet the use of the old style check is not discontinued and in this day when the roads are so hard up for power, they keep on killing engines to grind in boiler checks. When working on pony trucks, I have noticed cases where it has been impossible to remove truck brasses without first disconnecting the hangers. It is necessary to jack up the engine and remove the hangers to get at the brasses. This arrangement does not add to the efficiency of the roundhouse in making quick repairs, or in renewing brasses, and renewing brasses is a very frequent job in a roundhouse.

In the valve motion a number of weaknesses have developed in various designs of engines due to the links being placed close to the center line between the frames. At the same time the valves have been moved out farther on account of the increasing size of engines. These changes result in a greater offset between the drag of the valve and the motion of the eccentrics and throws an undue strain on the valve motion, which results in a rapid wear of pins and bushings. I have had to run over engines every few days from this cause and consider these changes unfortunate, as there are a great many more delays on account of lame engines and there is a greater number of broken parts from this cause than would seem necessary. This has been avoided almost entirely on some roads by modifying the design of valve gear in accordance with the results of experience.

It seems to me that a great deal of information in regard to the value of various designs of engine trimmings and parts could be obtained by the designers, if they would study more closely the repairs that engines receive in the roundhouse.

Yours truly,

A. M.

Retaining Technical Graduates.

Editor, Railway Master Mechanic:

The article by Professor Schmidt about the technical graduate in your December issue was very interesting to me as I am one of those who went with a road which has not "developed a system" in handling this class of men.

I entered upon what they called a special apprenticeship, which was to consist of a three years course of training in all the prominent motive power departments. The pay was to be twelve cents an hour for six months, then increasing three cents an hour every six months thereafter, with no definite promise of what it would be at the end of the course, although the hints given out were broad enough for my imagination to work on.

The start was very propitious and I took up the duties assigned me with a great deal of enthusiasm. I was given from three to six months in each, the machine shop, roundhouse, boiler shop, firing on the road, etc., and as I always kept my eyes open and tried to pick up all I could, I thought that my three years experience was very good training. The pay had increased to about $65 a month, so it was ample for my needs. Altogether my apprenticeship had been very successful and I looked forward to the future as a world of unknown possibilities.

The first move that was made at the close of my apprenticeship, in sending me to the drafting room was not what I expected, and I asked to be given some active work in operating the road instead of being buried in the drafting room. I was met with the reply that I was only a "technical man" and that I lacked the necessary "practical ability" to handle the work I asked for. Not satisfied with this I went to the superintendent of motive power and asked him to give me a job where I could "do something." His answer was that my training had fitted me for "special work" and if I wanted to go into active railroad life I would have to start down at the bottom with the rest and make my experience more practical. Even my best friends told me that I had received only a "smattering" of practical railroading and that I could not expect to be capable of assuming a responsible job.

Discouraged but not altogether satisfied with the arguments of these men I went back to my drawing board wondering why a special apprentice could not be a "practical man" also. I have been in the drawing room for one year now, and receive the maximum pay of $75 a month. At the present time I can see nothing ahead but this kind of work. At times I have been sent out on various special jobs and tests, but there has been very little to relieve the monotony of the drawing board. I might mention that I have been called over to the roundhouse frequently to help the foreman work out certain problems, but that is the nearest I get to the practical side of the work.

I intend to stay with the road one year more and if the opportunity for advancement does not present itself during that time, I have determined to leave the service.

Yours truly,

E. G. J.

The Lightest Eight Wheel Switcher.

E. T. & W. N. C. R. R.

THE eight-wheel switcher illustrated herewith was built by the American Locomotive Company for the Eastern Tennessee & Western Northern Carolina Railroad, and has the distinguishing feature of being the lightest weight locomotive of its type ever turned out by the builders.

The gauge is 36 inches, and the weight on drivers is 97,000 pounds which gives a wheel load of 12,000 pounds for the 45 pound rail to support. The engine has a starting power of 21,200 pounds which makes it a powerful machine for that class of service and character of road. The rigid wheel base is 12 feet which enables the engine to take curves of 185 feet radius with safety.

LIGHTEST EIGHT WHEEL SWITCHER.—E. T. & W. N. C. R. R.

The E. T. & W. N. C., is a logging road and the engine was perforce designed for poorer conditions than are known in general railway operation. The requirements were, therefore, for an engine with a minimum load per wheel on account of a light rail, in connection with largest hauling capacity possible on an indifferent roadbed.

The eight-wheel switcher has become an important factor in logging road operation, as it presents a solution of the light rail problem by a convenient distribution of wheel loads over several axles. While this engine is the lightest eight-wheel switcher ever built by the American Locomotive Company, it is the heaviest engine the road for which it is built has ever had. The attached specification will be found to read strangely in the presentation of diminutive details.

Cylinder, type, slide; 17 in. diam., 20 in. stroke.
Track gauge, 3 ft. 0 in. Tractive power, 21,215.
Wheel base, driving, 12 ft. 0 in. Rigid, 12 ft. 0 in. Total, 12 ft. 0 in.
Wheel base, total, engine and tender, 38 ft. 2 ins.
Weight, in working order, 97,000 lbs.; on drivers, 97,000 lbs
Weight, in working order, engine and tender, 157,000 lbs.
Heating surface, tubes, 1,174 sq. ft.
Heating surface, firebox, 126 sq. ft.
Heating surface, total, 1,300 sq. ft.
Grate area, 17.3 sq. ft.
Axles, driving journals, main 7x8 ins.; others, 7x8 ins.
Axles, tender, truck journals, diameter 4 x 7 ins.
Boiler, type R. S. S. T. O. D. first ring, 60 in.
Boiler, working pressure, 290 lbs.; fuel, soft coal.
Firebox, type long, length, 107 3-16; width, 23¼ ins.
Firebox, thickness of crown, ⅜ in.; tube, ½ in.; sides, ⅜ in; back, 5-16 in.
Firebox, water space, front 3½ ins.; sides, 2½ ins.; back, 3 in.
Crown staying, radial 1 in.
Tubes, material, charcoal iron; No. 224, diam. 2 ins.
Tubes, length, 10 ft. 1⅛ ins. Gauge No. 12 B. W. G.
Boxes, driving, main cast iron; others, cast iron.
Brake, driver, West. American.
Brake, tender, Westinghouse.
Brake, pump, 9½; 1 reservoir 17 11-16 ins. by 72 ins.
Exhaust pipe, single.
Grate, style, rocking.
Piston, rod diam., 3 ins.; piston packing, cast iron ring.
Smoke stack, diam., 14¼ ins. and 16⅛ ins.; top above rail, 12 ft. 2½ ins.
Tender frame, oak.
Tank, style U, shaped sloping back.
Tank, capacity, 3,000 gallons.
Tank capacity, fuel, 5 tons.
Valves, type, side; travel, 5¼ ins.; steam lap, ⅞ in.
Valves, ex, lap, ⅛ in.
Setting in full gear line and line.
Wheels, driv. diam. outside tire, 44 ins.; centers diam, 38 ins.
Wheels, driv. material, main cast iron; others, cast iron.
Wheels, tender truck diam., 24 ins.; kind, cast iron.

Courtesy to the Salesman.

THE custom followed by English firms when a salesman calls is to have a clerk make an appointment several weeks in advance in order to obtain an audience.

It is different here and as a rule the salesman has little difficulty in getting audience. However, there are some firms not unlike the English business man and it is next to impossible for a salesman to see the head. Such men resort to various means to keep salesmen waiting or even if they finally see them, "Jolly them along" with promises, excuses and subterfuges when they have no intention of giving an order—and to what end?

Salesmen do not object to waiting their turn. They do not expect to be admitted immediately at all times to the busy head of the firm. They expect some men to promise them orders and not live up to them. They expect to be turned down, but not insulted. They want only honest and fair dealing and they are usually men who can be trusted.

In any competitive line of business the successful salesman is a man of ability and respectability. He is broad-minded and honest, and he likes to be treated accordingly, as he is intensely human and nearly always deeply emotional. Salesmen expect brusque, curt and often harsh treatment. However, they appreciate an honest statement and confidence whether favorable to an order or not. They would rather a man express honest doubt, however forcibly, than agree supinely and indifferently to everything. Too many buyers take the position that the salesman is asking for something. He is not—he is giving.

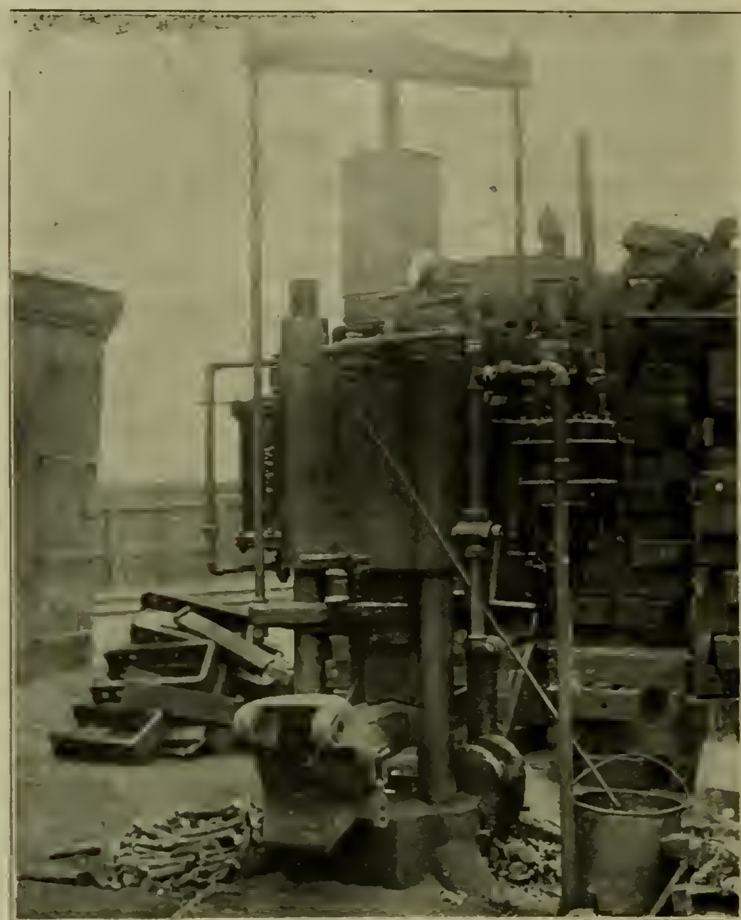


FIG. 1. COUPLER RIVET SHEAR. — L. S. & M. S. RY. VIEW SHOWS COUPLER IN PLACE WITH PLUNGER READY FOR DOWNWARD STROKE.

The good salesman gives value received. He desires above everthing to satisfy the buyer. His only hope of success lies along this road. His aim is to make his customers friends and his friends customers and he is a failure if he does not. It is not alone hope of success that he desires his patrons for friends. The pure love of his work makes it necessary and his friends and his business are his whole life. It is the thread of sentiment inwoven with the woof of business fabric that gives it stability, character and existence. Credit, without which business could not be carried on, on its present scale, is founded on this sentiment. It is most often the salesman who establishes credit by vouching for the character of his customer and friend, whether he has a rating or not.

Most firms appreciate the character and position of the salesmen, but some do not. These latter might change their office system, should they ask the advice of their own salesmen.

One of the largest manufacturing concerns in the country has not a private office in its six floor office building and the millionaire president sits at a desk in the same room with scores of his employes.

Hydraulic Shear for Coupler Rivets.

L. S. & M. S. Ry.

THE expense of cutting out rivets from coupler yokes by hand has been materially reduced on the Lake Shore and Michigan Southern Railway by the use of a hydraulic shear designed by Mr. R. D. Fildes, until recently assistant shop superintendent at Collinwood. There are several of the machines in use at different points on the road, and the general experience with them has been entirely satisfactory. The capacity of the machine is greater than that of a hammer, the rivet heads do not fly and it has other uses, such as a forging press for heavy car material.

By referring to the illustrations it will be seen that a heavy plunger is forced against the shank of the coupler, shearing off the rivets between the coupler and the yoke. Fig. 1 shows the coupler in position supported on blocks set under the yoke, with the plunger against the shank ready for the downward stroke.

In order to show the construction of the machine more clearly Fig. 2 and 3 are added which give sectional views of the various parts. At "A" in Fig. 3 an air cylinder is shown which receives air from a throttle through a self actuated reciprocating valve "B." This operates two hydraulic pumps "C" by means of a piston with extended rods which will give a pressure of 200 tons to the plunger with an air pressure of 100 pounds. The plunger cylinder "D" is filled with air from the reservoir "E" by means of a 3 way cock and the plunger forced down quickly by air pressure alone. The oil pumps are then started by another movement of the valve and the pressure increased sufficiently to shear the rivets. The plunger is returned quickly by admitting air pressure to cylinder "F."

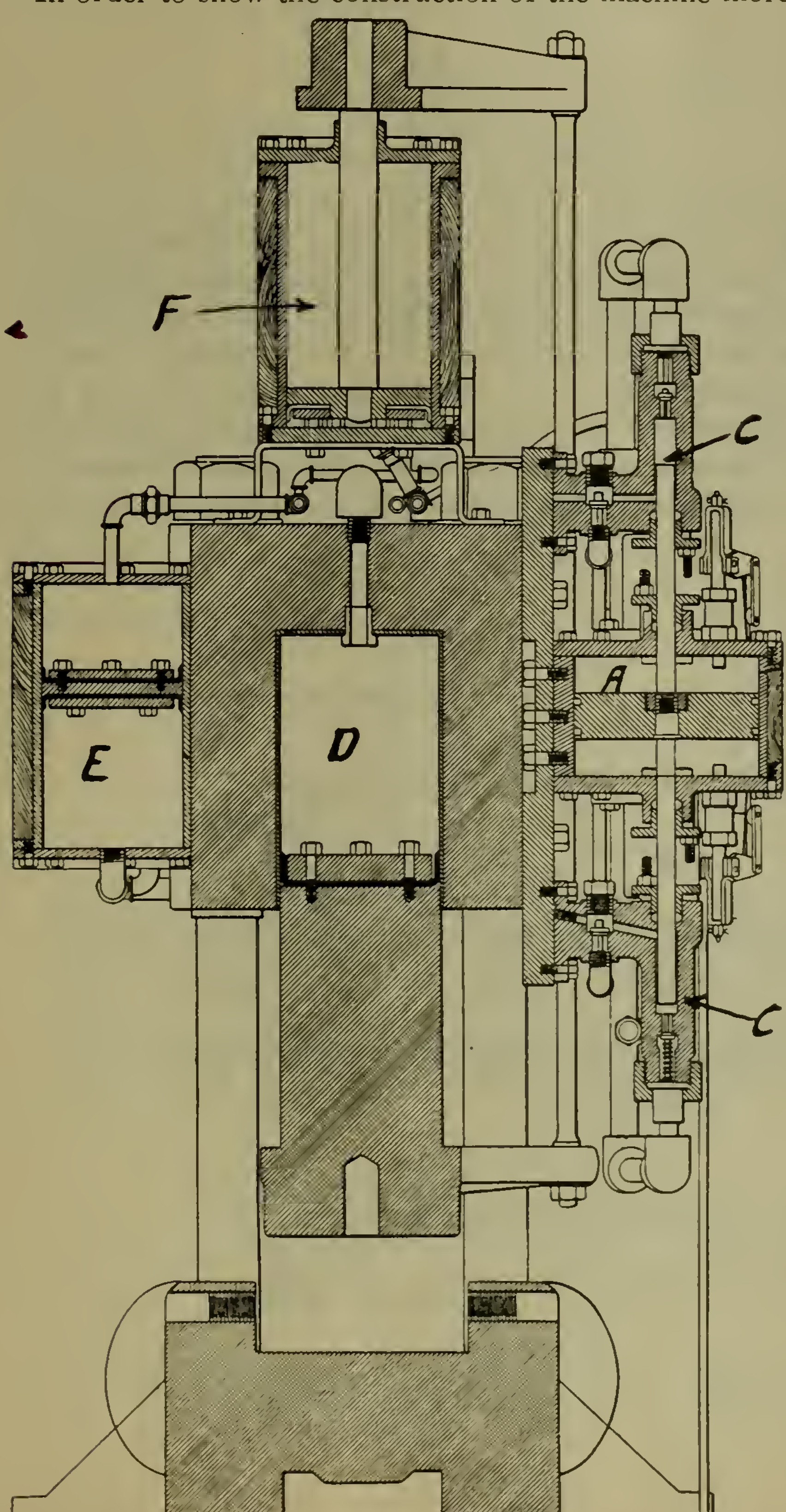


FIG. 2—SEC. OF HYDRAULIC SHEAR FOR COUPLER RIVETS—L.S.& M.S.RY.

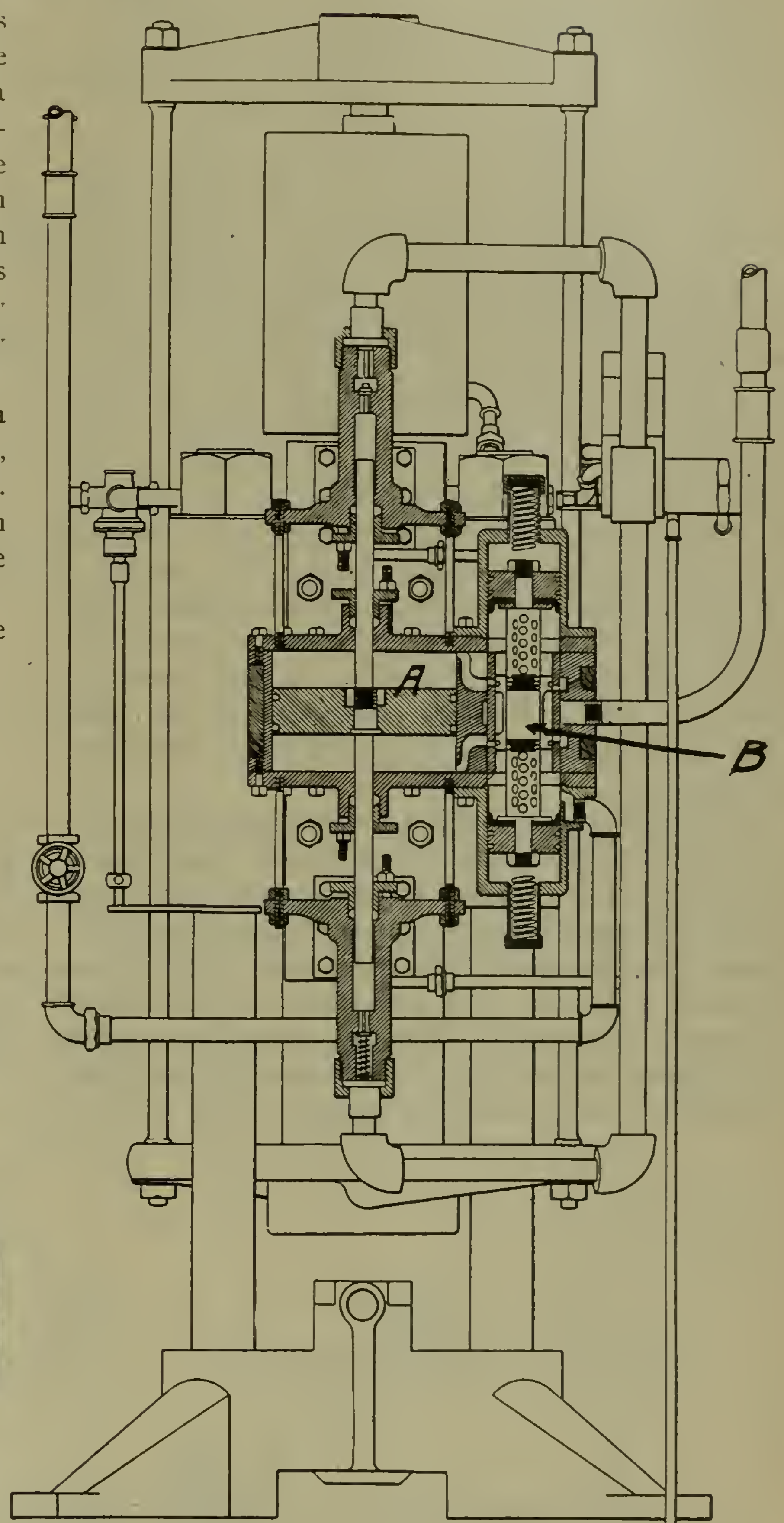
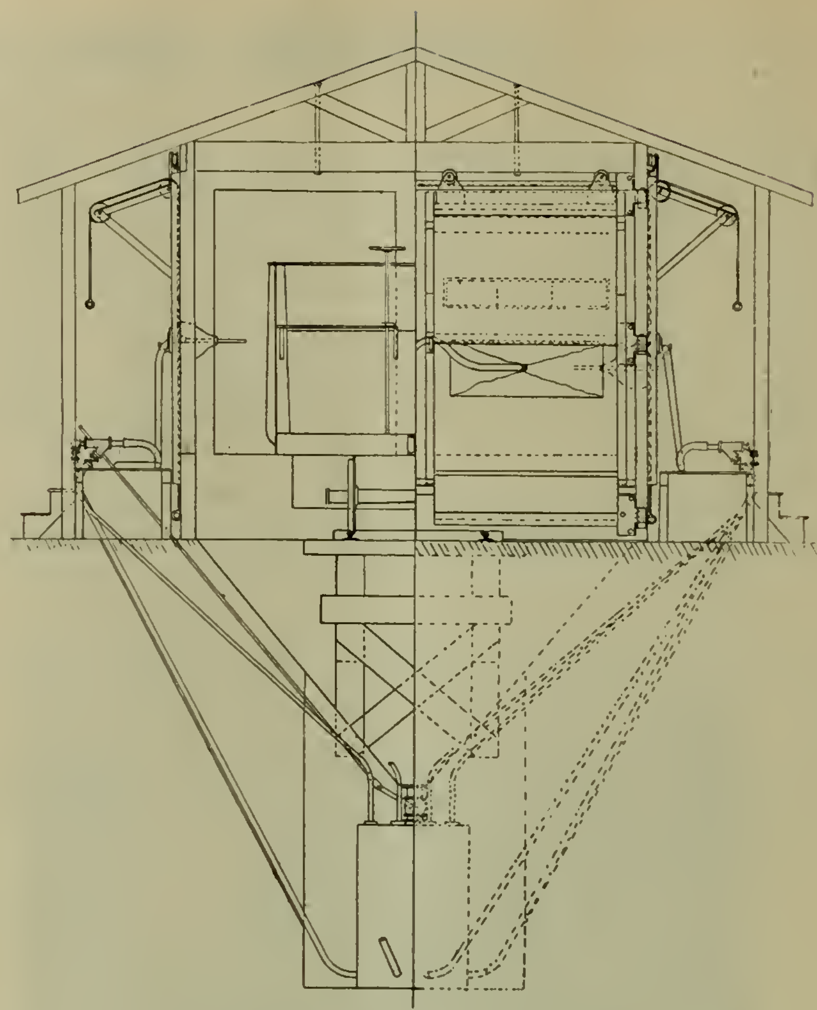


FIG. 3—SEC. OF HYDRAULIC SHEAR FOR COUPLER RIVETS.—L.S.& M.S.RY.

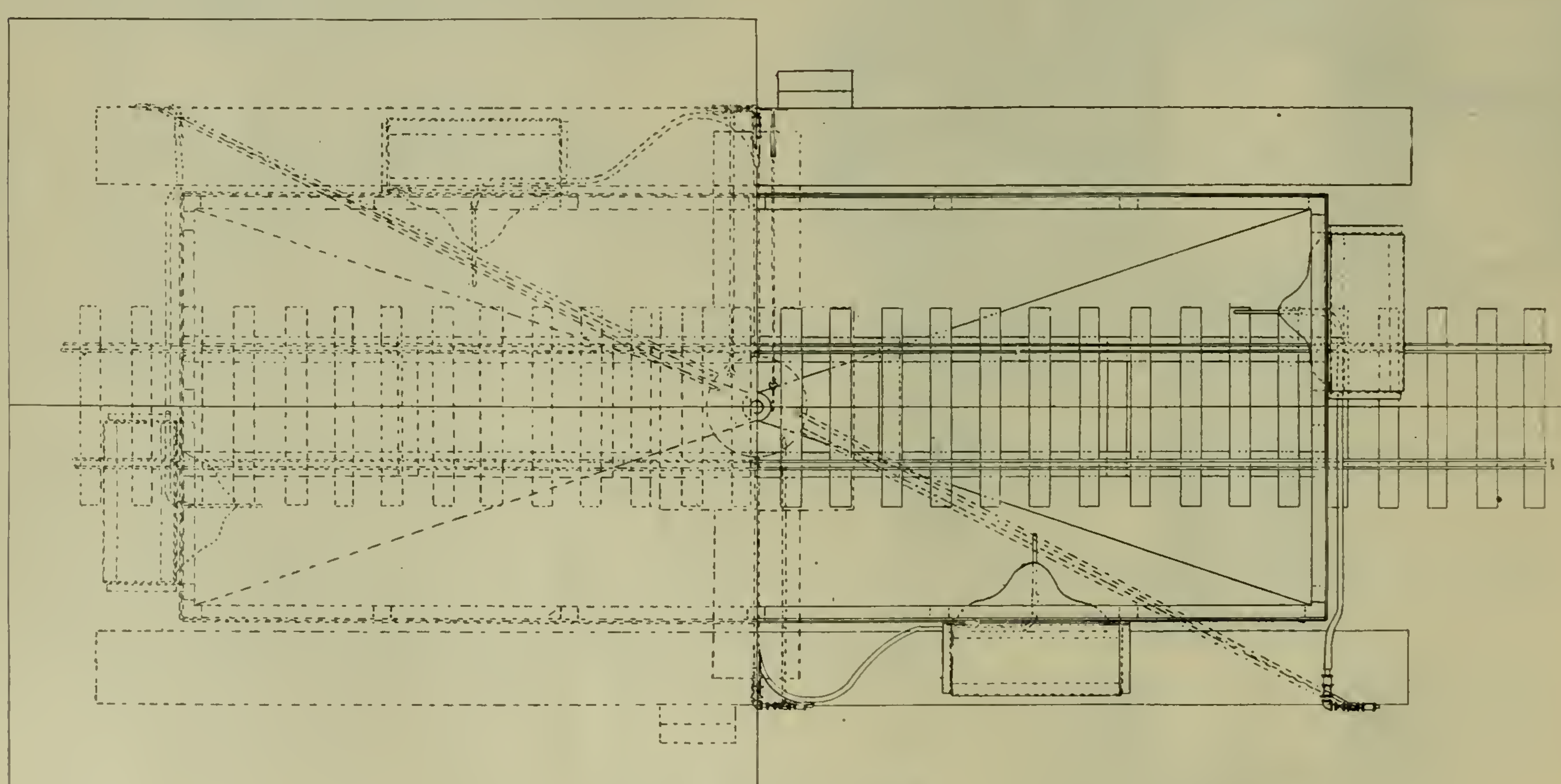
Sand Blast House.

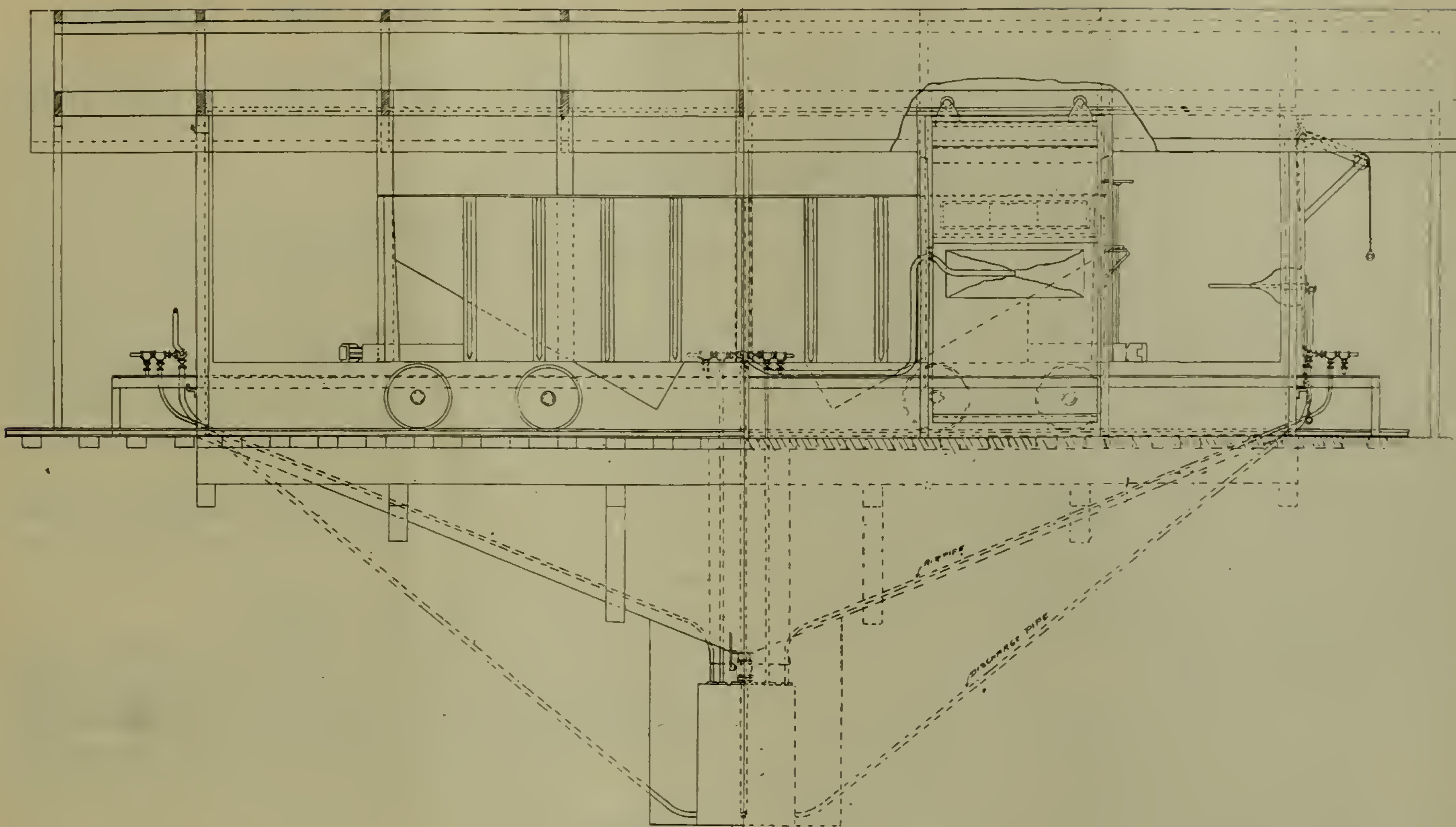
IN ORDER to provide a permanent location in which steel cars and locomotive tanks may be cleaned by the sand blast process and furnish an arrangement by which such work may be done under a roof, Mr. W. O. Quest, Master Painter of the P. & L. E. R. R. at McKees Rocks, Pa., has designed the sand blast house shown by the accompanying line drawings.

The most unique feature of this design is the adjustable protecting curtain providing for the comfort of the workman operating the sand blast and to obviate the necessity of his wearing the usual helmet, a bit of wearing gear uncomfortable at all times and especially in summer weather. This curtain is mounted on rollers as shown by the accompanying detail drawing and a narrow section is provided with removable glass slides through which the operator may look during the progress of his work. In order that the hose may be directed at any angle desired and to provide free movement in the direction of the nozzle, the hose is arranged to protrude through a loose canvas curtain which gives much leeway of the hose in the operator's hand. The curtain rollers are mounted on a traveling frame, by which the curtain may be transferred to any point along the sides or ends of the car as the work of cleaning progresses.


END ELEVATION,—SAND BLAST HOUSE.

The building is of wooden frame construction, surmounted by a wooden roof covered with paper and a car entering the structure is supported on a tracked trestle. Beneath the trestle is a mesh covered steel lined hopper which collects the discharged sand falling from the car sides and delivers it to a reservoir placed beneath the hopper. Sand falls by gravity through an opening in the bottom of the hopper, its movement being controlled by a valve located at this point and which is operated by a lever controlled by a rod extending from the operating platform. In this manner the same supply of sand can be used continuously until too great an amount of dirt and scale has been introduced. Sand is delivered from the reservoir and forced through the delivery hose by air pressure, control of the same being by valves in the pipe connections conveniently located on the platform. The pipe and hose connections, locations


PLAN.—SAND BLAST HOUSE.



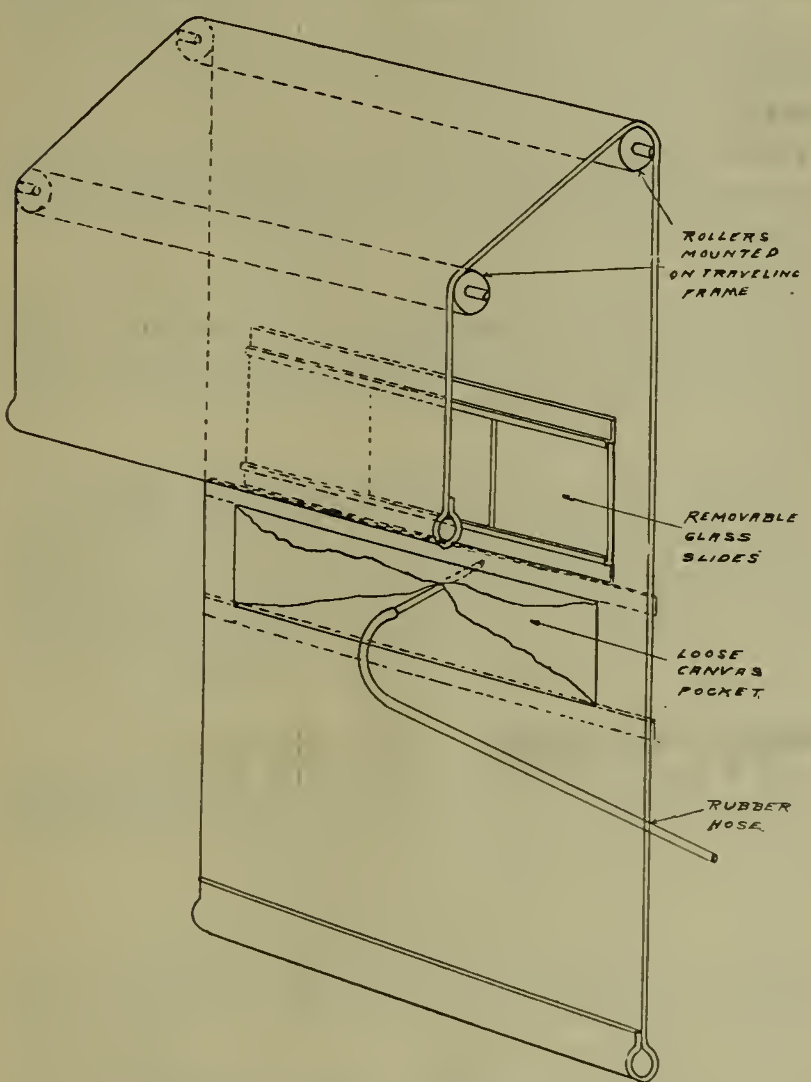
SIDE ELEVATION.—SAND BLAST HOUSE.

of valves, etc., are clearly shown by the accompanying general and detail drawings.

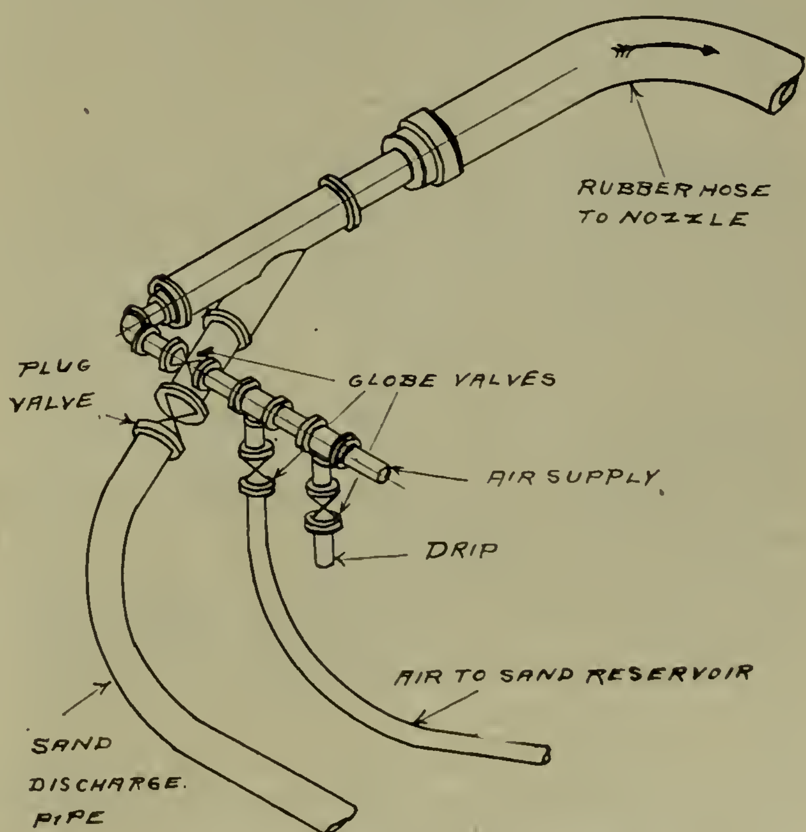
It will be noted that there are four separate sets of connections to the reservoir and that these are arranged at the most convenient points with regard to sides and ends in order that they will be readily accessible from the different working positions.

An elevated platform surrounding the car, and reached by a short flight of steps, provides a stand for the operator, from which all points of the outside of the car can be reached conveniently by the sand and air blast.

In presenting these drawings we acknowledge the courtesy of Mr. L. H. Turner, Superintendent of Motive Power, and Mr. W. O. Quest, Master Painter.



PROTECTING CURTAIN.--SAND BLAST HOUSE.



DISTRIBUTING VALVE —AND BLAST HOUSE.

Western Railway Club Library

THE library of the Western Railway Club has been developed into a very serviceable institution. Its present quarters and facilities provide a convenience of which the members of the club might avail themselves to advantage. The room containing the library is connected with the office of the secretary at 390 Old Colony Building Chicago, and has been fitted up in splendid shape with new book cases, tables, comfortable chairs, etc., and the various volumes have been so placed that they are easily accessible. On the reading tables are copies of the latest weekly and monthly engineering papers, magazines, club proceedings and such other literature as is ordinarily found in a library devoted to mechanical interests. On the shelves may be found bound volumes of practically all of the current engineering magazines, besides many valuable works on mechanical, civil and electrical engineering, aggregating a total of some two thousand volumes.

Two years ago the library was transferred to its present quarters and shortly thereafter a movement was started to properly fit up its quarters and the following firms and members contributed a fund to put it in proper shape:—W. M. Simpson, Fitz-Hugh, Luther Co., Niles-Bement-Pound Co., Harry Vissering, Railroad Gazette, American Brake Shoe & Fdy. Co., Railway Appliance Co., Ashton Valve Co., W. H. Miner Co., Chgo. Ry. Euipment Co., Adams & Westlake Co., J. L. Yale & Co., Camel Co., Railway Review, New York Air Brake Co., Chicago-Cleveland Car Roof Co., Ohio Injector Co., Standard Steel Works, Murphy Varnish Co., Railway Age, Geo. W. Cushing, Handy Car Equip. Co., Ingersoll-Sargent Drill Co., Pyle Nat'l Headlight Co., Buckeye Steel Castings Co., C. H. Ferry, Chicago Varnish Co., H. C. Buhoup, Aurora Metal Co., H. W. Johns-Manville Co., Westinghouse Air Brake Co., McCord & Co., Crosby Steam Gauge & Lantern Co., Geo. H. Bryant, E. E. R. Tratman, Nat'l Malleable Castings Co.

Specifications for Incandescent Lamps.

INCANDESCENT lamps are usually bought by railroad companies, simply with the idea of getting the lowest price; regardless of quality. Several roads are awakening to the fact that there is quality in lamps as well as cost and are accordingly issuing specifications with simple tests in order to buy as good a lamp for reasonable prices.

The following is a specification issued with the above points in view by one of these roads.

"The lamp desired under the following specifications and those that are made from the best materials and in accordance with the best modern methods of manufactures.

Lamps will not be ordered in less than barrel lots, except in cases of special lamps when lots of not less than one hundred (100) will be ordered.

Lamps shall conform to manufacturer's standard shape and size unless otherwise specified. Lamps are to be provided with —— —— bases.

Lamps furnished under this specification will be tested by this Company to determine whether lamps fulfill the requirements made.

Requirements:

All lamps shall conform to the following limits or initial candle power and total watts per lamp.

1st. Candle Power, when tested at marked voltage. No lamp shall vary more than nine per cent (9 per cent) above, or six per cent (6 per cent) below its rated candle power mean horizontal nor shall it give less than forty per cent (40 per cent) of its rated candle power measured at the tip of the lamp.

2nd. Economy. No lamp when tested at marked voltage shall vary more than six per cent (6 per cent) from its rated voltage.

Life and Candle Power Maintenance:

Tests for life and candle power maintenance will be made under perfectly uniform voltage and must not show a less average life or less hours maintenance of seventy four per cent (74 per cent) of the initial rated candle power.

Filament:

Filaments of all lamps must be uniformly placed in the middle of the bulb and not droop when burned horizontally during any portion of their life. All filaments must be uniform and free from imperfections, spots and discolorations.

Bulbs:

All bulbs must be uniform in size of moulded lead glass, or of glass equal thereto, clean and free from flaws or blemishes.

Bases:

The shells of bases must be of good quality of brass, firmly and accurately fitted to bulb, and be impervious to moisture. All bases to be —— standard.

Vacuum:

The vacuum of the lamp must be such that when tested on an induction coil giving ½-inch spark, there shall show no glow in the lamp.

Marked:

All lamps to be marked with the exact voltage and candle power, together with the name (of station) or (R. R. Co.), as selected by this company, to be etched upon the bulb close to its base, in order to determine its ownership. The size of lettering to be determined by the R. R. Co.

Rejection and Penalties:

The failure of ten per cent (10 per cent) of the lamps in any shipment to conform to the above requirements shall cause the rejection of the entire lot."

A means of protecting wooden piles from the ravages of the teredo, consists of an armor of cement, mortar or concrete, composed of magnesium oxide, in connection with an inert filler impregnated with magnesium chloride.

Superheated Steam Tests at Purdue.

The Carnegie Institution of Washington, D. C., has made a grant of $3,000 a year for a period of four years to Dean W. F. M. Goss of Purdue University, Lafayette, Ind., for the purpose of determining the value of superheated steam in locomotive service; first, in connection with single expansion engines; and second, in connection with compound engines. This is the second grant which the Institution has made to Dean Goss. While given to him personally, its effect will be to stimulate and to make more effective the work of the Purdue Locomotive Laboratory. Funds thus received will be employed in supplementing the resources of the laboratory as derived from all other sources.

Personal Mention.

Mr. George P. Goodrich has been appointed master mechanic of the Fort Smith & Western Rd. and the St. Louis, El Reno & Western Ry., with headquarters at Fort Smith, Ark., to succeed Mr. John Mailer, resigned. The appointment was effective Dec. 1, 1906.

Mr. Thomas J. Tonge has been appointed superintendent of motive power and rolling stock, bridges, buildings and water service of the Santa Fe Central Ry., with office at Estancia, N. Mex.

Mr. A. M. Carroll has been appointed assistant master mechanic of the Mohawk division of the New York Central & Hudson River Railroad, with office at West Albany, N. Y.

Mr. E. T. James has been appointed master mechanic of the New York, New Haven & Hartford Railroad, with office at New Haven, Conn. Mr. James recently resigned as shop superintendent of the Lehigh Valley Railroad at Sayre, Pa.

Mr. C. W. Seddon, formerly superintendent of shops of the Great Northern at Superior, Wis., has been appointed superintendent of motive power of the Duluth, Missabe & Northern Railway, with office at Proctor, Minn.

Mr. A. Stewart, who has been mechanical superintendent of the Southern Railway has been appointed general superintendent of motive power and equipment of that road, and the former title has been abolished. Mr. Stewart's headquarters are at Washington, D. C.

Mr. J. E. Cameron, master mechanic of the Atlanta, Birmingham & Atlantic, has been appointed superintendent of motive power of that road, with office at Fitzgerald, Ga.

Mr. R. F. Jaynes has been appointed master mechanic of the Lehigh & Hudson River, with office at Warwick, N. Y. Mr. Jaynes has heretofore had the title of general shop foreman.

Mr. James McDonough has been appointed general foreman of the El Paso & Southwestern System, with office at Carrizozo, N. M., to succeed Mr. H. H. Brinckley assigned to other duties.

Mr. J. M. Fulton has been appointed master mechanic of the Mexican Central at Chihuahua, Mex., to succeed Mr. R. H. Rutherford, who has been transferred to a similiar position at Torreon, Mex.

Mr. George Moll has been appointed master mechanic of the Reading and Harrisburg divisions of the Philadelphia & Reading. Mr. Moll has heretofore been road foreman of engines of the same road at Philadelphia, Pa.

Following the voluntary retirement of Mr. John T. Chamberlain as master car builder of the Boston & Maine, it is announced that Mr. Henry Bartlett will have charge of the rolling stock and mechanical departments with the title of superintendent of the mechanical department. Mr. C. H. Wiggin will have charge of the company's motive power, with the title of superintendent of motive power, and Mr. J. W. Marden will have charge of the car department, with the title of superintendent of car department. The offices of all of the above are in the Union Station, Boston, Mass.

Mr. A. H. Gairns, heretofore master mechanic of the Denver & Rio Grande at Grand Junction, Colo., has been transferred to a similar position at the Burnham shops, Denver, Colo.

The title of Mr. E. O. Shively, assistant division master mechanic of the Wabash at Decatur, Ill., has been changed to that of general foreman of locomotives, and the former position has been abolished.

Mr. D. D. Briggs has been appointed master mechanic of the Louisville & Nashville at Montgomery, Ala., to succeed Mr. C. Gifford, who has been transferred to Mobile, Ala., succeeding Mr. H. M. Minto, resigned.

Mr. L. W. Barger, heretofore chief draftsman of the Chicago, Burlington & Quincy Railway, Lines West at Lincoln, Neb., has been appointed mechanical engineer of the Davenport Locomotive Works, Davenport, Ia.

Mr. John H. Rankin has been appointed superintendent of materials and supplies of the Philadelphia & Reading, with office at Reading, Pa. Mr. Rankin has heretofore held the title of general storekeeper, which title has been abolished.

Mr. John McGie, master mechanic of the Chicago, Rock Island & Pacific at Shawnee, Okla., has been transferred to a similiar position at Little Rock, Ark., and Mr. C. M. Taylor has been appointed master mechanic at Shawnee, Okla., to succeed Mr. McGie. Mr. Taylor recently resigned as mechanical superintendent of the Santa Fe at La Junta, Colo.

Mr. Thos. B. Purves, Jr., has been appointed superintendent of motive power of the Denver & Rio Grande, with office at Denver, Colo., to succeed Mr. J. R. Groves, resigned. In May, 1904, Mr. Purves resigned as superintendent of motive power and rolling stock of the Boston & Albany, and was later connected with the Neponset Rubber Co.

Mr. Wesley Burke was recently appointed general foreman of the Baltimore & Ohio at Garrett, Ind.

Mr. F. W. Mahl has resigned as mechanical engineer of the Southern Pacific, and has been succeeded by Mr. H. Stillman, heretofore engineer of tests, with office at San Francisco, Cal.

Mr. W. G. Edmondson, heretofore engineer of tests of the Philadelphia & Reading, has been appointed mechanical engineer of that road, with office at Reading, Pa., to succeed Mr. F. F. Gaines, recently resigned.

Mr. W. J. Haynen has been appointed superintendent of shops of the Pere Marquette at Grand Rapids, Mich., to succeed Mr. M. C. Gregory, resigned. Mr. Haynen recently resigned as master mechanic of the Detroit, Toledo & Ironton.

Mr. John T. Chamberlain, who since 1890 has been master car builder of the Boston & Maine R. R., has voluntarily relinquished that position, and will retire from active railway work. After spending a few months in California, he will take a trip abroad with his family. Mr. Chamberlain has always been prominent in the affairs of the Master Car Builders' Association, having been president of that association in 1901-1902. His home address is No. 95 Otis St., Medford, Mass.

Mr. J. T. Carroll has been appointed assistant superintendent of shops at Collinwood on the Lake Shore and Michigan Southern Railway, succeeding Mr. R. D. Fildes, resigned. Mr. Carroll served his apprenticeship at the Brooks Locomotive Works—afterwards he went to the Erie R. R. as draftsman and later to the Rock Island and Northwestern railroads in the same capacity. From the Northwestern he went to the Nickle Plate as Mechanical Engineer, then to the Lake Shore as Chief Draftsman and Ass't General Foreman at the Collinwood shops, and was promoted from there to General Foreman of the shops at Elkhart.

Mr. J. W. Small has resigned as master mechanic of the Southern Pacific at Los Angeles, Cal., and has been appointed superintendent of motive power of the Arizona Eastern, the Arizona & Colorado, the Cananea, Yaqui River & Pacific, the Maricopa & Phoenix and Salt River Valley, and the Gila Valley, Globe & Northern railroads, with headquarters at Tucson, Ariz.

Mr. A. E. Mitchell, until recently superintendent of motive power of the Lehigh Valley, has been appointed assistant to the General Manager of the New York, New Haven & Hartford Railroad.

Mr. G. W. Wildin has been appointed assistant superintendent of motive power of the Lehigh Valley Railroad. Mr. Wildin was formerly mechanical superintendent of the Erie R. R.

Mr. Martin Bylander has been appointed acting shop demonstrator of the Union Pacific, with headquarters at Omaha, Neb., to succeed Mr. F. M. Titus, temporarily assigned to other duties.

Mr. J. T. Johnston has ben appointed assistant general boiler inspector of the Santa Fe, with headquarters at Albuquerque, N. M.

Mr. A. R. Manderson has been appointed master mechanic of the Portland & Rumford Falls and Rumford Falls & Rangeley Lakes railroads, with office at Rumford Falls, Me., to succeed Mr. M. R. Davis, who has been assigned to other duties.

Mr. G. W. Lillie has been appointed supervisor of the car department of the St. Louis & San Francisco, with office at St. Louis, Mo., to succeed Mr. C. D. Pettis, who recently resigned, to accept a position with the Hewitt Mfg. Co., Chicago, Ill.

Mr. F. R. Cooper has been appointed superintendent of motive power of the South Buffalo Railway, with headquarters at Buffalo, N. Y.

Mr. George M. Basford, heretofore in charge of the publicity department of the American Locomotive Company, has been appointed assistant to the president, with headquarters at 111 Broadway, New York City. Mr. Basford is favorably known throughout the railway field, due to his association with the American Engineer and Railroad Journal, as well as with the American Locomotive Company, and his many friends will be gratified at his promotion.

Mr. A. R. Ayers has been appointed superintendent of shops in the locomotive department of the Lake Shore & Michigan Southern Railway, at Elkhart, Ind. Mr. Ayers was graduated from Cornell University in 1900 and has been with the road since, beginning as a special apprentice. From 1903 to 1905 he was special inspector and was later night foreman at the Elkhart engine house. Until his recent promotion he has been assistant general foreman in the locomotive department of the Collinwood shops.

Mr. G. C. Gardner, assistant master mechanic of the Pennsylvania railroad's Trenton shops, has been appointed mechanical superintendent of the Belvidere division in charge of all the roundhouses. The appointment has been in effect since Dec. 1, 1906.

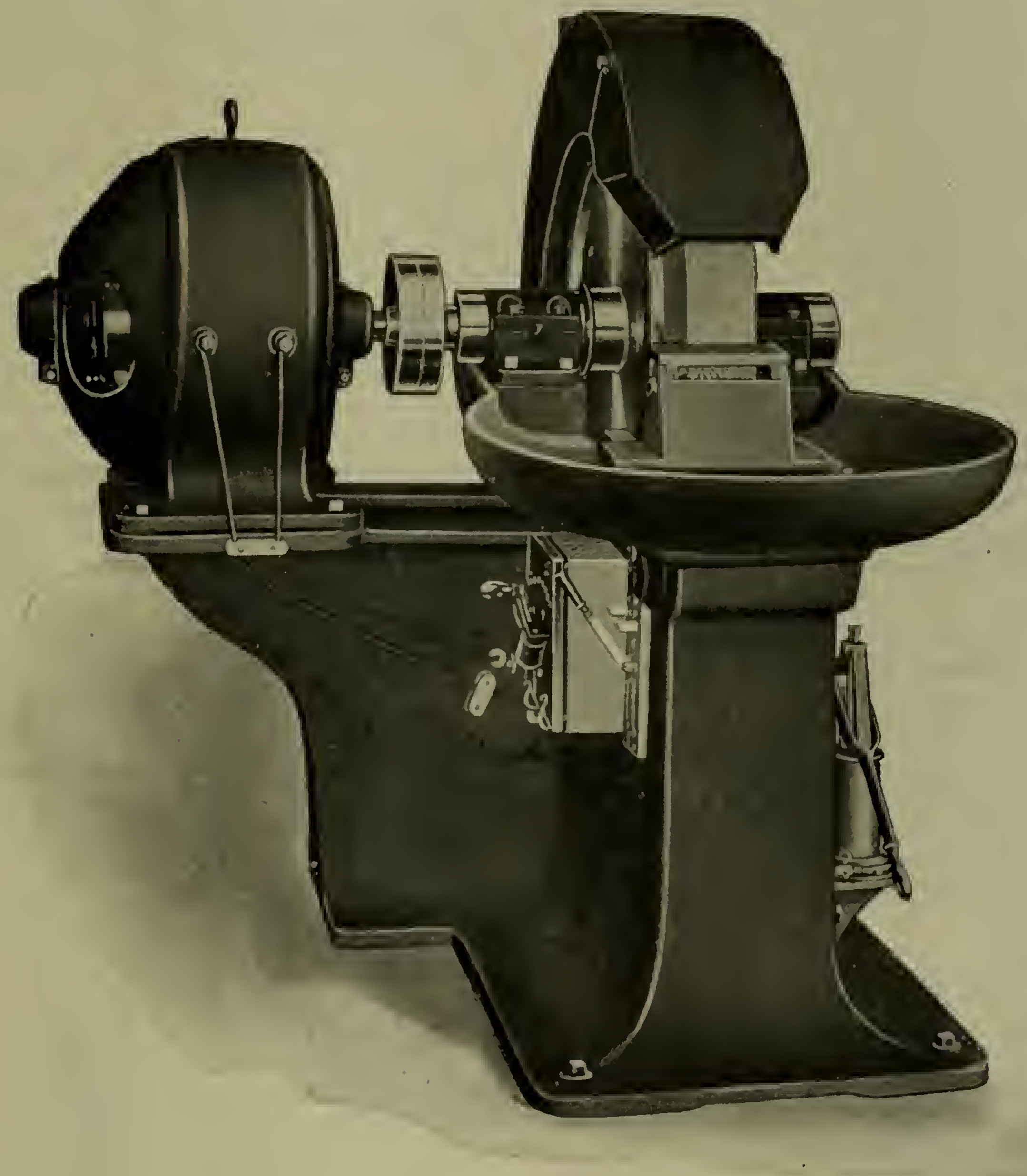
Motor Driven Tool Grinders.

As the belt driven tool grinder replaced the grindstone, so the modern motor driven tool grinder is replacing the belt drive as it can be placed anywhere that is convenient and does away with all shafting and belts, making a much more economical tool in the end to run than the ordinary belt drive. Machine shop practice has proven that it is more economical to have a number of these machines placed at intervals throughout the shop than to have one machine to which the workmen must walk a long distance to grind their tools, and then possibly have to wait until another man gets through with the machine. An advantage of these tools over the belt driven is that they can be placed in any position in the shop, in the most useful and convenient location. In the past in many shops it has been the practice for the workman when wishing to grind a tool to go to a machine, shift the belt onto the tight pulley, wait for the wheel to attain its speed, do his grinding and then stop the machine. These machines are built with the idea that they will be started up when the power starts in the morning and left running throughout the day if desired, avoiding all the time lost in starting and stopping each time it is desired to use the grinder and this lost time will more than pay for the little power used in running the machine idle.

The accompanying illustration shows an improved method of driving tool grinders by motors. It represents a Number 5 tool grinder, manufactured by the Bridgeport Safety Emery Wheel Company, driven by a 7½ H. P. motor mounted upon a substantial bracket which is cast on one side of the main column, and the armature shaft is connected by a flange coupling directly to the end of the emery wheel spindle. Wheels on machines of this class run at somewhat lower speed than those for ordinary dry grinding and this is arranged for by having a specially wound armature to suit the speed requirements of the wheels. This method of attaching the motor applies only to the direct current motors and for this type of motor it is the best equipment and is preferred to any other method of running this type of machine by motor, as it not only makes an equipment that runs noiselessly, but it does away with all chains or belts.

For using alternating current the same machine is driven by a 5 H. P. motor mounted upon a bracket in the same manner. The motor which may be of practically any make desired is back-geared to the emery wheel spindle at a ratio of about three to one. The gears are encased to keep out all dust and dirt. This makes another method of driving these tools by motor and it is a method recommended by the makers when alternating current motors are used, but the direct current motors can be also back geared in this manner if desired. In back gearing motors to the emery wheel shaft, a size smaller motor frame can be used as the motors run at normal speed, but when direct connected the armature has to be wound for the speed of the wheel so that one size larger motor frame has to be used in order to get the necessary power for driving the machine. This difference between the motors, however, is practically offset by the extra cost of the gearing. The machine has self-oiling bearings 8 in. long, wheel 36x4 in. The floor space occupiedby by the entire equipment is 30x47 in., and the weight of the machine, including motor, is about 2,600 lbs.

Water is supplied to the wheel by means of an air pump placed on the side of the machine, by which air is forced on top of the water in the lower tank which is an air tight compartment, and up through a pipe into the upper tank under the wheel, and as little or much water can be obtained as desired. Aside from this being a quick method of getting water to the wheel, there are no centrifugal pumps, floats or other parts coming in contact with the water to rust out. These machines are made in four sizes carrying wheels 20 ins., 26 ins., 36 ins. and 42 ins. in diameter.



TOOL GRINDER.—BRIDGEPORT SAFETY EMERY WHEEL CO., BRIDGEPORT, CONN. DRIVEN BY 7½ H. P. DIRECT CURRENT MOTOR.

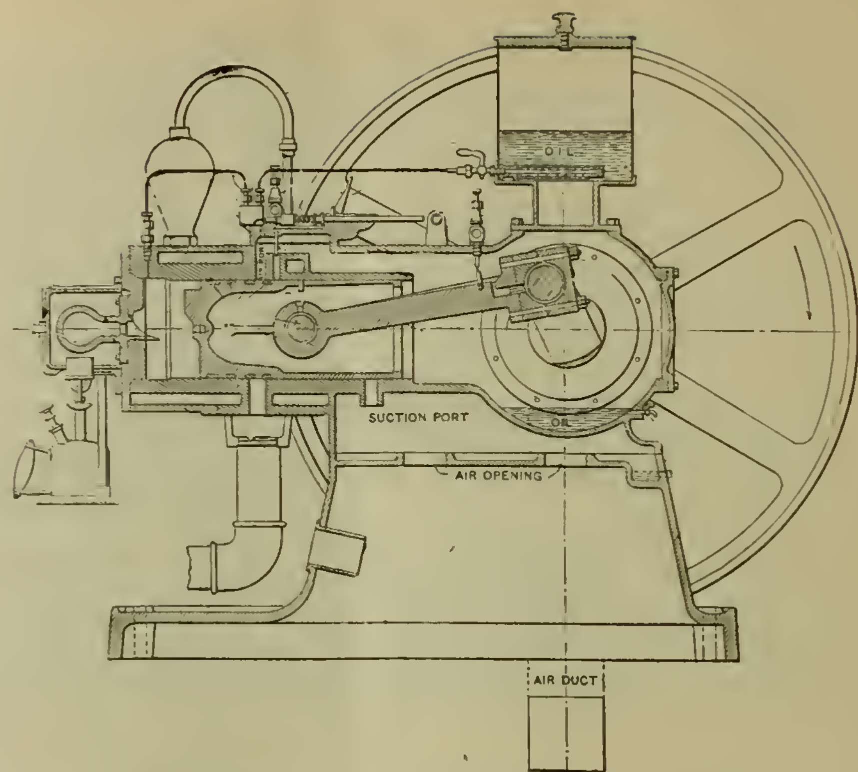
The Mietz & Weiss Oil Engine.

Among the many varieties of internal combustion engines now upon the market those using kerosene oil, fuel oil, crude oil, etc., are attracting a great deal of attention. It is quite natural that this should be the case, for users of small size engines are constantly looking for types consuming a fuel that is cheap, easily procurable and at the same time having a high economy. Mietz & Weiss, of 128 Mott St., New York City, have placed such an article on the market in their "Oil Engine," which is one that uses any of the above mentioned fuels.

This engine is an extremely simple one, and there are several special features which differentiate it from any other of its kind on the market. One of these relates to the use of the steam from the cooling water in the cylinder jacket to mix with the fuel, thus automatically keeping the temperature in the cylinder equalized at all times. The steam also acts as a lubricant and cleaner for the cylinder and piston.

The governor is of the centrifugal type and operates by changing the stroke of the pump which injects the oil into the combustion chamber. The crank shaft is completely enclosed, rendering the moving parts dust-proof. The foundations are very heavy and usually are completely enclosed to prevent the noise of the suction. The smaller sizes are provided only with ignition tubes, but the larger sizes are equipped with both electric and tube ignition. The consumption of water is reduced to a minimum, therefore allowing the installation of very small storage tank or service pipe. The lubrication is positive, as the oil is forced by pressure to parts needing lubrication. and oil rings are used on main bearings. The sizes in use run from 1.5 to 70 H. P. in the regular stationary type and in the marine type from 1.5 to 60 H. P.

Electric lighting is the most exacting service for which an engine can be used. The regulation of this type of engine has been proved so close that practically a constant voltage is given within the range of no load to full load. Another feature which commends it to the public is the fact that it is also adapted for use of alcohol. There will undoubtedly be a demand for engines using this fuel in the near future, since the act of Congress in placing denatured alcohol on the free list will cause a marked decrease in its cost. Results of tests made in Germany, France and other countries where alcohol has been used for fuel, compare very favorably with gasoline, kerosene, fuel oil, etc. Several railways in Cuba have already adopted the alcohol engine for use in pumping stations and in the shops for air compressors and auxiliary machinery. There is undoubtedly a wide field for its use in the United States.



LONGITUDINAL SECTION—MIETZ & WEISS OIL ENGINE.

New Riveter Installation.

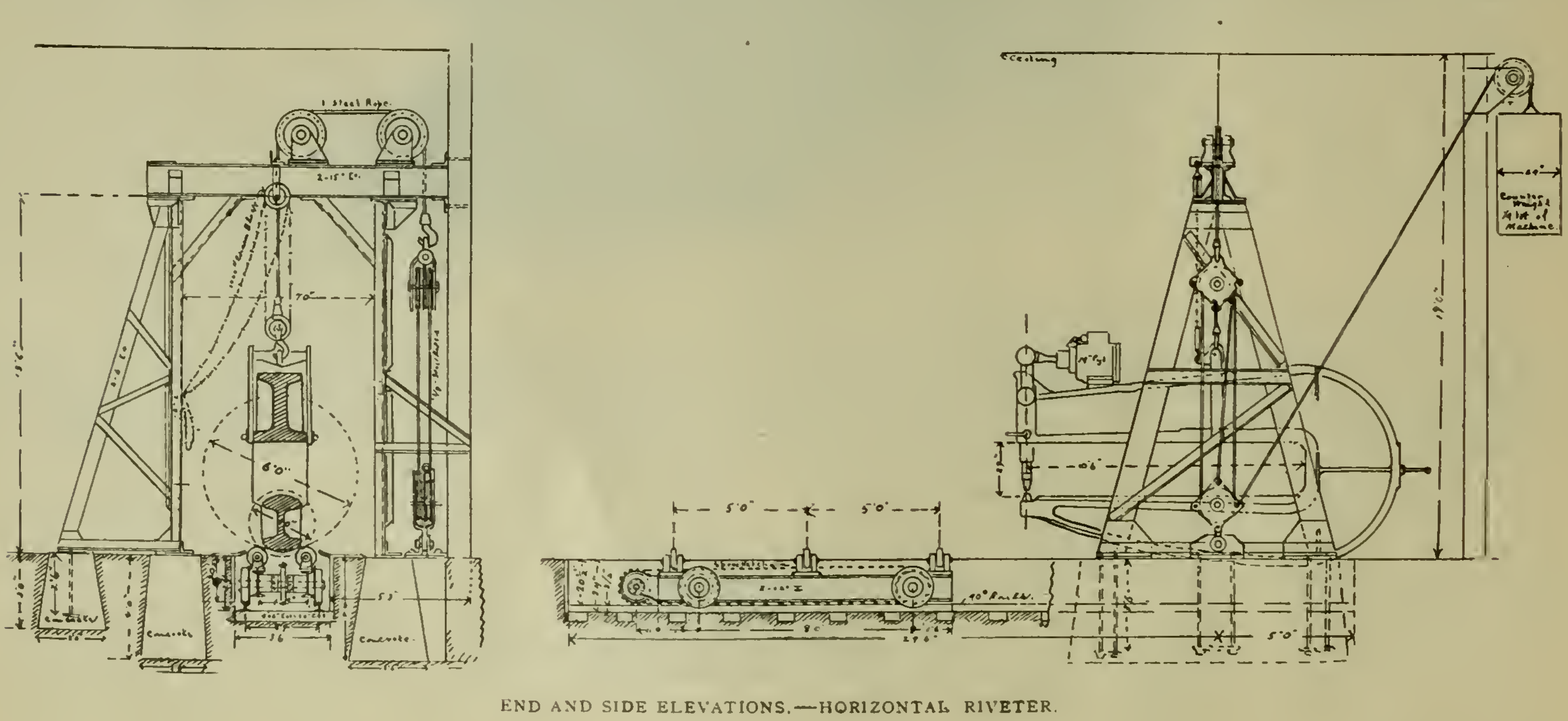
The necessity of a large riveting machine is felt in every shop where boiler and structural work is handled. The vertical riveter is a satisfactory installation for all classes of work but is expensive on account of the special building and accessories that are required.

With the idea of furnishing a riveter with the capacity of the vertical type and without the excessive cost, the Albree Iron Works Company, Allegheny, Pa., have recently employed a new method of installation with considerable success.

A compression riveter with 10 ft. 6 in. reach is suspended from a wooden trestle 13 ft. 6 in. high by a 1 inch steel rope over two sheaves to a block and falls balanced by a counter weight. A heavy chain and block are within easy reach of the operator for shifting the position of the riveter.

Beneath the riveter, a pit is located 24 inches deep and 29 feet 6 inches long, in which is laid a track of 2 feet 9 inches gauge. On this track is placed a steel car with a sprocket wheel and chain for moving the car when carrying heavy loads. Three rollers are placed on each side of the car to support cylindrical boiler shells.

The method described will cost about one-fourth that of a



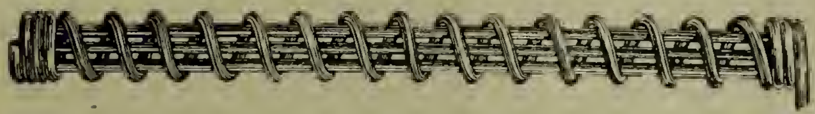
END AND SIDE ELEVATIONS.—HORIZONTAL RIVETER.

complete hydraulic installation and about one-half of a vertical compression riveter for doing the same class of work. There is also a considerable saving by using compressed air instead of hydraulic power, and while there still exists a preference for the hydraulic riveter it has been found that the work is not superior to that of the machine operated by air.

Anti Waste Grabber.

A large percentage of hot boxes is due to the fact that waste is carried around by the rolling of the journal and is wedged up between lug of brass and journal, wiping the latter and therefore depriving it of lubricating oil and causing it to heat. An examination of a lot of bearings which have started to heat will show that the trouble began from "waste grab" somewhere between the lugs in center of bearing.

The Anti-Waste Grabber has been designed to keep the waste in the journal box in place and prevent it from being carried up between the brass and the journal. It is made of copper wire,



ANTI WASTE GRABBER.

in the form of a coil and stiffened by three wires soldered on the inside to each turn of the coil. At the end of the grabber the wire projects from one-fourth inch to one-half inch and holds firmly in the waste, preventing the grabber being lost in case a journal box should be open.

The use of this simple device insures care being taken in packing journal boxes as they cannot be jammed full of waste. The weight of the grabber tends to hold the waste down and it cannot be raised above the lugs of the box and brass, in which position it is impossible for waste to get beyond the grabber.

It is claimed that the use of the grabber will reduce the number of hot boxes and there will be a saving in waste, oil and bearings, and the number of delays to fast trains reduced. The grabber is made by the V. O. Lawrence Company, Philadelphia and New York.

Technical Publications.

"Mechanics of Materials." By Mansfield Merriman. The tenth edition of this work has been brought out to keep it abreast with modern progress. A clearer and more logical presentation of the subject is also made in order to advance the interests of sound engineering education and to promote sound engineering practice. Most of the topics of the last edition have been treated in a fuller manner than before. The subject of impact on bars and beams, resilience and work, and apparent and true stresses have been changed with the intention of rendering the presentation more clear and accurate. Among many new topics introduced are those of economic sections for beams, constrained beams with supports on different levels, the torsion of rectangular bars, compound columns and beams reinforced—concrete beams, plates under concentrated loads, etc.

Price $5. Published by John Wiley & Sons, New York.

"Switch Boards." By Wm. Baxter, Jr. This book deals with switch boards of both alternating and direct currents for lighting, power and railway service, containing also a section devoted to a very complete review and exposition of modern switches and circuit-breakers.

The half tone illustrations of the various types of switch boards with their accompanying explanatory diagrams are numerous and very well executed.

Switch Boards as the treatise is named covers the field very thoroughly and is of undoubted value to engineers and others who may have to do with this kind of work.

Price $1.50. Published by the Derry-Collard Company, New York City.

"Locomotive Performance." By W. F. M. Goss. This book is a compilation of the researches conducted by the Engineering Laboratory of Purdue University. A history and description of the Purdue testing laboratory and experimental locomotives, with the results obtained by various appliances, are given in the opening chapters with many interesting items that developed as the work progressed.

Tests have been made on practically all of the variable quantities of locomotives and are grouped under one of three heads as they apply to the boiler, the engines or locomotive performance. The tests are very complete and represent years of investigation and research. The scope of the book can be shown by giving some of the chapter headings.

Under the boiler will be noticed chapters on boiler performance, high rates of combustion and boiler efficiency, spark losses, radiation losses, front end, superheating in smoke box, effect of thick firing on boiler performance. Under the engines are shown results of tests on effects of lead, lap and inside clearance on locomotive performance, valve gears, action of the counterbalance machine friction. Under Boiler Performance are noted chapters on effect of throttling, effect of high steam pressures on locomotive performance, concerning diameter of driving wheels, atmospheric resistance to the motion of railway trains and the final chapter gives a generalization concerning locomotive performance.

Price $5. Published by John Wiley & Sons, New York.

"The Walschaert Locomotive Valve Gear." By W. W. Wood. In view of the general adoption of the Walschaert valve gear by American railroads the arrival of this book is timely and will add information on a subject of which little is generally known. The purpose of the book is to give a clear understanding of the Walschaert gear to one familiar with the ordinary forms of link motion. The author has not treated the subject mathematically but has taken up the analysis of this gear in a way that is easily understood. The book has been divided into four divisions, each dealing with different phases of the gear in question. In the first division is an analysis of the Walschaert gear which gives a clear exposition of its action and construction. The second division enters into the theoretical discussion of the gear with rules for setting valves, etc. Two diagrams are given, with separate cardboard models of valves, that will give the position of the valve, links, etc., at nine different positions of the crank pin. The fourth division gives the advantages of the Walschaert gear in service on the road with many interesting illustrations. The fourth division is composed entirely of "Questions and Answers on the Walschaert Valve Gear," which forms a complete set of instructions in regard to breakdowns, etc.

Price $1.50. Published by Norman W. Henley Pub. Company, New York.

"Self-Propelled Vehicles." By James E. Homans. This is a practical treatise on all forms of automobiles for the requirements of the motor car owner, operator and repairer. It is the second edition of this work, and in the revision the author has emphasized the practical aspects of motor vehicles of all powers and confined his discussion of matters fundamental in construction and management. Theoretical treatment of the subject is only introduced where necessary and the book is not filled with obsolete material in regard to construction and design. The accessory parts of an automobile are fully described and illustrated in a way readily understood by the average reader.

Published by Theo. Audel & Company, New York.

"Boiler Waters." By William W. Christie, M. Am. Soc. M. E. The object of this book is to furnish steam users with information regarding water, its use and troubles arising from the use of water and remedies that may be applied; the gain being more efficient generation of steam. The properties of water and materials found in water with analyses of various waters are taken up in the opening chapter. Boiler scale is treated very comprehensively with a number of illustrations and tables showing the effect of scale on the transmission of heat. The corrosion of boiler plates from various causes, with special attention given to chemical action of various feed waters, is taken up fully. Priming and foaming, hardness of water, and water softening are subjects treated. The book should be invaluable to those having boilers to care for.

Price $3. Published by D. Van Nostrand Company, New York.

"Proceedings of the Fortieth Annual Convention of the Master Car Builders' Association." Held at Atlantic City, N. J., June 1906. Published by the Association, J. W. Taylor, Secretary, Old Colony Bldg., Chicago, Ill. This volume of the Proceedings has not changed in form and appearance from those of previous years. It contains all of the committee reports, among which may be mentioned those on cast iron wheels, brake shoe tests, triple valves tests, supervision of standards and tests of M. C. B. couplers.

Notes of The Month.

The Wilmarth & Morman Co., Grand Rapids, Mich., announces that on January 1, 1907, Mr. E. T. Gorham, for over seven years superintendent of the shops of the Oliver Machinery Co., associated himself with the Wilmarth & Morman Co., as a substantial stockholder and director, and with the position of shop manager. Mr. C. H. Rhodes, formerly connected with the McDowell, Stocker & Co., of Chicago, has been appointed sales manager of the Wilmarth & Morman Co. The company reports that the year 1906 was a very satisfactory one in the sale of the new Yankee drill grinders and Nelson loose pulleys.

Messrs. S. F. Bowser & Co., Inc., Fort Wayne, Ind., announces that owing to the large increase in business during the year 1906, about 75 per cent greater than that of 1905 and three times that of 1904, the company has found it necessary to open a branch office at 299 Broadway, New York City. This office is in charge of Mr. W. T. Hatmaker, formerly manager of the mail order department of the company's Boston, Mass., branch. The opening of this office is only one of the many additions which have been made in the past year. The company's factory in Fort Wayne has been increased in size 125 per cent, and the Fort Wayne office has been quadrupled. In addition, it has built and just moved into a $25,000 factory at Toronto, Canada, and has added over sixty salesmen to the selling force.

Mr. George A. Post, Jr., M. E., Cornell '05, has resigned his position as a sales engineer with the Westinghouse Machine Company and accepted service as engineer representative with the Standard Coupler Company, 160 Broadway, New York City.

The Falls Hollow Staybolt Co., Cuyahoga Falls, O., reports that its business for the year 1906 was the banner year in the history of its business, and fully 50 per cent better than any previous year.

The Nathan Mfg. Co., 92-94 Liberty St., New York, announces that Mr. Charles R. Kearns, after an enforced absence of six years, due to illness, has again resumed his duties with the company.

For many years past the Baldwin Locomotive Works, Philadelphia, Pa., has done all its riveting with hydraulic riveters exclusively. Influenced by the results attained by the Allen riveters elsewhere, the company voluntarily decided to try one of the Allen compression lever riveters, which, after a thorough trial in its own works, is found to be a complete success.

The Foote-Burte Co., Cleveland, O., manufacturer of drilling machinery for boiler and locomotive shops, has arranged with The Marshall & Huschart Machinery Co., of Chicago, to represent them in that territory, and with the Prentiss Tool & Supply Co., of New York, to represent them in the New York and Boston territory. The Foote-Burte Co., which also handles the Reliance bolt cutters, reports that business is increasing rapidly, and that the prospects for 1907 are very flattering.

The Piqua Blower Company, of Piqua, Ohio, is being incorporated under the laws of Ohio with a capital of $50,000. This corporation will take over the interest of the Piqua Foundry & Machine Co., Piqua, Ohio, and will make a specialty in the manufacture of the positive blower and gas exhauster as developed by the latter company in the past two years. As the machinery of the latter firm has met with unbounded success it is necessary to effect this reorganization in order to take care of the large volume of business offered.

Mr. Howard M. Post recently accepted the position of advertising manager with the Quincy, Manchester, Sargent Company, manufacturers of railroad appliances, who have offices in Chicago and New York with factories at Chicago Heights, Ill., Milwaukee, Wis., and Plainfield, N. J., this company being the successor to the Railway Appliances Company, The Q. & C. Company and the Pedrick and Ayer Company. The Quincy, Manchester & Sargent Co. is also the sole agent for the Milwaukee Elastic Nut and Bolt Company. Mr. Post has for some time been advertising manager for the Kellogg Switchboard & Supply Co. of Chicago.

At the recent election of officers the Board of Directors of the Locomotive Appliance Company elected Ira C. Hubbell, President; J. B. Allfree, Consulting Engineer; Clarence E. Howard, R. J. McBride, F. W. Perry, Vice Presidents, and W. H. England, Secretary and Treasurer. H. H. Newsom, a graduate of Purdue and who served a special apprenticeship with the Chicago & Northwestern and who was for sometime connected with the Victor Stoker Co., has been appointed Sales Agent for the Locomotive Appliance Co., with headquarters at 490 Old Colony Building, Chicago. Mr. Newsom's appointment dates from January 1, 1907.

Colonel John T. Dickinson, who for several years past has been connected with the Consolidated Railway Electric Lighting & Equipment Company, has tendered his resignation and accepted the position of vice-president of the Bliss Electric Car Lighting Company of Milwaukee, Wis. Col. Dickinson's headquarters will be in New York at the new office of the Bliss Electric Car Lighting Co., in the Night & Day Bank Building, Fifth Ave. and 44th Street, New York. The Chicago office of the Bliss Electric Car Lighting Company will be in the Monadnock Building, and Mr. W. N. Lalor, who was formerly also with the Consolidated Electric Lighting & Equipment Company, will be in charge of the Chicago office as Assistant General Sales Manager. The extensive additions to the large plant of the Bliss Electric Car Lighting Company will be completed February 1, which will afford ample facilities for the manufacture and prompt delivery of electric car lighting and train lighting equipment batteries and supplies, to meet the large demand for the same during the current year.

The fifth of the series of pamphlets which is being issued by the American Locomotive Company has recently been published. This pamphlet is devoted to 10-wheel type locomotives weighing less than 150,000 pounds, and will be followed shortly by another presenting the heavier designs of this type. The pamphlet illustrates and describes twenty-one different designs of ten-wheel locomotives, ranging in weight from 64,000 to 150,000 pounds and adapted to a variety of road and service conditions.

This series now includes pamphlets on the Atlantic, Pacific, Consolidation and ten-wheel types and copies of these may be had upon request.

Jenkins Bros., New York, are distributing their 1907 catalogue, which shows an unusual variety of valves and packing for use with high steam pressures.

Railroad Paint Shop

Edited by
J. H. PITARD
M. C. Painter, M. & O. R. R.

Devoted to the Interests of
Master Car and
Locomotive Painters

Official Organ of the Master Car and Locomotive Painters' Association

We have received a copy of the bound volume, containing the official proceedings of the Master Car and Locomotive Painters' Convention held in Washington, D. C., in September last, and can only speak in the highest terms of praise concerning its excellence. The cuts of the newly elected officials are excellent reproductions and true to life. In its corrected form, and general absence of errors, it bespeaks the arduous and painstaking efforts of secretary-treasurer, Mr. A. P. Dane.

The careful and tasteful arrangement of the contents, printed in large clear type, on a good quality of paper and encased in handsome substantial binding, it reflects much credit on the firm of W. E. & J. F. Twombly, Reading Mass., by whom it was printed.

All things considered it is undoubtedly superior in many, or we might say in all respects, to any of the previous issues of the official proceedings, and Mr. Dane may well feel proud of his production.

The secretary-treasurer, Mr. A. P. Dane, advises that he has forwarded to each member in the package containing the bound volume of the procedings of the association, a blank form intended to be filled out in person by the various members and promptly forwarded to the secretary. This is desired in order to have an absolutely correct mailing list for the secretary's own information, and also to be furnished the Railway Master Mechanic for guidance in making up the mailing list of the official organ. Thus far, there have been but few responses to this request, and it is the secretary's desire that the matter be attended to at once in order to avoid future complaints from the members who may fail to receive regularly their copy of the Railway Master Mechanic.

Manufacture of Vermillion.

Vermilion can be made both by dry and wet methods; the former are those mostly used; the latter are employed in some places, but not to the extent of the dry methods. The product is not quite equal, although very little inferior to that made by the dry methods. The Chinese have long been renowned as makers of vermilion; although their product is not any finer or more brilliant in tone than that made in Europe. Until lately the process by which Chinese vermilion was made was not known with certainty, although it was conjectured that the wet method was used, and consequently this method is usually described in text-books as "the Chinese method"; but this is now known to be erroneous, and that Chinese vermilion is made by a process very little different from that used in Europe. The difference in quality almost entirely arises from the greater care the Chinaman takes in making it.

Dry Methods.—First, Dutch Process.—This is the method commonly used for making vermilion. It is conducted in two stages. In the first stage 108 pounds mercury are mixed with 15 pounds of sulphur in a shallow iron pot; this is usually placed over a furnace, so that a gentle heat may be applied; the two bodies gradually combine together to form a black sulphide of mercury or "ethiops," as it is called, the union being promoted by a continual stirring with an iron spatula. When the combination is considered by the workmen to be complete, the iron pot is emptied of its contents into a store pot and a fresh mixing is made.

The "ethiops" contains some free mercury, free sulphur, as well as sulphide; the proportions will vary according to the length of time the operation has been continued, the heat applied, etc.

The second stage consists in heating black ethiops in a suitable furnace whereby it is converted into the red vermilion. A number of simple furnaces or fireplaces are built side by side to form a range; in each of these fireplaces is placed a cylindrical earthenware pot, so arranged that the lower two-thirds of the pot are in, while the upper third is outside the furnace.

The pots are fitted with a closely fitting iron lid, in the center of which is a small charging hole. The fire in the fireplace is lighted and, when the pot has been heated to a red heat, a small quantity of the black ethiops obtained in the first stage is charged into the pot; much of the sulphur in the ethiops burns off; when there is no further appearance of sulphur fumes from the pot more ethiops is added; these additions are continued at intervals for thirty-six hours, the cover being kept on during the whole of the operation; then the pots are allowed to cool down; when cold the cover is removed and the vermilion is found as a crust on the under side of the cover and around the sides of the upper portion of the pot. This crust is carefully removed, the red portions being placed on one side for further treatment, while any black, unchanged portions are mixed with some fresh ethiops to be again heated. The red vermilion is now ground up as fine as possible with water; if not of sufficiently brilliant color it may be treated either with acids or alkalies, as is described below, well washed with water, allowed to settle out of the wash waters, dried at a gentle heat, and sent into market ready for use.

Second, Chinese Method.—A few years ago a description of the process used by the Chinese for the preparation of vermilion appeared in several journals, and at the Colonial and Indian Exhibition, held in 1886, there was shown in the Hong Kong Court a model of a Chinese vermilion factory. Like the Dutch method, the Chinese process is in two stages, and is carried out as follows:

An iron pan, measuring 25 inches in diameter and 6 inches deep, is placed over a charcoal fire; into this pan is placed 17 1-3 pounds of sulphur and 37½ pounds of mercury, heat is applied, and the mixture stirred until the materials melt and become amalgamated together; then 37½ pounds more mercury are added, and the heating and stirring continued until the two bodies have become united.

The pot is now removed from the fire and water added in sufficient quantity to form a paste, which has a blood-red color; the first stage of the process is now complete.

Second Stage.—The crude vermilion obtained in the first stage is broken up into small pieces and placed in iron pans measuring 29¼ inches in diameter and 8⅞ inches deep; on the top of the vermilion is placed a number of broken pieces of porcelain plates arranged in the form of a dome; over all is placed the pan used in the first stage, the two pans being luted together with clay, and a few vent holes left in the luting. The pans are placed on a furnace, which is constructed in a simple manner; usually a number are built side by side. The pans are heated for 18 hours at a dull red heat, after which they are allowed to cool down; when cold the pans are opened, when the vermilion is found as a red sublimate on the under side of the porcelain plates and the upper pan; this red mass is collected and transferred to another place for the finishing operation. The crude vermilion which has been scraped off the porcelain plates is now ground as fine as possible with water in a mortar; the ground color is next mixed with water in which alum and glue in the proportions of 1 ounce of each in a gallon of water have been dissolved, and allowed to stand for a day; it settles down and is found as a cake at bottom of the vessel, which is made of earthenware and has a capacity of 6 gallons. The top of the cake is of fine quality; this is separated from the bottom portion, which is re-ground up with the next batch; sometimes the top portion is re-ground. After being washed well with clear water, the finely ground vermilion is dried and packed up ready for sale.

Wet Methods.—First Common Method.—In making vermilion by this method 68 pounds of sulphur and 30 pounds of mercury are mixed and ground together until they are thoroughly incorporated; they are then added to a solution of 160 pounds of caustic potash in water, placed in iron pots and heated to a temperature of 45 degrees C., which is maintained for some hours. For the first two hours the water lost by evaporation is made good, but after this no further addition is made, and the mass is kept constantly stirred. After some time the mass, which has at first a blackish appearance, turns brown and gradually passes into red; when it is considered that color is fully developed, the mixture is removed from the fire, well washed in water and dried. This process requires careful watching. With care and attention the product is equal in quality to that made by the dry method.

Second, Firmenich Process.—The process described by Firmenich consists in taking 10 parts of mercury and agitating them with 2 parts of sulphur and 4½ parts of potassium pentasulphide (prepared by heating potassium sulphate with charcoal) and boiling the residue with excess of sulphur for three to four hours, when it takes a brown color; it is then kept at a temperature of 45 to 50 degrees C. for three to four days, being agitated at intervals during that period. It is next treated with water, then with a weak lye of caustic soda (to free it from excess of sulphur), washed thoroughly and dried.

In these wet processes it is important that care be taken not to heat the mixtures of mercury, sulphur and alkali to too high a temperature; from 45 to 50 degrees C. is high enough.

Time, not heat, seems to be the most important element to consider in these processes; too great a heat turns the vermilion brownish.

The brilliancy or fire, as it is sometimes called, of the vermilion may be increased during manufacture by

First, grinding very fine and levigating.

Second, by warming with a caustic soda lye.

Third, by treatment with nitric acid.

Fourth, by treatment at about 50 degrees C. with a mixture of the caustic and sulphide of potash.

Fifth, by treatment with hydrochloric acid.

Any of these, or a combination of them, may be, and are, used for this purpose.

Properties of Vermilion.—Vermilion is a very bright scarlet powder. It is the heaviest pigment known, its specific gravity being 8.2, which causes it to settle readily out of paints, etc., in which it is used, and renders its application somewhat troublesome. It is very opaque and consequently has great covering power or body.

It is quite insoluble in water, alkalies and any single acid, but a mixture of nitric and hydrochloric acid dissolves it with the formation of a colorless solution of mercuric chloride; as a rule, very few substances are capable of acting on vermilion. Heated in a tube out of contact with air, vermilion first turns brown, then sublimes in the form of a red sublimate. Heated in contact with air, vermilion burns with a pale blue, lambent flame, giving off vapors of sulphur dioxide and mercury oxide; if pure, there will be but a trace of ash left; thus a sample of good vermilion analyzed by the author contained:

Sulphide of mercury	99.63
Ash	.37
	100.00

This forms a reliable test for the adulteration of mercury, for any adulterants which may be used will be left behind on heating. The usual adulterants employed are red lead, oxide of iron, red lakes, vermilionettes, etc.

The presence of any of these is easily ascertained by the application of the characteristic tests, which will be found described under each particular pigment.

When used as an oil-color vermilion is permanent, but the experiments recently made by Captain Abney and Dr. Russell throw some doubt on this point; they found that vermilion used as a water-color turned brown after two years' exposure to light and air, probably owing to an intermolecular change; much appears to depend on the care with which the vermilion has been made.

Selected.

Why Varnish Cracks Prematurely on Gilt and Silver Lettering and Stripping.

It is a fact generally known to the painting fraternity that varnish often cracks and shrivels immediately over gold and silver or alluminum lettering on a car or other vehicle far in advance of cracking on any other parts of the work, and occasions no little annoyance and much speculation as to the source of the trouble, and much anxious solicitude as regards a remedy for the trouble.

It is one of those phenomena, if I may so characterize it, that is likely to happen just as soon as a car leaves the shop, and the rays of the sun come in contact with it at right angles. Then again it is not likely to occur, or in some instances does not occur until a car has been several times revarnished. On account of these characteristic vagaries of this deviltry, it would appear that it is subject to no rule, and on that account, a remedy is all the more difficult.

By some it is thought to be due to the metal's power of attraction, or on account of its brilliancy, its power for attracting light is extraordinarily strong, in which case, or according to which theory, the damage is caused by the rays of light, and not by the direct rays of the sun.

This theory is not borne out by experiments recently made, and which experiments clearly demonstrated that varnish cracking is more common on dark than on light colored surfaces, the theory of which is that light colors reflect the sun's rays, and dark colors absorb them; therefore, the greater the brilliancy and reflective power of paint or metal, the less injury it is likely to sustain from the sun, and as to the destructive power of light on either paint or varnish, it has not been demonstrated that it exerts any influence in this respect, except to cause the fading of colors that are chemically made. But upon the natural colors like that of the rose, the green leaf, etc., it exerts no injurious influence whatever; on the contrary it is a benefit to its growth and culture.

The sun, light, and color are co-related; the sun produces light, and light produces color; an object that seems red is red because it has the property of reflecting all the rays of light except the red ray. This ray it absorbs, and therefore becomes red, and so also with all other colors. But black and other very dark colors have not the property of reflecting any of the rays of light, and therefore absorb them all, and which rays when converged produce heat.

In the case of white or brilliant objects, none of the rays are absorbed, but on the contrary all are reflected, and for this reason the light colors remain the coolest of all colors, and for the same reason varnish proves the most durable on light colored surfaces or objects. But where there are apparently exceptions to this rule or theory, as in the case of varnish cracking on gold, silver or aluminum, as mentioned above, it is reasonable to attribute it to some cause that is peculiar to the metal itself, or to the nature of the varnish.

In seeking for a plausible solution of this matter, the writer has observed that on passenger engines, striped and lettered in gold, and varnished with a medium quick drying varnish, this trouble never occurs, but more frequently occurs on cars where a very elastic varnish is used.

Now, this appears to be the key to the solution, which is this: the gold or aluminum presents a smooth or glass-like surface to which none but a quick drying varnish will adhere sufficiently to resist the tendency that the sun has to draw it away from the surface; or in other words, as the fluids contained in the varnish are driven off by the sun, and the gum only is left, the natural tendency of the gum is to shrink, and where it has the weakest hold, there it will give way first.

Regarding the difference exerted in the case between a quick and a slow drying varnish, the quick drying varnish becomes sufficiently dry to resist this tendency of the sun before it is exposed to extreme sun heat, and although its hold or adhesion is weakest at or directly on the gold or aluminum, it is sufficiently strong to resist the sun, while in the case of an elastic or slow drying varnish, it becomes exposed to the sun before it has reached the degree of drying necessary to resist the action of the sun, at its weakest point of adhesion, and which point is, of course, where there is the least homogenenity and cracking of the varnish at this point, due to shrinkage, is the result. The matter, concisely expressed, is that the trouble in question is due to lack of adhesion.

Grain Showing.

A soft porous wood with large and decided grain marks is the most difficult to permanently fill, and even with good material and good process it is not always possible to avoid a gradual development of grain showing. Little trouble should, however, be met in avoiding this trouble with homogeneous wood of close grain. White wood is always preferable for panel work.

The first important point for consideration is the condition of the surface of the wood, when the priming coat is to be applied. A job taken from the wood shop, finished smoothly and primed immediately, is no guarantee that grain raising will not follow. Why? Because you have not given the wood a chance to recover (expand) from the pressure brought to bear upon it in leveling the surface. The safe, sure way is to give it a rest of a few hours, in a perfectly dry atmosphere, then redress with sandpaper lightly, and apply the priming, giving it ample time to dry before another coat is applied. Some of the best known wood workers claim that a job should not be primed until a second finishing with sandpaper has been given it. After the panel has been finished in the usual way, go over the entire surface with a sponge sufficiently wet to raise the grain. Let stand until dry, then go over the surface again with sharp sandpaper, cutting the raised grain down level. One thing is certain, there is less grain in the panel than before, and this must lessen the chances of grain showing.

A panel may be perfectly well seasoned, finished today smoothly in a dry atmosphere, left over for a day or two, and during the time rain may set in, causing a change from dry to damp. The dry, porous wood feels it quickly, drinking in enough to raise the grain, which is hardly perceptible, unless closely examined. No drying, baking or any other known process will even restore it to its original smoothness. The grain has come up to stay, and only a redressing will bring it back to its former smooth and level condition.

Many jobs are primed before this is done; coat upon coat is applied, and when rubbed to a surface (if rubbed too closely), the raised grain is reached first, rubbed through in places, absorbing the water and spreading generally through the wood. The wood swells, and in time it dries. When dry it is shrinking and drawing from the outside the priming and surfacer, etc.

Certain conditions of priming and roughstuff favor production of grain showing: An oily priming which does not dry hard and firm before the application of roughstuff; a soft and spongy roughstuff used with a view to make the work of rubbing easier. Either priming or roughtstuff, containing but little binding or resinous material, and very much turpentine or other thinner, will cause shrinking and swelling of the wood.

Usually one side of a panel, as in the outside of a carriage body, has great care, much labor and many coats bestowed upon it in the best possible manner, while the inside of the body has only a rough, thin coat of priming, consisting of refuse material that accumulate about the shop. If the latter operation is not carefully done, and enough material applied to protect the surface thoroughly from all atmospheric influences for a long while, the outside surface will gradually be undermined by moisture, etc., creeping through the pores of the wood from the underside, filling the latter, and thus causing swelling and shrinking of the wood with every change of temperature, and hastening the gradual decay of the job, often causing the grain to show plainly. These are some conditions favoring grain showing.

The permanence of filling and surfacing depend so much on priming and roughstuff, that in proportion as these materials are thoroughly and correctly applied will the danger of grain showing be obviated. It can readily be seen that hurrying these coats can never be safely indulged if this is to be avoided. Priming and roughstuff are applied as liquids; they must be allowed to harden by evaporation and oxidation to solid driers, otherwise they will gradually sink out of sight into the pores of the wood, which is much like a sponge in this particular.

If, therefore, coats succeed each other at short intervals which do not allow of thorough hardening, the final coats enclose a soft layer of various undercoatings, thoroughly sealed from contact with air, and incapable of ever becoming dry and hard. In this condition which favors the gradual sinking and absorption of the latter into the grains and the original surface and figure of the wood becomes visible.

Only liquids rich in gummy resinous matters, which will dry and harden thoroughly and be of tenacious nature, should be used in priming and roughstuff, and the less japan used the better.

To make the priming thorough, give a coat all the time possible to harden and dry thoroughly. Have a care to the same thing in the succeeding coats of roughstuff or lead, and be sure the latter will not rub off like whitewash when rubbed or sandpapered, but at the same time carefully retain the flat or dead condition of the coats previously described.

The folly of using a poor japan or varnish in compounding a roughstuff is manifest. Wherever else it may seem admissable to use medium or cheap grades of goods, the greatest economy lies in the employment of the very best materials that can be obtained in preparing the foundation for a fine finish. It seems unnecessary to touch upon sappy wood: it is sure to ruin any system of surfacing, and it is only a waste of time and material to operate on a surface where this condition prevailed.
—Selected.

Mr. John A. Jackson.

We present herewith a half tone engraving of Mr. John A. Jackson, who has charge of the car and locomotive painting department of the Wisconsin Central Railway, and who is located at the new shops of the company at Fond du Lac, Wis.

Mr. Jackson is a Scandinavian by birth and is 62 years of age. At the age of eight he was placed in a paint shop where he served his time as an apprentice until 18 years of age. From that time he worked at various kinds of work belonging to the painters' trade. In the year 1872 Mr. Jackson came to the United States and found employment in New York City as a carriage painter. He left New York in 1874 and located in Brainerd, Minn., and was employed in the Northern Pacific Shops at that place. After remaining there 18 years, he was transferred to the Wisconsin Central, which was then operated by the Northern Pacific, and took charge of the engine painting at the Waukesha Shops. After the new shops at Fond du Lac were completed Mr. Jackson was transferred to that point, where he is still located and has charge of the entire painting. He joined the Master Car and Locomotive Painters' Association in 1902.

MR. JOHN A. JACKSON.

Driers.

Manganese dioxide, the black oxide of manganese, is now very extensively used as a drier. It comes into the market from two sources, one natural, the other artificial. The natural manganese forms the mineral manganese or pyrolusite, and is found widely distributed in large quantities; for use, it is simply ground to a powder with water and then dried. It forms a greyish black powder insoluble in water.

Manganese sulphate is prepared by dissolving manganese in sulphuric acid, and evaporating the solution down to dryness. It is a crystalline salt of a faint pink color. Its drying action is, perhaps, rather more powerful than that of the lead compounds, but is less than that of the last named compound. Rather less than ½ pound should be added to each hundredweight of oil or paint. It possesses one advantage over manganese in not adding to the color of the oil. Artificially, manganese is obtained from the still liquors of the bleaching powder manufacturer, who, to prepare chlorine, treats manganese with hydrochloric acid, when he obtains a solution of manganese chloride; this is treated by a process invented by Weldon, when all the manganese it contains is recovered in usable form. While much of this recovered manganese is used over again in the preparation of chlorine, some of it is sold for other purposes. Manganese dioxide is soluble in hydrochloric acid with evolution of chlorine, and the formation of manganese chloride; in sulphuric acid it dissolves with evolution of oxygen and the formation of manganese sulphate. Essentially it is a peroxide, a class of bodies which may be described as containing more oxygen than is exactly equivalent to the metal present in them; this extra oxygen is often rather loosely combined, and ready to enter into combination with other bodies; it is this feature in the composition of manganese which makes it useful in oil boiling, for the oxygen during the process, combines with the oil and oxidises it, while the manganese dissolves to some extent in the oil in the form of a manganese compound of the linoleic acid of the oil. Manganese is in consequence a powerful drier; in fact, the most powerful known.

The proportion usually added in the process of boiling, is ¼ pound to 1 hundredweight of oil, and it is not advisable to increase this proportion much, as it would give rise to too much drying action, and cause the oil to form a hard brittle coat. Unfortunately the manganese has a tendency to darken the oil. It is not a safe drier to use generally in mixed paint, unless added by actual measurement, as there is danger of adding too much.

Queries.

What is the best method of maintaining the locomotive front end?

Should the heated parts of a locomotive be primed and finished the same as the other parts of the engine?

Can the paint sprayer be advantageously used in painting a locomotive?

What, if any, are the advantages over a wooden car, in painting a steel passenger car?

In view of the increasing cost of cross ties, is it economical to treat them with wood preservers?

From Mr. W. H. Truman of Newbern, N. C., we learn that a consolidation has been effected between the Norfolk & Southern, Virginia & Carolina Coast, Raleigh & Pamlico Sound, Oriental & Western, and Atlantic & North Carolina railways, with headquarters at Newbern, N. C., which means quite an addition to Mr. Truman's baliwick.

To those who may be in need of the services of a capable foreman painter, either at present or in the near future, we wish to state that two members of the association desire a change of locality, one desiring the East, and one the South. Both are capable men and are now occupying good positions, but desire a change for reasons personal to themselves. If any one who desires their services will communicate with the editor he will gladly furnish any information desired.

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Contents

Storehouse Stock.

THE stock of material carried by the store department is one of the most important factors entering into rapid movement of locomotives through roundhouses, as the time for making repairs will be materially shortened when there is an ample supply of finished material to draw from.

Along with the conditions which have made it necessary for the motive power department to move locomotives rapidly through terminals without delay, there has grown a tendency toward concentration of material at a central store with a corresponding reduction of stock at the outlying roundhouses. This adjustment of stock is for the purpose of reducing the amount of unnecessary material carried, at the same time alloting to each store house a working stock consistent with the local demands.

A number of good reasons justify the system of carrying a minimum stock, but it has been demonstrated that it will not always meet the fluctuating demand for material such as found in locomotive operation. The demand for a certain class of material may be doubled from one month to another, due to varying road conditions and if the stock carried is based on the lesser demand, there will be a shortage at a time when it will cause serious delay to locomotive repairs. A stock of material is not elastic, and in order to meet constantly varying conditions it should be adjusted to meet the maximum rather than the minimum demand.

When locomotives having an earning capacity of fifty dollars or more per day, are delayed in the roundhouse on account of a shortage of inexpensive material, it would seem that the economy represented by maintaining a limited supply is false rather than actual. The economical limit has been passed when expense instead of saving results.

Bulletins.

IT SEEMS to be very common practice to attempt to direct the attention of men in the various departments to certain subjects by issuing bulletins concerning the matter under consideration. For instance, a master mechanic, shop superintendent or general foreman will observe that some of the men are washing up before the whistle blows at night or are hanging around their lockers preparatory to getting their dinner at the noon hour. In such an event a bulletin may be issued, calling the attention of the men to the fact that this practice is being observed and advising that same should be discontinued and ending with the usual stereotype phrase, "please be governed accordingly." On some occasions the men will cluster around the bulletin to see what item of interest it may contain but beyond this it will exert no influence over them. By many men such bulletins will not be read at all.

It would seem therefore that a more desirable practice and one more apt to bring results would be to advise the foreman of any information that the master mechanic desires to distribute among the men and hold the foreman responsible for spreading such information, as well as for seeing that instructions are carried out.

In the case of road men it is often necessary to issue bulletins with regard to certain conditions on the road, for instance the necessity of approaching and crossing a certain bridge at reduced speed or to look out for repair men at such and such a point, etc. On the other hand, however, bulletins are sometimes used for the purpose of criticising certain incidents which have happened and which really concern a comparatively small number of men. In such a case it would seem more practicable for the purpose of obtaining results if this information was incorporated in a circular letter, directed to each man concerned and put in his box in the roundhouse. There would then be no question about his having received it and the information contained would probably carry more weight, unless such letters become too frequent or are dictated exclusively by clerks, unfamiliar with the subject under consideration.

Savings from the Scrap Pile.

WHILE the railroad scrap pile should not be the pride of the shop, it is worthy of more attention than it receives ordinarily. The easiest way to dispose of material that may be removed from either locomotives or cars is to gather it up as scrap and sell it at scrap value; but in the process much usable material is wasted. At nearly every shop more or less usable material is disposed of at scrap price regardless of its condition, for the reason that the man who is usually assigned to the duty of picking up scrap in the shop is not competent to determine and separate the usable from the unusable.

In order to separate the usable material from the unusable scrap and save the dollars that are in many cases being wasted, a man should be assigned to the inspection and loading of scrap material. At a small shop this man should be skillful enough to make repairs to a great many articles that find their way to the scrap bin, but which at a small expense could be repaired and serve as well as new material. To illustrate, a monkey wrench that is thrown in the scrap pile on account of the handle being broken could be repaired for a matter of five cents, placed in stock and given out on an order the same as new material and would answer the purpose fully as well. Globe valves, angle valves, cut out cocks, usable brasses from front ends, finished nuts, usable bolts, packing, whistles, whistle valves, wedge bolts, new stud bolts, rod brasses, rod bolts, cab pulleys, unions, pipe nipples, cellar bolts and any and all material could be repaired with profit to the company. A man to do this work should be of ability between that of a machinist helper and a machinist.

When scrap is being loaded the parts that this man selects as being usable may be laid aside and taken to a place or room assigned to this purpose. Here they may be repaired and then distributed either to the men in the shop who can use such material or they may be delivered to the store-house where the material could be furnished on order by the various foremen and charged out at a second hand price.

A scrap man whose efficiency and ability would entitle him to an average compensation of say $75 per month could save in repair enough material from the scrap pile to make the investment a very profitable one to the shop. The amount would depend on the man's opportunities, the amount of scrap, the ability of the man and his facilities for making repairs, as well as the co-operation of the shop force.

Concerning Piece Work.

ALTHOUGH a number of well organized shops are successfully handling piece work and the men are apparently satisfied, there exists a widespread feeling of dissatisfaction with the system, which may not always be openly expressed. Side by side with this will be found a feeling of entire satisfaction on the part of foremen and higher officials with piece work, as a successful and popular method of handling men. It is generally admitted that the fundamental principles of piece work are just, and in accord with the best interests of both employer and employee, but the piece work of the shop, as presented to the men by inspectors and foremen, may not be the ideal method which it is in principle.

The undercurrent of unrest which prevails in so many piece work shops, may in some cases be laid to the attitude of organized labor, but generally the cause is deeper than that and springs from a lack of confidence in the system. This feeling is not always a blind antagonism to piece work as a principle, but is in large measure a product of questionable methods used in shop operation.

Unscrupulous and incompetent inspectors and foremen, along with the schedule of ever changing prices are chiefly responsible for the unenviable reputation which piece work has sometimes earned. Next to this, lack of facilities for doing work and improper organization have prevented the successful operation of the system.

The schedule of prices must be fair, and lived up to absolutely; the shop must be equipped with proper tools and facilities for rapid work and the supervision broad minded and competent. The organization should be such that the maximum amount of work is received from every man for which the schedule prices are paid on a fair and impartial basis. A close investigation of shop conditions may reveal another side of piece work which was not supposed to exist in a given shop. Piece work as it should be and piece work as it may be found to exist in some shops would indicate that there are two sides to this question.

Does It Pay?

THE machine tool to be at its best must be operated by a man who knows how to get results, never by mediocre talent. No greater mistake can be made in a machine shop than to place a tool in charge of a man who is not able to work it to the limit of its possibilities—be they few or many, and a disregard of this proposition can have only one result—lessening of output, and therefore a crippling effect on a plant that would otherwise be able to take care of its work.

It is generally understood and followed in shops that are afflicted with ancient tools, that no man is too high priced—if he knows his business—to be employed on those relics, for it is recognized as the only means by which anything like paying results are to be obtained. A recent instance of linking the past with the present was noted in which a single head driving wheel lathe having a wooden bed and rope feed, was delegated to the wheel job instead of the retirement it had earned, in a modern well equipped railway shop. This old timer could not be scrapped for various reasons, and was made to do duty as a wheel borer to fill a void in that class of tools.

It bores wheels under the guidance of a man at the head of his craft, and the aid of a universal jawed chuck on the face plate; a crane to handle the wheels in and out; and an expansion boring tool fitted to the tail stock spindle completing the ensemble. The question presented itself, that while this old tool helped out in a case badly needing assistance, did it pay? When the output was compared to the possible 150 wheels per day from a tool designed to do that very thing and nothing else, the answer could be only in the negative, and that the place for tools that have outlived their time and usefulness is not in the shops of to-day, no matter how they may be galvanized into a semblance of utility by the best class of manipulation.

Railway Records

By U. H. Clarke.

Second of a Series of Articles on Accounting and Office Records of the Motive Power Department

HAVING outlined in the previous article the manner in which distribution of labor charges can be carried in convenient form, and the expenses tabulated from day to day, it will next be shown how the system can be applied to material charges. This is a much simpler matter so far as the accounting part is concerned than with labor charges, as material is issued from store house upon requisition or ticket, signed by foreman, and it is merely necessary for material clerk to price ticket, and after grouping them properly, enter them in material ledger under heading of proper account to which they should be charged, dating the ledger and tickets with corresponding dates, and filing the tickets in date order in a file labeled with name of account to which they relate. Thus should any item appearing on the ledger be called in question, the clerk has only to note the date, reach to his file for packet of tickets relating to the particular account for that date, and quickly locate the origin of the entry.

For benefit of economy in operation I think that greater details as to cost of various items entering into expenditures should be gone into, to enable the shop management to locate exactly the particular items entering into cost of maintenance of locomotives and cars. With this object in view I would use a sheet or ledger ruled like accompanying illustration, having a double column, one each for labor and material, the subheading over the two columns to be given as some of the principal items entering into repairs of the kind of equipment to which charges relate. In all classes of material, there are, as a rule, some particular parts, which through poor material, faulty design or inferior workmanship are a constant source of expense to maintain, and the average shop foreman or master mechanic will go on for years keeping up repairs on this sort of equipment, when if he once saw reliable information showing the actual per cent which certain parts were contributing toward the total expense of maintaining his equipment, the desirability of at once correcting the trouble would be brought forcibly to his mind. This would be particularly valuable in freight car repairs, as most of the larger railroads are constantly experimenting with various kinds and qualities of material, and articles used in car operation, and it could be accurately ascertained by this means what articles were most desirable from the point of view of economy in maintenance. Most of

CLASS__________ **MONTH__________**

REPAIRS AND RENEWALS--FREIGHT LOCOMOTIVES

__________SHOP

Date	Eccentrics		Valves		Grates		Front End		Driving Brasses		Miscellaneous		Miscellaneous		TOTAL
	Mtl.	Labor	Mtl.	Labor	Mtl.	Labor	Mtl.	Labor	Mtl.	Labor	Mtl.	Labor	Mtl.	Labor	

PAGE OF LEDGER SHOWING SUBDIVISIONS FOR KEEPING THE CHARGES ENTERING INTO THE VARIOUS CLASSES OF REPAIRS.

the railroads with whose system of accounting I am familiar, have a general account called "Repairs of Freight Cars," which is used as a sort of general clearing house for the business, having thrown into it in hopeless confusion, charges for material of all descriptions used in car construction, and in some cases perhaps being charged with labor and material which should not have been properly chargeable to this account at all.

An important feature also in segregating charges to this account, would be that of carrying on a separate sheet or page the cars damaged in accidents on the road and in terminals, which would enable the management to tell accurately how much money was being expended for repairs to freight equipment due to ordinary wear and tear, how much for road damage, and how much for terminal damage, and showing the specific parts which were failing under the three conditions. The weak parts causing failures could thus be readily located and the remedy applied.

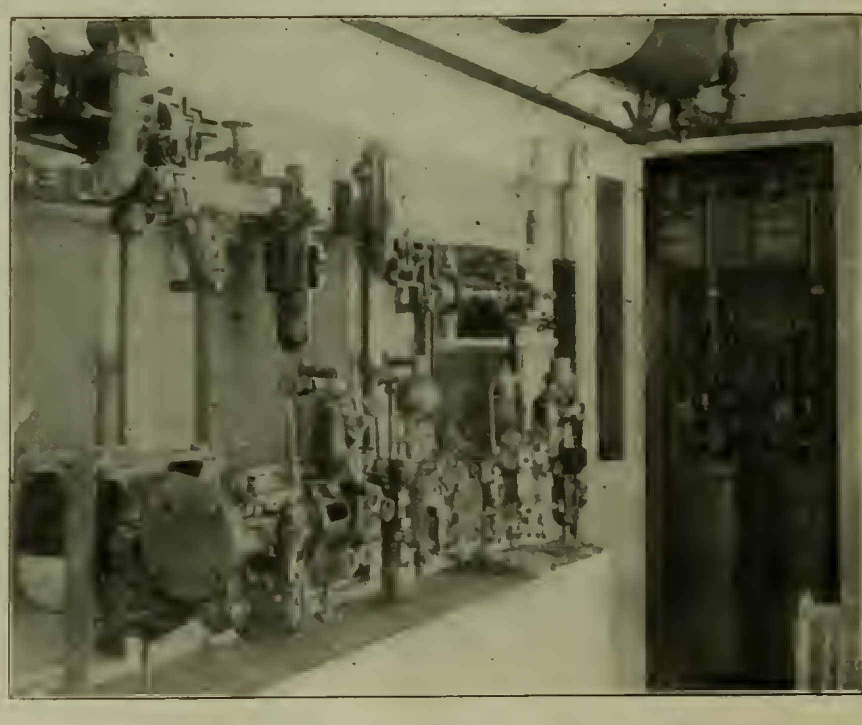
Another considerable item of expense in railroad operation is the charges to accounts "Other Engine Supplies and Expense," "Passenger Train Supplies and Expense," "Other Freight Train Supplies and Expense," etc. The articles of material entering into charges to these accounts is not large, but are chiefly of a light and portable nature and readily available for domestic use, and unless followed up very closely a great many things such as brooms, dusters, locks, lanterns, etc., are lost, thrown away or appropriated by employes and others to their personal use. While these articles are not expensive, in the aggregate they are quite a considerable item of expense at a fairly large size terminal. To keep close track of this class of material I would use the same ledger page as shown in cut showing heading of proper account to which items were chargeable at the top, and showing in column spaces for sub-headings the names of the various articles used, filing requisitions in a case labeled in the same manner. Should the amount of any particular item used appear abnormal, the reason of doing so could be investigated and notes made for future reference, and if any was at fault the proper remedy could be applied. By pursuing this method it would not be long before all the employes using this class of material would realize that there was some one systematically and intelligently following up the matter and the result would be that the material would be taken care of.

To my mind the most important feature of division or shop operation is a perfection of office detail, which enables, or to the minds of the average shop employe seems to enable, the master mechanic to keep in direct touch with every detail of the business carried on under his jurisdiction. The only means by which he can accomplish this result is by segregation of detail and bringing each transaction into direct relation to the cost, for results are of little value unless the cost is known. The latter may make the former prohibitive, and by far the greater number of railway shop officials with whom I have come in contact have been apparently raised with the idea that results were all that were expected of them, and that the cost of such results were no part of their business. In fact the greater part of them have an inate idea that they must do only what their superior officer tells them, however expensive, and that it is more or less in the nature of presumption for him to offer suggestions, or use his own brains, notwithstanding the fact that he may be an expert in his particular line of business, while his superior would possibly be a man who had never possessed more than ordinary ability for that particular line, and whose experience in practical shop practice dated back to a remote period, since when methods of shop management have been entirely revolutionized. Thus the average railway organization is as a rule more or less out of date, and they do not get the results of the best effort of the brains of those whom they employ, and to which they should be justly entitled.

However, to my mind the time is now here, when between the two practical certainties, that legislation will reduce rates and labor organizations will raise wages of employes, the only resource left is to economize in operation. Considerable progress has apparently been accomplished toward this end, but so far as my observation goes the greater part of it has been along lines that contribute but little toward actually getting more value for each dollar expended.

Joint Convention of International and Master Steam Boilermakers' Associations.

The joint convention of the International Master Boilermakers and the Master Steam Boilermakers Associations, to be held in Cleveland on May 21, 22 and 23, marks the end of the independent existence of the two organizations. At the close of the convention one set of officers will be elected and the two associations merged into one.



CORNER IN THE CLASS ROOM OF THE NEW AIR BRAKE INSTRUCTION CAR, C. B. & Q. RY., SHOWING SECTIONAL MODELS OF DISTRIBUTING VALVE, INJECTORS, LUBRICATORS, ETC., WITH CLOSET CONTAINING ACETYLENE GAS APPARATUS.

New Air Brake Instruction Car

C. B. & Q. Ry.

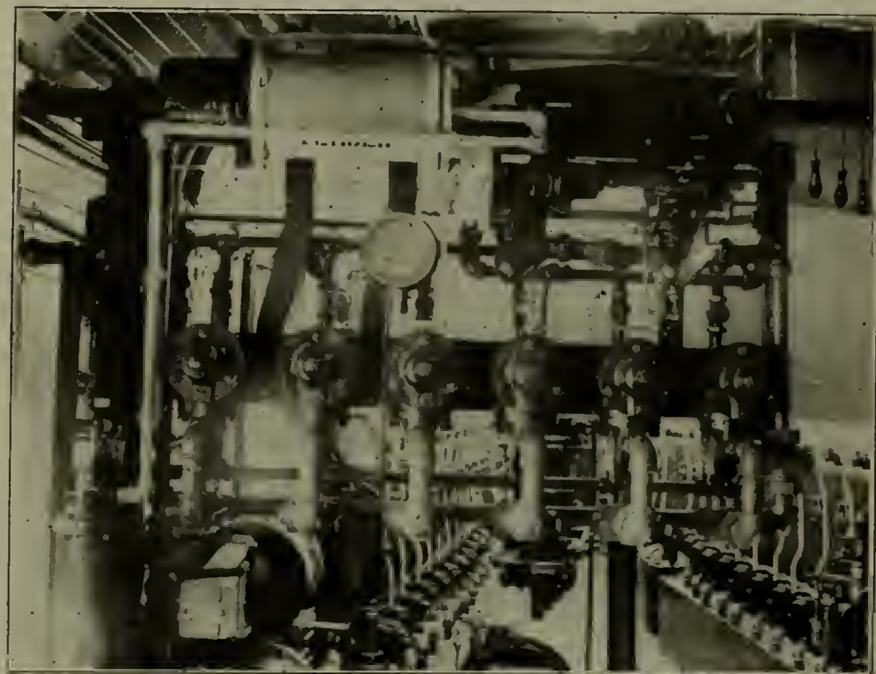
THE new air brake instruction car just completed at the Aurora shops of the Chicago, Burlington and Quincy Railway is noteworthy as representing the latest development in cars of this type. The originality of design and general arrangement, with the handsome finish and appearance, combine to make the car an ideal one for instruction purposes.

The car body which was converted from a mail car is divided into three compartments: an office 12 feet long, a class room 41 feet long and a boiler room 9 feet long. The office is arranged with a roll top desk, upper and lower berths, wardrobe and toilet room. Above the desk is placed a triplex gauge showing train line, signal line and brake cylinder pressures under the car, for the purpose of showing the manner in which the train brakes were handled while the car is in transit.

The boiler room contains a 46 inch vertical boiler, carrying 200 pounds pressure and is equipped with shaking rates, and extension smoke stack. A 9-1/2 inch air pump is attached to the boiler for supplying air to the car and connections are also made so that air can be furnished from a locomotive when coupled to the car. A Baker heater is placed in the rear of the room for heating. The two ton coal box and 600 gallon water tank are placed in the forward end of the boiler room behind the two rows of brake cylinders.

The instruction room is a compartment 41 feet long with space at the forward end for 18 men seated on folding chairs, and is provided with a complete assortment of the latest air brake equipment. The freight brake cylinders are arranged vertically, in two rows each side of the car, which converge toward the boiler room end, bringing every piston rod in view. The value of this feature is apparent to those who are familiar with the average air brake car. There is an equipment of 52 brake cylinders, consisting of 36 Westinghouse 8 by 12 inch freight brakes, 11 New York 8 by 12 inch freight brakes, 2 Westinghouse 10 by 12 inch passenger brakes, 1 Westinghouse 8 by 12 inch tender brakes, and 2 Westinghouse 10 by 10 inch driver brakes. The brake cylinders, main and auxiliary reservoirs, triple valves, retaining valves, pumps, brake valves with all necessary piping and fittings are painted in the standard Westinghouse colors, so that instruction is rendered much more simple and effective.

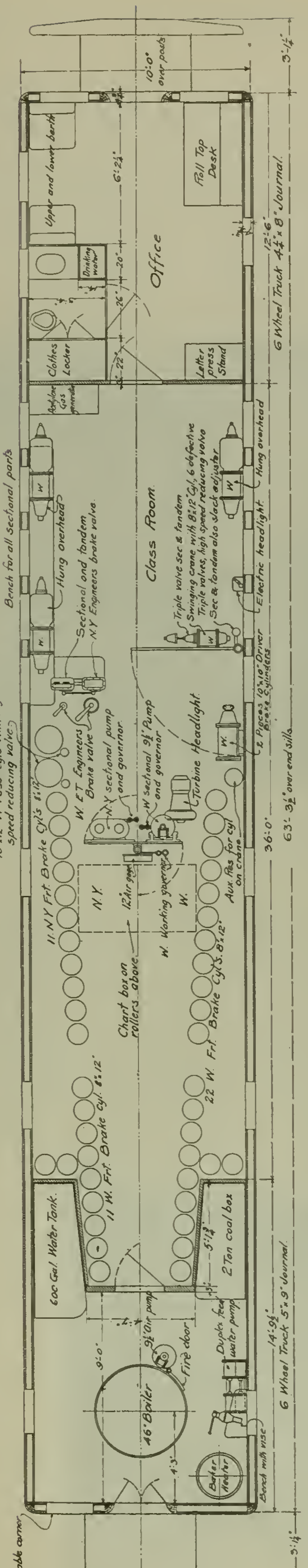
One of the novel features of the car is the substitution



RACK ON WHICH DEFECTIVE TRIPLE VALVES ARE MOUNTED, SWUNG OUT FROM THE WALL FACING THE CLASS ROOM FOR DEMONSTRATING PURPOSES.—NEW AIR BRAKE INSTRUCTION CAR, C. B. & Q. RY.

of 45 10-inch by 12-inch equalizing reservoirs for the train line piping of 45 freight cars. It has been found by experiments on the Chicago and Northwestern railway that the operation of the brakes is not affected by substituting the reservoirs for the train line. This method saves a great deal of space and weight. The reservoirs are placed on the floor directly beneath the brake cylinders and are enclosed in a galvanized iron casing as shown in the illustration. The triple valves are attached

THE NEW AIR BRAKE INSTRUCTION CAR—C. B. & Q. RY.



FLOOR PLAN OF THE NEW AIR BRAKE INSTRUCTION CAR.—C. B. & Q. RY. SHOWING ARRANGEMENT OF COMPARTMENTS AND DISTRIBUTION OF EQUIPMENT

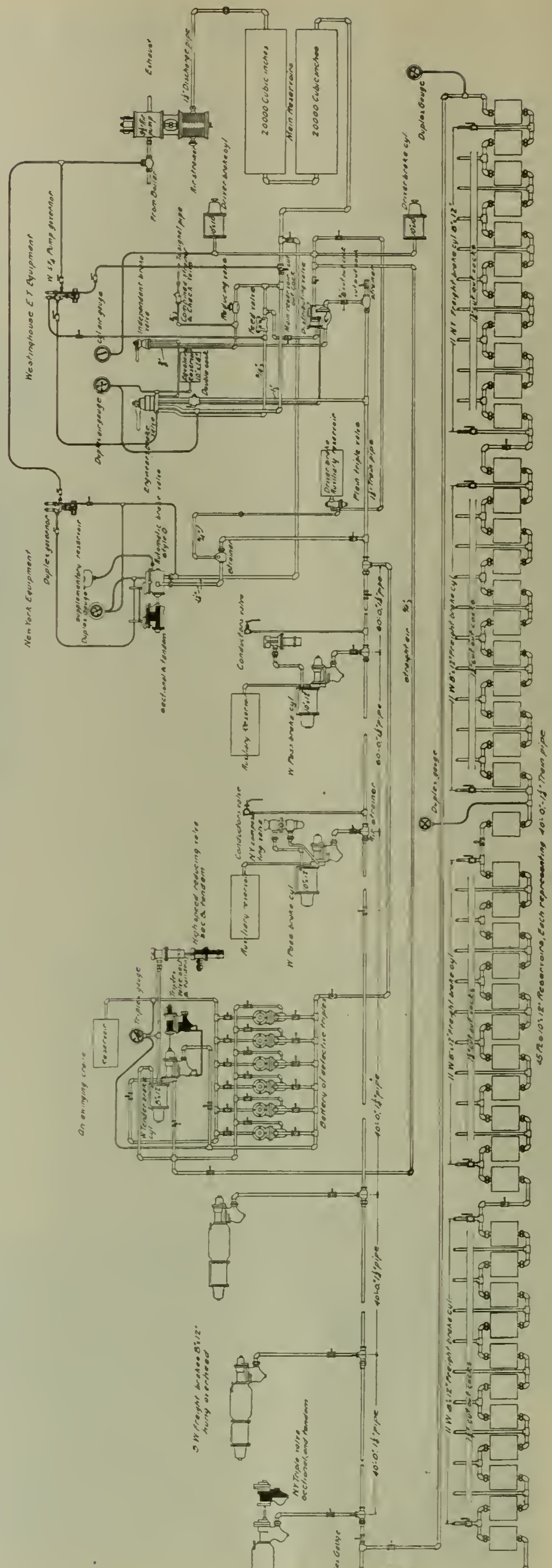
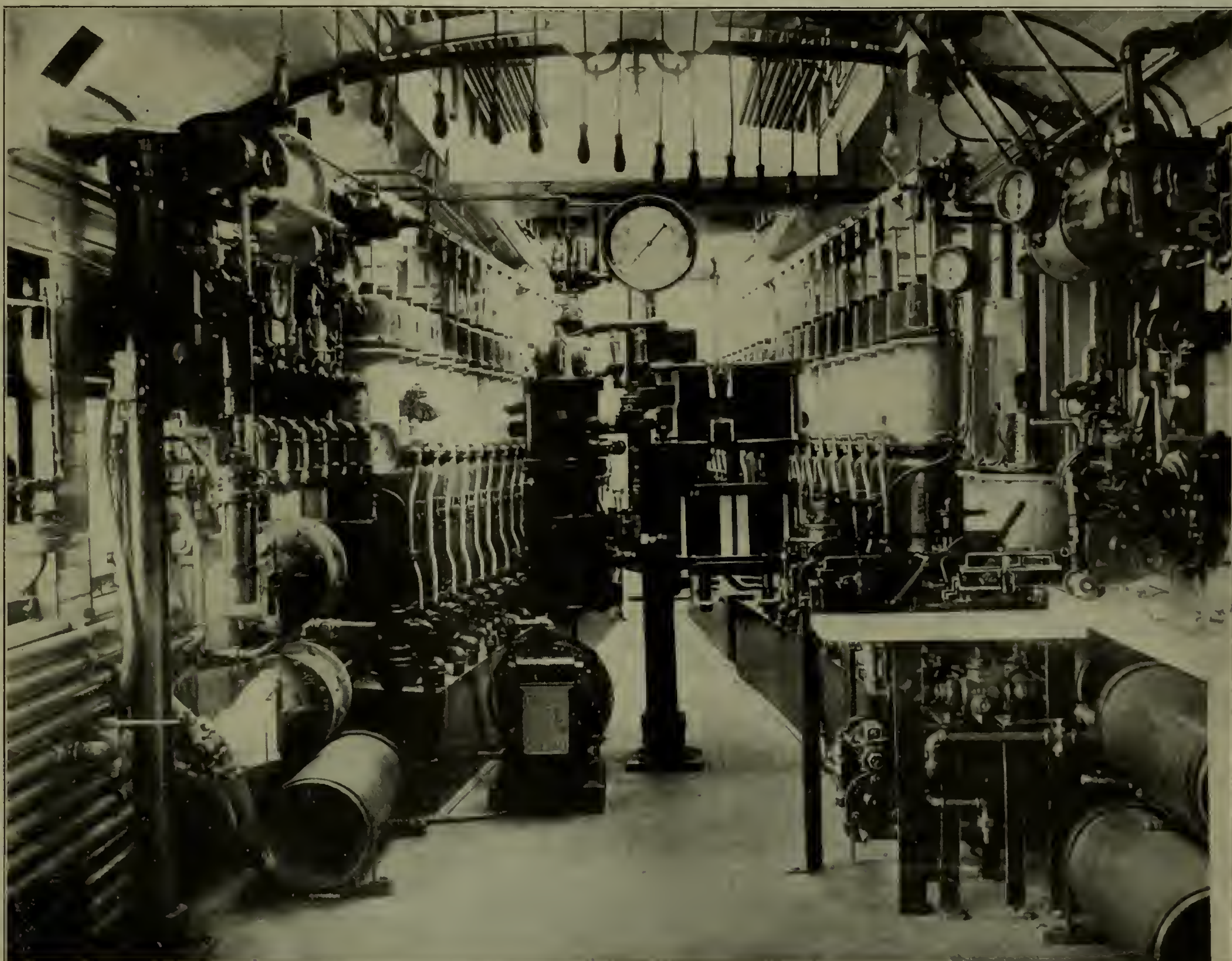


DIAGRAM OF PIPING AND ARRANGEMENT OF EQUIPMENT.—NEW AIR BRAKE INSTRUCTION CAR, C. B. & Q. RY.

by means of a special elbow which brings them into horizontal position, the same as under a car.

For special purposes, three of the brake cylinders are hung horizontally below the lower deck and the tender brake cylinder is bolted to a swinging crane on which are also mounted six triple valves having various defects, any one of which can be connected with the cylinder for the purpose of showing the effect they produce on action of the brake. The illustrations show the crane in place against the wall and also swung out at an angle of 90 degrees, facing the class unobstructed view of the brake cylinders. In order to show the train line reductions more clearly when demonstrating to a class, a 12-inch gauge is mounted above the pumps in plain view. The colored air brake charts are mounted on spring rollers in a movable case which is placed on guides each side of the deck. When in use the case is slid ahead close to the class, the doors unlatched and the charts pulled down in plain view. When not in use the case is moved back beyond the pumps out of the way.

The various appliances and equipment are arranged



NTERIOR VIEW OF NEW AIR BRAKE INSTRUCTION CAR.—C. B. & Q. RY. LOOKING FROM THE CLASS ROOM. ON THE LEFT, SWINGING CRANE WITH DEFECTIVE TRIPLES; IN THE CENTER, SWINGING POST WITH SECTIONAL MODELS OF AIR PUMPS, AND 12-INCH AIR GAUGE ABOVE; WHISTLE SIGNAL HANDLES IN UPPER FOREGROUND, BEHIND WHICH IS SEEN THE CHART BOX. ON THE RIGHT ARE THE BRAKE VALVES, ETC. THE CONVERGING ROWS OF BRAKE CYLINDERS ARE PLAINLY SHOWN, WITH IRON CASINGS BELOW FOR THE TRAIN LINE RESERVOIRS. ON THE FLOOR IN THE FOREGROUND IS THE ELECTRIC HEADLIGHT TURBINE FOR INSTRUCTION AND LIGHTING PURPOSES.

room for the purpose of instruction. The brakes are connected up so that they can be operated in various combinations and by either the Westinghouse or New York systems.

The air signal apparatus consists of a complete equipment of 14 sixty foot cars, the piping being placed on each side of the skylight, with the signal cord handles arranged for convenience of operation.

Directly in front of the class room are mounted sectional models of Westinghouse and New York air pumps, on a swinging post which allows the pumps to be turned in any position for the purpose of instruction. When not in use they are turned edgeways in order to leave an around the class room so that everything is in full view. On the right hand side are sectional models of brake valves, lubricators, injectors and steam heat apparatus, with electric headlight etc., on the other side. For purposes of instruction and also for lighting, the car is equipped with Pyle electric headlight outfit and Adlake acetylene system complete. Natural lighting is well provided for by windows and long skylights in the deck, with 26 electric lights and 22 acetylene jets for artificial illumination.

We are indebted to Mr. F. H. Clark, general superintendent of motive power, and Mr. A. Forsyth, superintendent of shops, for the illustrations presented.

Engine Sand

By W. B. Landon, Chemist Erie R. R.

A RAILROAD of a little over 2,000 miles used during the year 1905 about 23,060 tons of sand for engine purposes. The best engine sand would be Silica, 100 per cent., of a tough texture, angles sharp and not over 25 per cent. passing through a sixty mesh sieve, and free from small pebbles. Engine sand, however, of the above mentioned purity, is not probably obtained. Following are six analyses of samples of engine sand which well represent the 23,060 tons of engine sand used by this system of a little over 2,000 miles in length:

SAND ANALYSIS.

	1.	2.	3.	4.	5.	6.
Silica	84.92	60.54	93.70	88.84	89.02	76.24
Iron and Alumina Oxides...	10.08	11.66	6.48	7.62	5.94	18.02
Lime Oxide...	2.84	12.48	Trace	Trace	3.92	1.28
Magnesia Oxide	Trace	3.64	Trace	Trace	Trace	Trace
Fine material through 60 mesh sieve, ..	51.50	66.50	24.00	39.00	70.00	36.50

There is only one sand that approaches the ideal engine sand and that is the one containing 93.70 per cent. of silica, a small percentage of iron and alumina oxides, and a trace of lime and the fine material through a sixty mesh sieve not exceeding 25 per cent. The silica in the other samples runs as low as 60.54 per cent., which sand contained a considerable quantity of iron and alumina oxides, lime and magnesia, the last two being present largely as carbonates.

A poor sand may not cause trouble in good weather, when everything is in its favor, but may fail utterly in bad weather, as the impurities contained are oftentimes such that when they become wet form a slippery mass.

The value of engine sand depends on five things: First, the amount of silica contained; second, the size of the grain, and whether same is smooth or has sharp angles; third, the percentage of fine material, as clay; fourth, the percentage of fine material, as silica; fifth, the percentage of iron and alumina oxides, lime, magnesia, etc., present as carbonates, or in other combinations.

Some sand for engine use is only grit. The term grit is applied to a very fine sand; the name sand being restricted to the coarser particles of sandy material. Grit, or fine sand, free from clay, is probably far better for engine purposes than a coarser sand containing considerable quantities of that material, as there would not be such a tendency to produce slipping on a wet track. But grit, or fine sand, is objectionable because it will not give the number of coarse particles when crushed under the locomotive as a coarse sand would before it becomes subdivided to such an extent that it is a powder. If the sand is crushed fine it forms a flat cake with a glazed surface and in that condition is no longer grit, but a slippery mass. When the weight of the modern locomotive is considered it is no wonder that the sand is easily pulverized. The fine material may be of two kinds, powdered silica or powdered clay, lime and magnesia. The last three are the most objectionable, as they have very little stopping quality. Powdered silica, if not too fine, serves as stopping material until crushed to a fine powder.

Sea sand, such as Rockaway sand, is almost an ideal sand for engine use. It being white shows at once that the percentage of iron and probably also alumina is low, which constituents tend to make a sand brittle.

Sand, artificially made from nearly pure silica rock, makes a splendid sand for engine use. To produce good engine sand artificially is rather expensive. The following is a method employed by one company which is turning out a very good sand: The rock is first quarried, then passed through an ordinary crusher, which reduces it to about the size of ballast. From the crusher the material is taken to a large set of steel rolls, where it is made still finer; then to the finishing rolls, which reduces it to sand. The sand is taken from the finishing rolls by a system of belt-conveyers and elevators to the drying department. The process of drying is done in a large revolving cylinder, 4 feet in diameter by 25 feet long, the inside of which is so arranged that in revolving the sand is caused to fall like rain. One end of this cylinder is provided with a furnace, which is heated by coke under a forced draft. As the sand passes from the cylinder it comes in contact with a strong current of air produced by a fan and a large portion of the dust is blown into a dust chamber. The sand is again elevated to a height of 70 feet, where it passes into a large revolving screen, in which the sand is again agitated as in the drying cylinder. The sieve is enclosed in a large box on the top of which are three exhaust fans, which suck practically all the fine dust from the sand. From here, the sand goes to the storage bins. Sand of this kind analyzes as follows:

Silica	95.65 per cent.
Iron and alumina oxides................	2.50 per cent.
Fine material through 60 mesh sieve......	25.00 per cent.

It is claimed that it takes much less of this artificial sand to do the work as compared with bank or river sand.

The following is a sample specification which might be used in the purchase of engine sand:

SPECIFICATIONS FOR ENGINE SAND.

1. Material purchased to this specification will be designated on orders issued by the purchasing agent as engine sand, and will be ordered in carload lots.

2. The material desired under this specification is a clean, white sand containing 95 per cent. of silica and free from clay or other foreign substances.

3. Engine sand ordered to this specification will be inspected upon its arrival at destination.

4. A representative sample of each carload will be selected by the inspector in the following manner: Small quantities of sand will be taken from six points on each side of the car and six through the center; same being removed from the top, center and bottom of the car. This will be thoroughly mixed and subjected to test.

5. The contents of a standard measure of the sample sand will be poured over a 60 mesh sieve, which must be thoroughly shaken and the material passing through returned to the measure. This amount must not exceed 35 per cent. of the full measure. A sample taken in the manner described may be forwarded to the test department for analysis, and must contain not less than 85 per cent. silica.

6. Any shipment which contains clay or other foreign material that does not conform to the requirements of the physical test or to the limit in chemical composition, may be rejected.

7. Rejected engine sand may be returned or accepted for other purposes at the option of the railroad company, but if returned shipper must pay freight both ways.

Shopwork as a Factor in Engineering Education

By Prof. Dexter S. Kimball

(Professor of Machine Design and Construction, Cornell University)

NOT many years ago the only way in which a young man could become an engineer was to enter the employ of some engineering firm and slowly work his way upward through the shop and drawing room, till by individual study and constant association he was considered able to design and superintend engineering work. There is no question as to the ability of the men so developed, as any one knows who has been at all closely associated with one of them; they were men of undoubted ability and endless resources. One of the greatest assets which these men possessed was their intricate knowledge of shop work, particularly of machine work and just as such knowledge strengthened the shop educated man, so today it is one of the most desirable features in the training of the modern engineer.

As the scientific side of engineering grew, it became less and less possible for an engineer to receive all his training, above his common school education, in the shop and the length of his school period has been gradually extended till now the average graduating age of students in our best engineering colleges is between 22 and 23 years. During the early days of technical education there was much discussion regarding the desirability of thus educating an engineer and many were inclined to favor the older and slower method. But it is now almost universally conceded that a technical education is not only desirable but almost essential for the man who wishes to attain his highest level in engineering work.

The devotion of so much of the young man's time to the pursuit of strictly technical studies of a necessity reduced the time available for instruction in shop work and actual construction. In addition it has always been difficult to make the necessary arrangements between commercial shops and schools so that the two branches

VIEW IN PATTERN SHOP SHOWING ONE-EIGHTH OF THE FRESHMAN CLASS AT WORK.—CORNELL UNIVERSITY.

of instruction could be carried on simultaneously although a few isolated cases of successful efforts of this sort exist or have existed. We find therefore that nearly all of our engineering schools have shops of some sort that have either been inherited as a legacy from industrial training of some kind, or have been established with a view of supplementing technical instruction with a knowledge of actual shop processes. Thus the engineering colleges that have grown up in the State Colleges of Agriculture and Mechanical Arts have all inherited more or less shop work from the old Mechanic Art Courses and where new schools have put in such equipment they have naturally followed more or less after the older schools and their instruction has been based on the older curriculum.

Now it is to be noted that these old school shops taught handicraft only and were in fact organized for that purpose. In the early stages of engineering education their instruction was no doubt sufficient. But the scientific side of engineering has grown apace and the information regarding shop practice which the modern engineer must have, to be most effective, is no longer covered by the simple instruction in handicraft given by these early shop courses. For just as the scientific side of engineering has grown so has the art of shop management and methods of production improved. The modern methods of producing parts in quantity, high speed steel, motor driving, improved handling devices, and in some branches, as the electrical business, a countless number of new processes are all indications of the growth of shop methods in keeping with the parallel growth of the technical side.

It is more difficult therefore for a young man to master all the details of all the trades which may be required in the work which he has chosen as a life calling, as in the case, say of an electrical engineer, even if he has the time to spend for that purpose in the shops themselves. And while there is no doubt that actual experience in a commercial shop is most desirable and in fact within limits absolutely necessary it is no longer desirable or necessary for a boy to serve the long apprenticeship required by the older method to make him a successful engineer. There is no doubt that the deeper knowledge an engineer has of all the trades pertaining to his specialty the stronger engineer he will be and there is no doubt that a considerable amount of manual skill is necessary, but it is no longer possible to teach a boy all the trades which may be connected with the specialty he may chose as his life work.

VIEW IN MACHINE SHOP SHOWING LATHE SECTION.—CORNELL UNIVERSITY.

Unquestionably it would be better if the desired instruction on the practical side of engineering could be given in a commercial shop, but it has been found very difficult to obtain this instruction, particularly in schools where the attendance is large, and modern manufacturing methods are every day making it harder still to make the desired arrangements. And besides there is a certain part of this instruction which will be touched on later that can be better given in the school-room. Nearly all engineering schools therefore give what instruction they can along these lines and expect the student to supplement the knowledge with actual shop work after graduation, or during summer vacations.

The question, then, is, what shall be the character of the shop instruction in the college shop? An examination of the field of engineering will quickly show that the requirements of the engineer in modern practice are vastly different from what it was even a few years ago. New materials, new tools, new methods of manufacturing and new methods of shop management have radically changed the character of the information which the engineer must have, and it is more important that he should have a clear idea, say of the elements that go to make up the cost of a piece, than to have skill in the process of welding. Because engineering is a commercial business, and no man can be a successful engineer who has not a clear idea of the effect of the various departments of the modern complex organization, which we now see in even fair sized manufacturing works, on the cost of production. The commercial side of production is therefore a logical and necessary part of the the engineer's equipment and some of this can be imparted to him in college as well as in the field. And in our best colleges attention is now being given to this phase of education not only in connection with shop work but in all lines of engineering training.

While therefore the engineer should have considerable manual skill it is manifestly impossible for him to be an expert at all the trades; but he must have a good working knowledge of shop processes, manufacturing methods, and the commercial features of his specialty; and the modern course of shop instruction should provide what it can along these lines. It is also to be noted that this instruction can be given without any sacrifice

SET OF EXERCISES IN PATTERN MAKING, 150 HOURS WORK.—CORNELL UNIVERSITY.

of manual training. A student can learn to turn wood while making elementary patterns just as well as in turning vases and ornamented work so much used in manual training work. And it is very easy to explain

VIEW IN FOUNDRY SHOWING CLASS IN MOULDING AT WORK.—CORNELL UNIVERSITY.

to a student in the machine shop the methods by which pieces are made in duplicate which also adds a great deal of interest to the work. By a judicious selection of exercises any shop course can be made singularly instructive in manufacturing principles as well as effective as a means of imparting manual skill.

The shop courses in Sibley College are conducted along these lines. Thus Fig. 1 shows a set of patterns made by the freshman class and the result of a total of 200 hours work. In the beginning a few simple exercises are given on the use of tools, and the student is at once put to making simple patterns, each one leading to a more complicated one and each intended to illustrate some principle in pattern work. These same patterns are afterward moulded in the foundry and the castings are used in the machine shop as exercises. In addition these exercises are also used in the drawing room as drawing exercises so that the student is given a general idea of all the steps necessary to the complete production of a piece of machinery.

In the machine shop particular attention is given to economical ideas and a course of lectures running parallel to the shop work discusses the principles that underlie modern manufacturing methods, cost of production, time keeping systems and manufacturing principles generally. The exercises in the shop, which contains some automatic and semi-automatic machinery are designed with these ends in view, and it has been found that this auxiliary work not only gives the student instruction in these most important matters but really acts as an incentive to him in his more practical work. In this shop particularly an effort is made to illustrate actual modern shop methods, the student keeping his time on a regular time clock and in many other ways conforming to commercial practice. The first exercises here are elementary and intended to familiarize the student with machine tools and then he is put at work on regular machine work making some part for one of several machines which are continually under construction.

The accompanying cut shows the various shops and their equipment. The pattern shop has facilities for 450 students, the forge and foundry each can accommodate 200 and the machine shop about 300. The pattern-making is given in the freshman year, the forge and foundry in the sophomore and the machine shop in the junior year. At present instruction is being given to about 850 students which includes no members of the senior class. The total attendance in all classes in Sibley College is now about 1,100.

VIEW IN FORGE SHOP SHOWING STUDENTS AT WORK.—CORNELL UNIVERSITY.

Courses in Railway Engineering, University of Illinois.

A pamphlet has been issued by the University of Illinois giving information in regard to the courses of Railway Engineering and Administration, offered by the institution. It is expected that these courses will prepare men to become efficient workers in the department of motive power and maintenance of way and in the financial, traffic and operating departments. Illustrations are shown of the steam and electric railway test cars which are used in connection with these courses and other data giving general information.

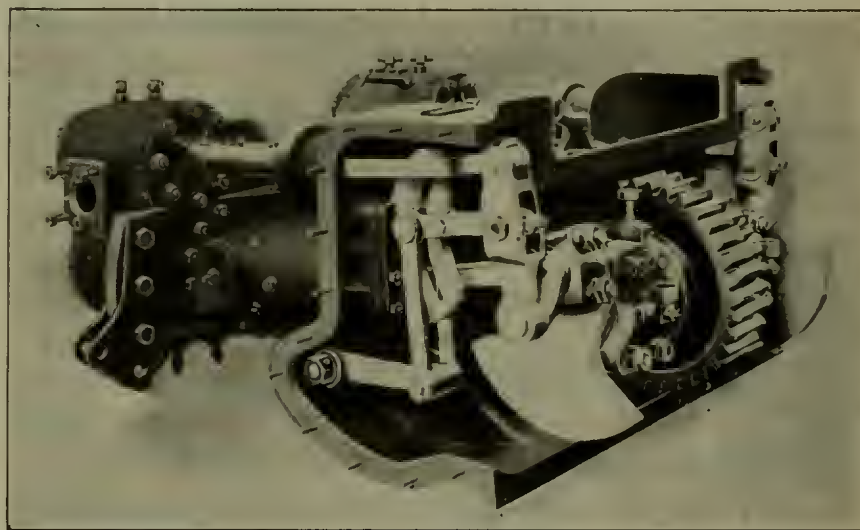
Ganz Steam Motor Car

C. R. I. & P. Ry.

THE Chicago, Rock Island and Pacific Railway Co. is soon to receive a Ganz self propelled steam motor car from the Railway Auto Car Company, New York, the American company which controls the patents and manufacturing data for the Ganz system. The general plan and elevation of this car is shown herewith and from which it will be seen that the total length over end sills is 54 feet 10¾ inches. The car has seats for 52 passengers including 16 in the smoking compartment. The baggage room is 7 feet, 1¾ inches long and the motorman's compartment at the forward end of the car which contains the generator and accessories is but 6 feet 4¾ inches long over all. The coal bunker is supported over the front end sill and the coal is removed through a small sliding door opening into the motorman's compartment. The coal bunkers carry sufficient fuel for a continuous run of 50 miles.

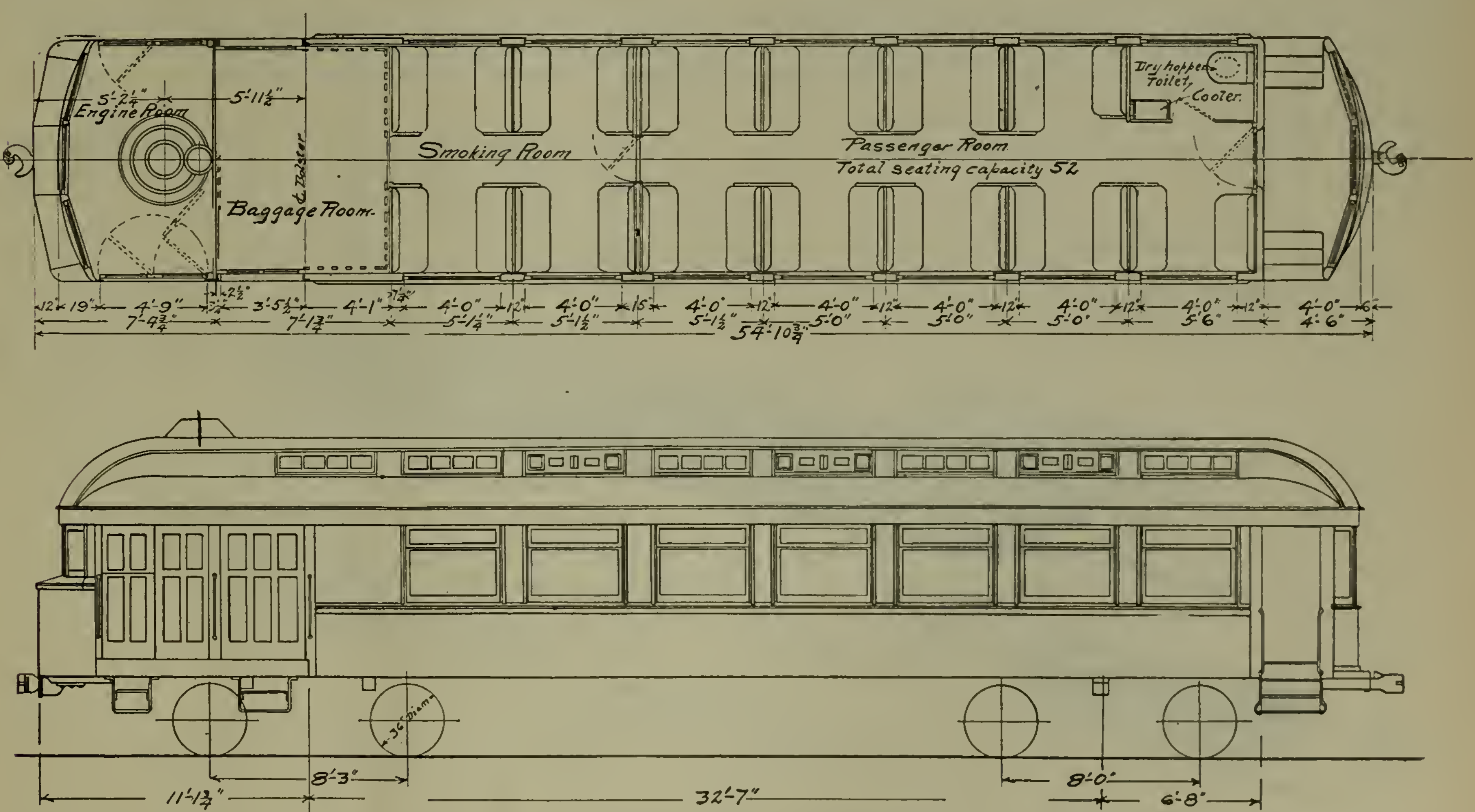
The feed water for the steam generator is carried in two longitudinal steel tanks suspended from the underframe of the car. These tanks have a total capacity of 600 gallons or sufficient for a continuous run for about 60 miles. The steam generator is of the standard Ganz type and 42 inches in diameter outside. This steam generator is capable of developing a maximum of 120 H. P. in conjunction with the compound steam motor which is mounted in the forward truck and which drives on the rear axle thereof.

The accompanying photograph shows the steam motor with the cover enclosing the gears and link motion removed. This motor is compound and steam jacketed and is entirely enclosed. The gear case is partly filled with oil so that all moving parts receive a continuous and thorough lubrication. The normal speed of this motor is 600 revolutions per minute although it can be operated satisfactorily up to a speed of 900 revolutions per minute. The working pressure is 270 pounds per square inch and the steam is superheated. The motor is controlled absolutely from levers conveniently located at the right hand side of the motorman's compartment.



GANZ STEAM MOTOR, WITH CASING REMOVED. HORSE-POWER, 120; SPEED, 600 R. P. M.—GANZ STEAM MOTOR CAR C. R. I. & P. RY.

The car body is of all steel construction with the inte-



PLAN AND SIDE ELEVATION OF GANZ ALL STEEL MOTOR CAR FOR C. R. I. & P. RY. WEIGHT OF CAR 36 TONS; HORSE POWER OF MOTOR 120; SPEED OF CAR ON LEVEL TRACK 35 MILES PER HOUR.

rior finished in quartered oak. The design of the car body is in accordance with what is now considered to be the most advanced practice in passenger car design. That is to say the vertical load of the car is taken care of by the sides of the car which form deep girders, while the buffing strains are taken care of by relatively light longitudinal center sills. The total weight of this car in working order fully loaded is 36 tons. The car is equipped with Westinghouse automatic brakes and the air compressor is of the axle driven type and mounted on the trailer truck.

The car is designed to maintain a speed of 35 miles an hour on level track, 24 miles an hour on a 1 per cent grade and 15 miles an hour on a 1½ per cent grade. The car is also capable of hauling a trailer at a speed of 30 miles an hour on a level track and 15 miles an hour on a 1 per cent grade. The fuel is to be coke and the consumption is not to exceed 16½ pounds per mile.

This is the first standard car of the Railway Auto Car Company which will be built and delivered in this country, and its performance will be watched by railway mechanical men with a great deal of interest.

New Locomotive Shops at Battle Creek

Grand Trunk Railway.

THE shops of the Grand Trunk Railway System, now under construction at Battle Creek, Michigan, are to be the general locomotive shops for the lines west of the St. Clair and Detroit rivers. The divisions involved include about 1,000 miles of road, and 300 locomotives, and as the small shops are unable to handle the large power, improved facilities are imperative. The location is well chosen as Battle Creek is the logical centre of the Western Division, and is an important freight and passenger division point, with good yard and terminal facilities. It is a natural distributing point for supplies for all departments, and an attractive home city.

The shops are about two miles from the business district of the city, and a half mile from the present street railway terminus. They occupy a tract of 188 acres adjacent to the present freight yard and main line tracks.

Plans here presented show only the locomotive department, but the requirements and relation of a future car department have been carefully considered, and the complete general shop layout is characterized by the following features:

A midway crane of 70 foot span, at right angles to the base line tracks, travelling through the centre of the group of buildings of both departments, will handle all the cross-yard traffic and be supplemented by a net-work of industrial tracks and turn-tables of standard gauge.

A system of through tracks parallel to the main line will serve all departments and be connected to the main line at both ends of the shop yard.

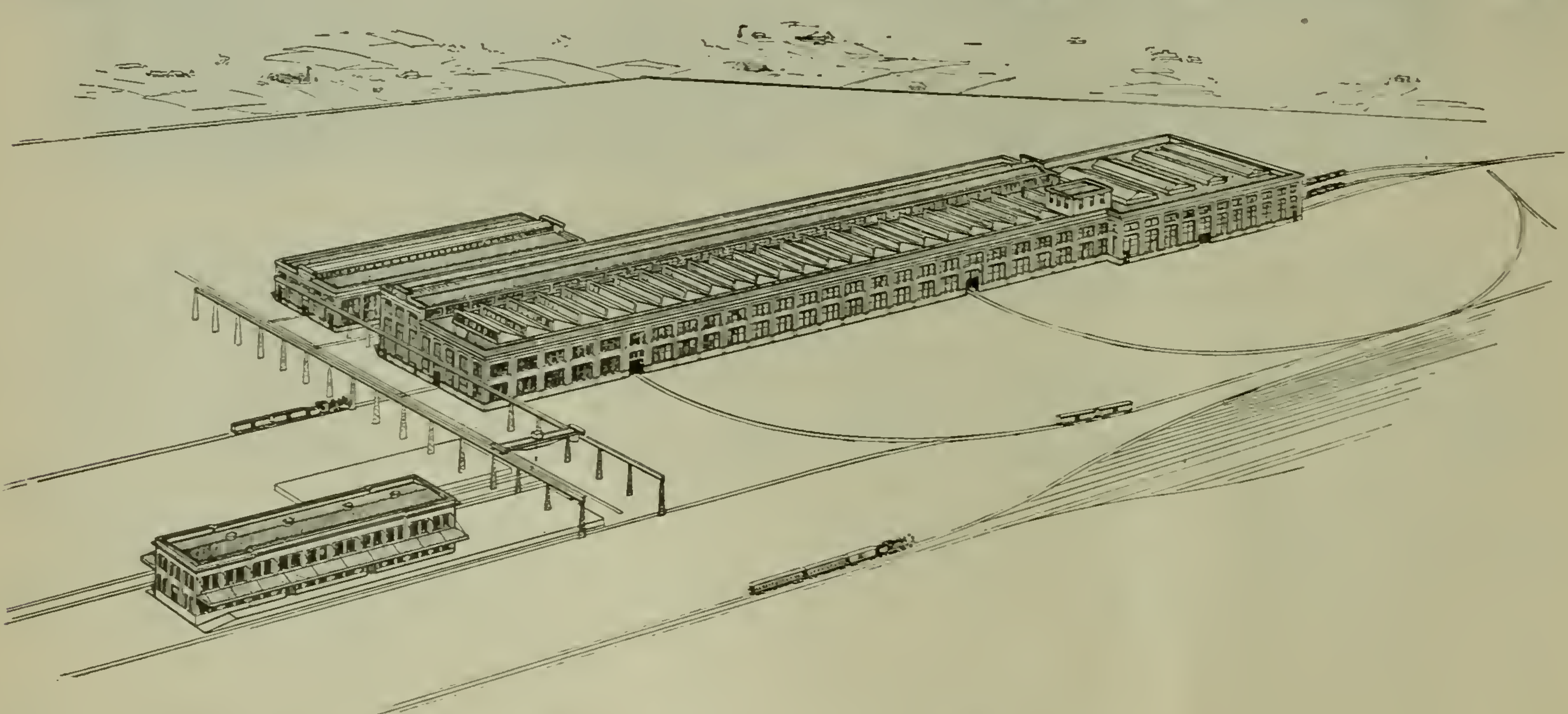
Provision has been made for 100 per cent increase in all departments without in any way interfering with future yard traffic and without materially increasing the future travel between departments.

The buildings are separated from each other by a minimum distance of 50 feet for fire protection.

There is ample yard space tributary to each building, yet the layout is not spread over an unreasonable area.

An economical use has been made of the property, and a liberal provision left for the Maintenance of Way, Bridge and Building departments at the eastern end of the yard.

The power house is centrally located, all large power consuming buildings being within 1,000 feet. It will be



GENERAL VIEW OF NEW LOCOMOTIVE SHOPS AT BATTLE CREEK.—GRAND TRUNK RY.

adjacent to the future planing mill, which in addition to being a large power consumer, will produce a vast amount of shavings and refuse, which can easily be disposed of as fuel at a profit in the power house.

A feature of the transportation facilities is the provision made for a system of mono-rail electric cranes, which will supplement the ordinary travelling crane service. In this system any or all of the regular cranes become transfer cranes, connecting with I-beam runways extending throughout the shops and yards. These runways will be installed as the plant develops and as rapidly as the needs require.

THE LOCOMOTIVE SHOP.

This building includes both the locomotive machine and erecting shop as well as the boiler and tank shop, and the machine department of the latter. In order to prevent the length of the building from becoming excessive when the future extension is added, a departure from the usual proceeding has been made in placing the boiler and tank shop at right angles to the main part of the building.

The building is a self-supporting steel frame structure, with brick walls and a concrete roof. The overall length is about 823 feet, and the maximum width about 185 feet. The boiler and tank shop is separated from the machine and erecting shop by a brick curtain wall, which will in a great measure prevent noises from the former shop reaching the main building. An opening is provided in this wall large enough to pass a boiler.

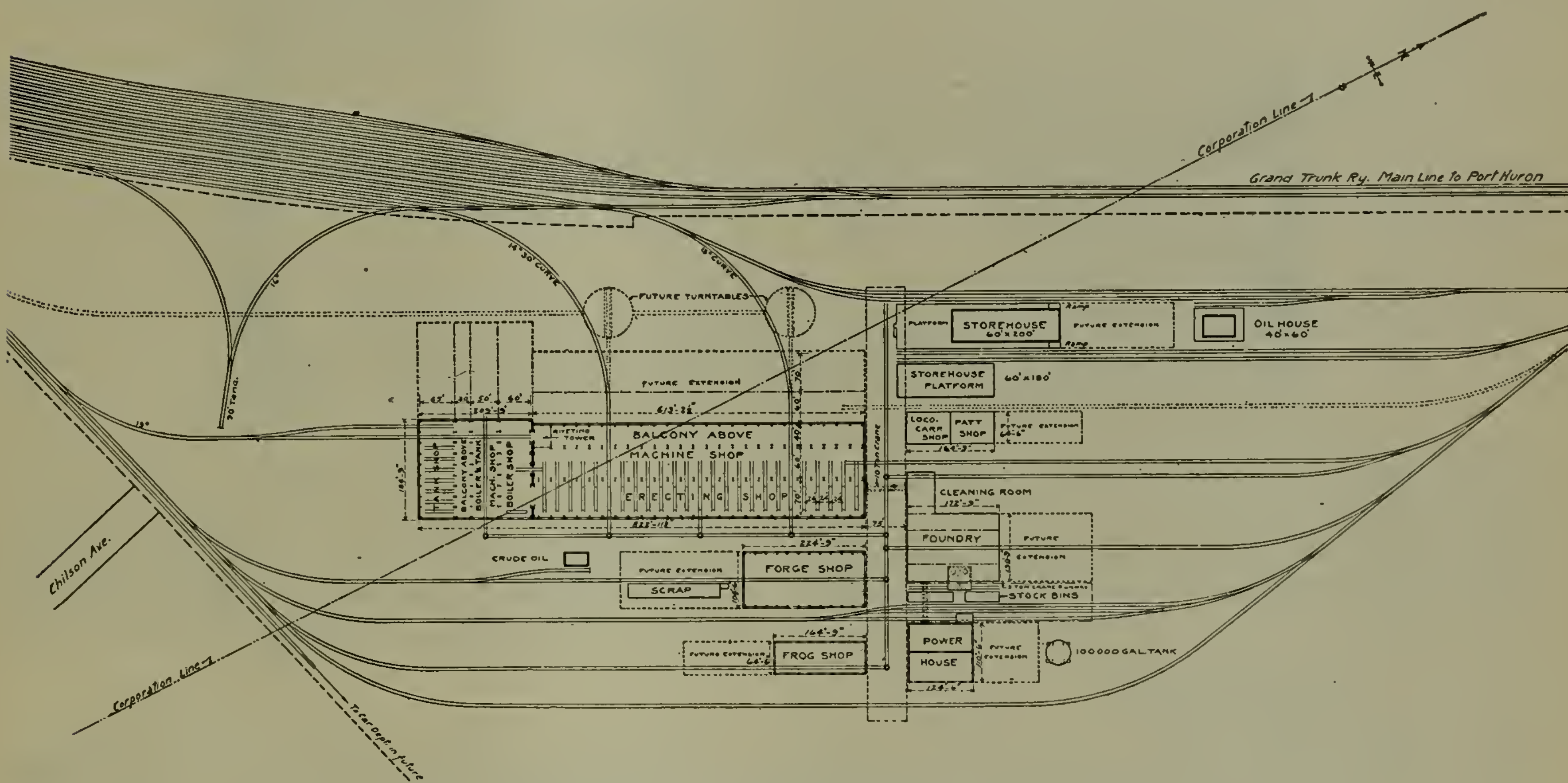
The erecting bay is 70 feet in width and contains 25 pits on 24 foot centers. Locomotives will enter and leave the buildings from the west side, and, until future extension is made, the use of turn-tables has been avoided. Each pit will be provided with compressed air, water, steam and electrical connections, while the entire shop will be served with a 120 ton crane and an auxiliary crane immediately beneath, of 10 tons capacity.

Paralleling this shop is the locomotive department of the machine shop, in two aisles, one with crane service for the large machines and one without crane service containing small belt-driven tools. Above the latter is a gallery for heating fans, lavatories, locker-rooms, the tin shop and the air-brake department. Alternate columns in these two aisles will be provided with compressed air and water service connections, while on every few columns the water service connections will be extended to the roof.

The boiler shop is in the first aisle of the part of the building at right angles to the main shop. Stalls are located on 30 foot centers, with 60 feet of clear width between columns. Opening from this shop is the riveting tower, situated so as not to interfere with any other department, and, at the same time, conveniently located for direct service from the boiler shop crane. A 30 ton crane serves the boiler shop and a 20 ton crane the riveting tower.

The boiler and tank machine shop extends throughout the next aisle and is served with a 10 ton crane, while beyond is the tank shop, of sufficient width to allow room for a tank and its frame on a single stall. A balcony for heating apparatus, lockers and toilet rooms will extend over a portion of this shop; a 30 ton and a 5 ton crane supplying all the transportation facilities necessary.

The entire building will be heated by indirect radiation, steam or hot water being used in the heaters. Fans and heaters will be located on the balconies, the hot air being distributed through a system of underground ducts with openings in the walls and locomotive pits, and



LAYOUT OF NEW LOCOMOTIVE SHOPS AT BATTLE CREEK.—GRAND TRUNK RY.

through an auxiliary distributing system of galvanized iron ducts extending along the west wall of the building under the balcony.

All tools throughout the building will be driven by individual motors when of sufficient size, while smaller tools will be grouped and driven by a single motor or connected with line shafting under the balcony. All wiring will be concealed, a main wiring tunnel extending throughout the building with cross ducts in each bay.

Particularly good natural lighting is obtained from the large windows and from the sky-lights, and saw-toothed roofs.

BLACKSMITH SHOP.

This building is a self-supporting steel frame structure with brick walls, 105x225 feet. A jib crane will serve the large fires, furnaces, and the heavy tools. A total of about 40 fires will be installed, with a full equipment of steam hammers, punches and shears, bolt headers, up-setting machines, etc. The floor will be of cinders laid on tamped clay. Individual motor drive will be used on all tools that require it, while smaller tools will be grouped and driven by motors from line shafting.

This building is designed to give good ventilation; a monitor equipped with swinging windows, extending the entire length of the roof. A small amount of heat will be supplied by direct radiation. This will only be used to keep the building warm over night, as the forge fires will give the required amount of heat during working hours.

IRON FOUNDRY.

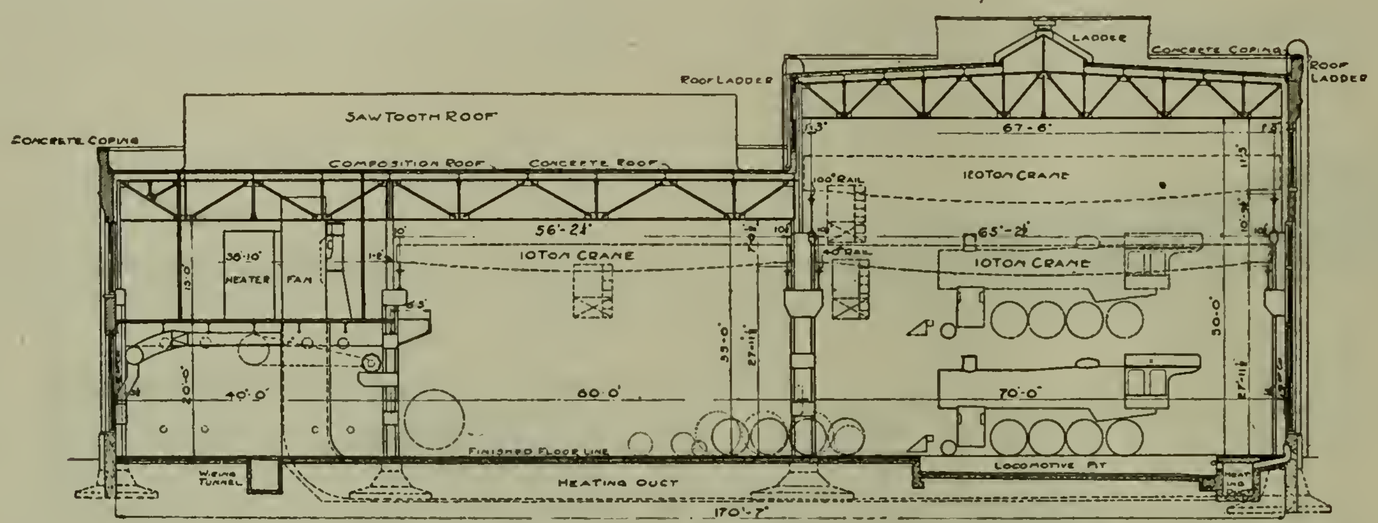
In locating the iron foundry, care was taken to have it convenient both to the storehouse and the locomotive shop, the principal consumers of its output. A 20 ton crane reduces the manual handling of ores, ladles, castings and flasks to a minimum, while an outside crane of 5 tons capacity, running between it and the power house, will serve the charging floor. This crane will be of more utility than an elevator, as coke can be unloaded directly from cars either into bunkers or onto the charging platform; pig iron can be easily delivered to the platform from any part of the yard, and truck loads of slag can be transferred to the ash car near the power house.

A system of narrow gauge tracks and turn-tables in and about the foundry will supplement the cranes.

The brass foundry 30 feet by 72 feet will be located in one side of the foundry building. It will be equipped with one or more furnaces of the converter type and with other modern appliances.

The cleaning room of the foundry is contained in a wing 48x81 feet, and this portion of the building will be served by a 5 ton crane, which will run into the main part, thus facilitating the transportation of castings to the cleaning room.

The building will be a self-supporting steel structure with brick walls, a cement roof, and exceptionally good lighting. The floor will consist of a fill of moldings and on the natural soil. The equipment will be designed for an output of 20 tons per day.



CROSS SECTION OF MACHINE AND ERECTING SHOPS. NEW LOCOMOTIVE SHOPS AT BATTLE CREEK.—GRAND TRUNK RY.

THE FROG SHOP.

The frog shop will also be of brick and steel design, of construction similar to that of the other buildings. It will be 65x165 feet and will be supplied with crane service. All the frogs, switches and crossings required on the Western division will be built here.

THE PATTERN AND LOCOMOTIVE CARPENTER SHOP.

This building will be similar to the others in design and of such construction that the pattern storage rooms will be absolutely fire-proof. Its size will be approximately 65 feet by 165 feet.

THE STOREHOUSE.

In contrast with the average locomotive repair shop storehouse of semi-fire proof construction, in this case the storehouse will be absolutely fire-proof throughout, of concrete construction, with brick walls, occupying a space 60x200 feet. All stores will be kept on the ground floor and the upper story reserved for the offices of the storekeeper and master mechanic. The building will be liberally supplied with platform space and track facilities on each side which will permit easy access for loading and unloading supplies while not impeding traffic between the shops and the store. The platform in front of the building extends under the yard crane, allowing materials to be easily transported.

THE OIL HOUSE.

The oil house will also be of reinforced concrete construction, of similar design to the storehouse, and will have one story and basement, the latter containing the large tanks used for oil storage. These will be arranged for filling by gravity from tank cars on the tracks at grade level. The upper floor will be surrounded by a concrete platform with inclines to grade. A fire wall will separate a room for waste from the oil service room. Oil will be handled by the most approved methods. Every precaution will be taken to have this building fire proof and its isolated position with regard to the remaining buildings gives additional protection from fire hazards.

POWER PLANT.

The power plant is designed with a view of supplying all the power necessary for operating the plant and for heating during the winter months, and to supply sufficient steam for all steam driven tools, also for operating an auxiliary generating unit of 200 k. w. capacity which will be used in emergency in the event of it being decided to purchase power which question is now under consideration. Should the power be purchased the necessary transforming apparatus will be installed in the power house, current being received at 5,000 volts and distributed for shop use at 440 and 110 volts alternating current and 220 volts direct current. Alternating current motors operated on the 440 volt circuit will be installed wherever possible, being used to drive line shafting and individual crane and machine tool motors that do not require excessive variations in speeds. Variable speed motors and a few crane motors will be run on the 220 volt direct current system, and all lights on the 110 volt line. Also if power is obtained from outside sources the capacity of the boiler plant will be governed by the amount of heat required in the various buildings in the winter time, and in order to heat the buildings during the coldest weather it will be necessary to install approximately 1,800 boiler horse power. Steam will be taken from these boilers and used in connection with the blower system and distributing ducts in all the larger buildings, and in the smaller buildings the heating will be obtained through direct radiation.

PIPING SYSTEMS.

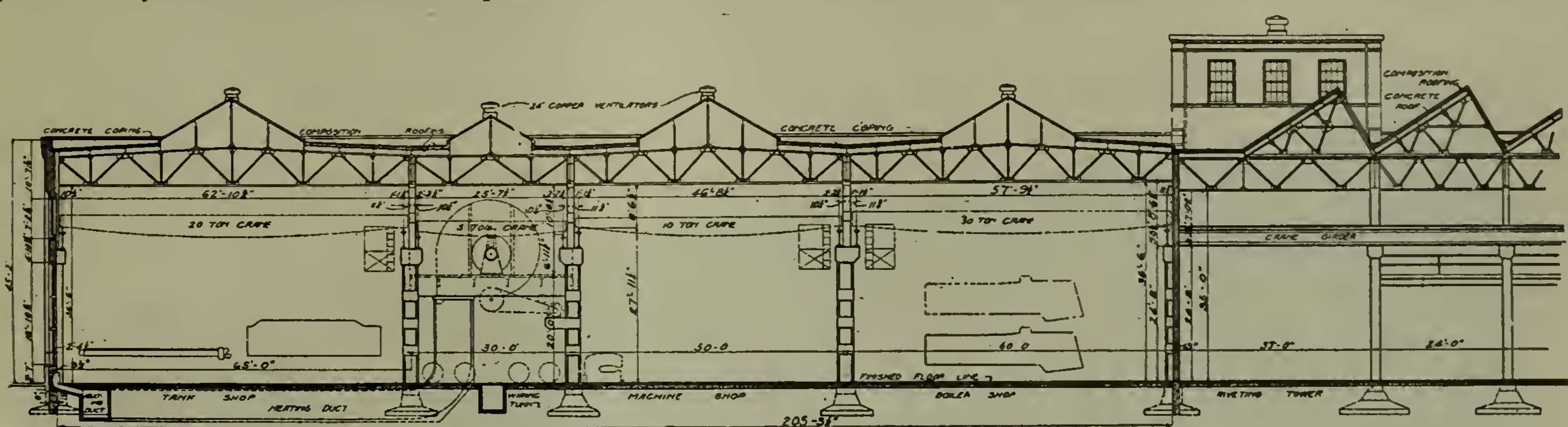
Piping from the power house to the shops will, as far as possible, be carried on the supports of the midway crane. This obviates the necessity for a tunnel, in this case, hard to drain. Air compressors will be located in each building, furnishing the necessary air for that building, different buildings being connected through a small pipe line, which will prevent absolute shut-down in case the compressors in any particular building fail.

Water for shop and boiler purposes will be taken from Battle Creek river, a pumping station with electrically driven pumps being located at the bank of the creek. This pump will force water into a 150,000 gallon tank located in the vicinity of the power house, the latter giving sufficient pressure to supply the various buildings. This tank will be divided into two portions, one of 50,000 and the other of 100,000 gallons capacity, the latter being kept in reserve in case of fire. The river pumps will be supplemented by fire pumps in the power house, which can be used on the line in case of necessity. As a supplementary water supply, connection will be made with the city water service of Battle Creek, it being the intention to use this supply for drinking water and for all purposes only in case the supply from the Battle Creek river should fail for any reason.

The water service lines will loop all the buildings, and from 40 to 50 hydrants will be placed in different parts of the yard, so that there will be no distance greater than 300 feet between any two hydrants. Inside of the buildings, hose connections will be placed every 200 feet, with a swinging hose reel and 75 feet of hose.

SEWER SYSTEM.

It is the intention at the present time to discharge all sewage into Battle Creek river, with the understanding that should this sewage become objectionable at any future time it will either be treated or the system changed to discharge all the sanitary sewage into the sewer system of the town.



CROSS SECTION OF BOILER AND TANK SHOPS. NEW LOCOMOTIVE SHOPS AT BATTLE CREEK.—GRAND TRUNK RY.

Mr. E. H. Fitzhugh, Third Vice-President of the Grand Trunk Railway Company is in active charge of the arrangements for the entire installation, and Mr. W. D. Robb, Superintendent of Motive Power, Montreal, is planning the operating features of the shops. The shops will be operated under the supervision of Mr. J. T. McGrath, Master Mechanic now in charge of the Fort Gratiot shops, who is co-operating with Mr. Robb in selecting and arranging the tool equipment.

Plans and specifications have been prepared for the entire installation by The Arnold Company, Consulting Engineers, of Chicago, who are also acting as supervising engineers on the work.

All Steel Box Cars

Union Pacific Railroad.

ALTHOUGH steel has entered largely into freight car construction and there has been considerable development of the steel passenger car, the two sample all steel box cars recently built by the Union Pacific Railroad at their Omaha shops, are an advance step in the use of steel as applied to cars of this type. The accompanying illustrations show the original design of these cars and the practical manner in which steel has been used in their construction. The cars are built after the same general dimensions and specifications, but a different arrangement is followed in regard to side sills and bracing for the purpose of testing the comparative value of two designs. The principal dimensions, with the variations in weight, etc., resulting from the modified designs of the two cars are shown in the following table:

	Car No. 72,851	Car No. 72,850
Length, inside	40 feet	40 feet
Width, inside	8 ft. 10⅛ in.	8 ft. 10⅛ in.
Height, inside	7 ft. 10 in.	7 ft. 11 in.

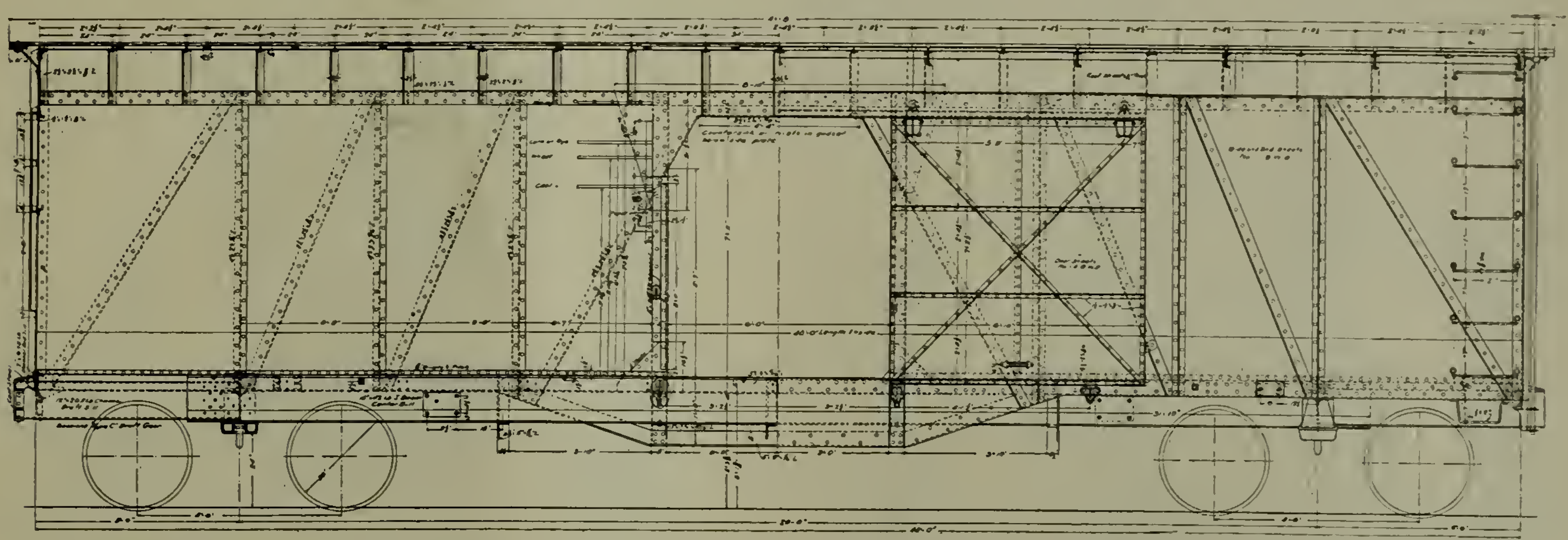
ALL STEEL BOX CAR, NO. 72851, UNION PACIFIC R. R., WITH SIDE SILLS OF LONG TRUSS CONSTRUCTION. WEIGHT OF CAR 38450 LBS.

ALL STEEL BOX CAR, NO. 72850, UNION PACIFIC R. R., WITH SIDE SILLS OF SHORT TRUSS CONSTRUCTION. WEIGHT OF CAR 38050 LBS.

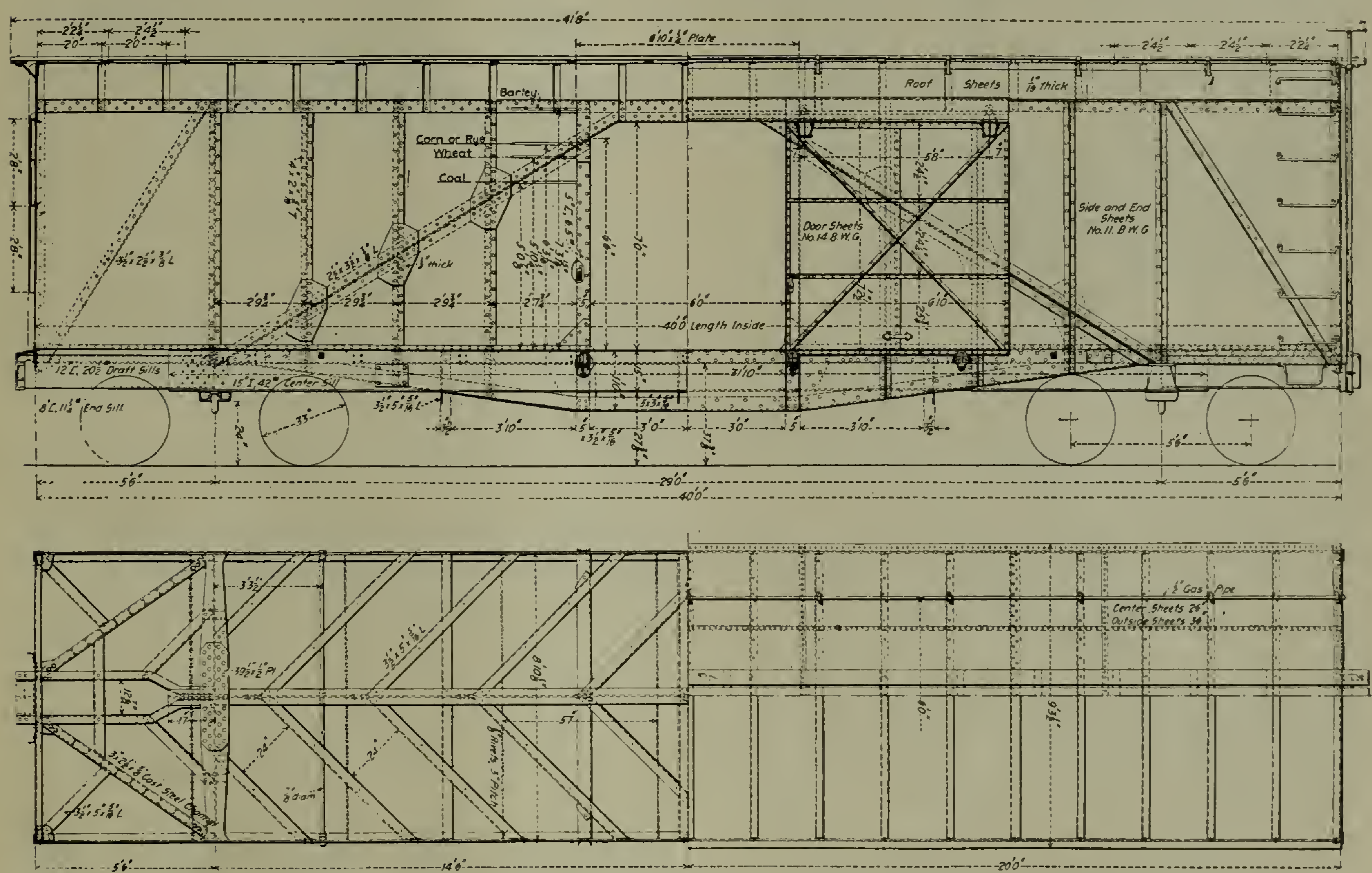
Height of top above rail	12 ft. 5⅝ in.	12 ft. 6⅝ in.
Capacity, pounds	100,000	100,000
Capacity, cu. ft.	2,770	2,800
Light weight, lbs.	38,450	38,050

It will be observed that although the light weight of car 72,850 is 400 pounds less than the other car, its height inside is 1 inch greater and the capacity is increased 30 cubic feet. The light weight of this car is also 4,150 pounds less than that of the standard 40 feet wooden box car of the Harriman Lines.

The load is carried by a single center sill and the plate girder sides and side sills. The side plates are extended below the floor of the car and by means of angles, a side sill of the fish belly type is built up, the truss having a depth of 22 inches at the center. The arrangement of side bracing and design side sills constitutes the principal difference in the construction of the two cars. This is clearly shown by the photographs. Car 72,851 has 10 vertical and 4 diagonal braces on each side, with a side sill of the fish belly type having a long truss. Car 72,850 has 8 vertical and 8 diagonal braces in each side, after the pattern of a Howe truss, with side sills of the



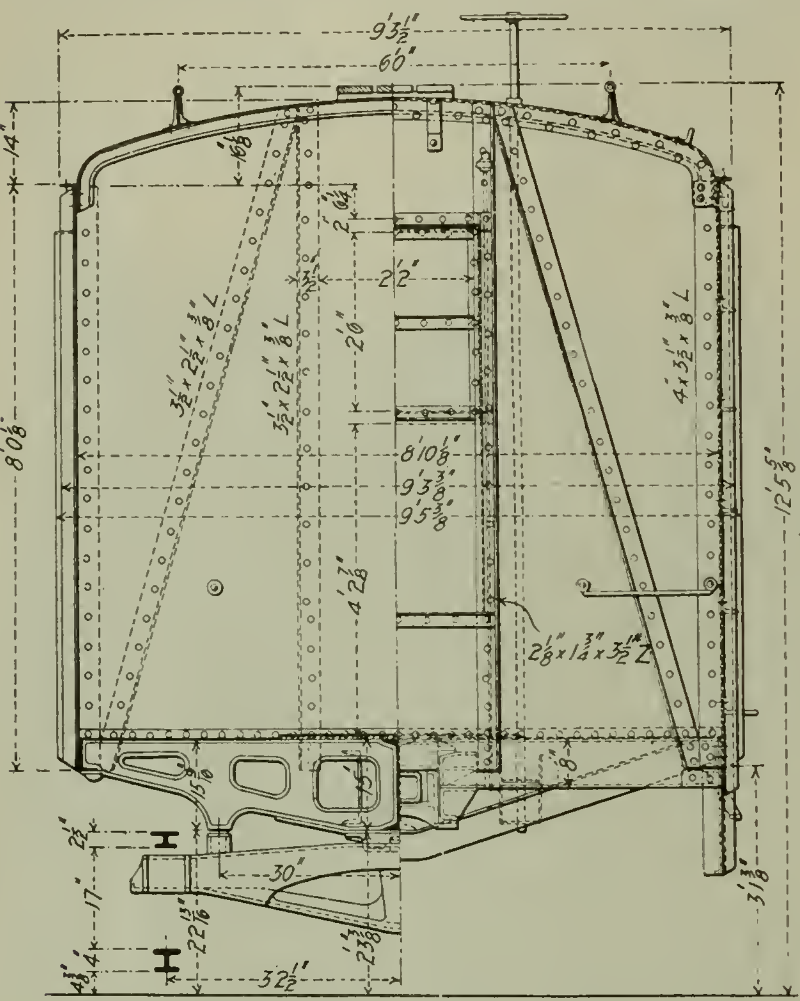
SIDE ELEVATION OF ALL STEEL BOX CAR NO. 72850, UNION PACIFIC R. R., SHOWING CONSTRUCTION OF CAR AND DESIGN OF SIDE SILLS



SIDE ELEVATION AND PLAN OF ALL STEEL BOX CAR NO. 72851, UNION PACIFIC R. R. THIS CAR HAS SIDE SILLS WITH LONG TRUSS CONSTRUCTION. THE PLAN IS THE SAME FOR BOTH CARS.

fish belly type, in which the truss is about one-half the length of the other design.

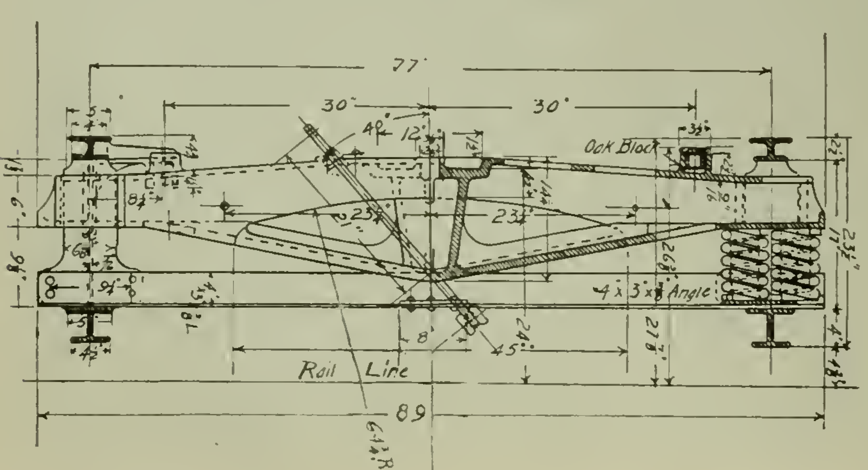
The single center sill is a 15 inch 42 pound I beam which extends 17 inches beyond the center of the body bolster. The draft sills are 12 inch—20½ pound channels spaced 12⅞ inches apart and are riveted to the web of the center sill as shown in the illustration. A system of structural iron braces arranged diagonally with the



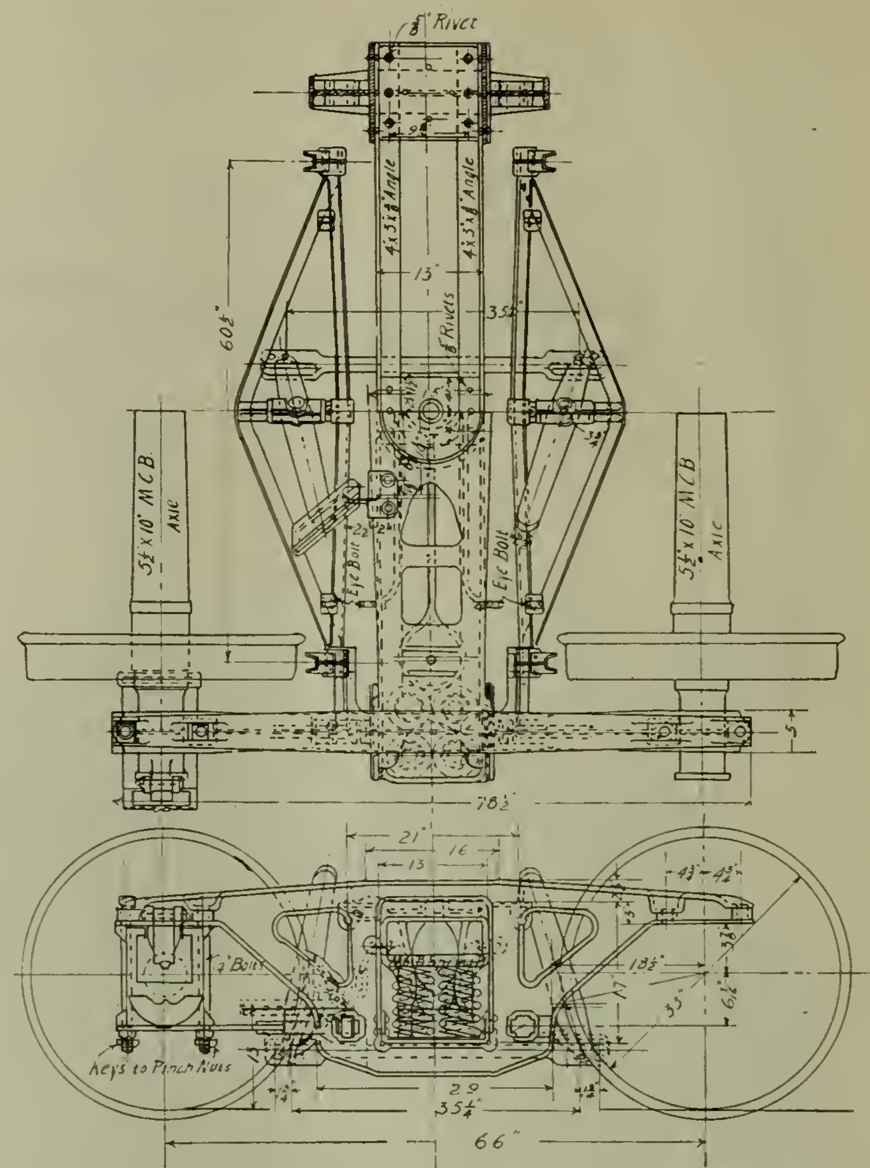
END VIEW OF ALL STEEL BOX CAR.—UNION PACIFIC R. R.

draft and center sills form a light but stiff construction for the body framing. The roof is semi-elliptical and supported by 2½ inch angle carlines, spaced 24 inches apart. The ends of the car are reinforced by 2 vertical and 2 diagonal angle braces. The interior of the car is smooth as all braces and framing are on the outside.

The side and end sheeting are No. 11 B. W. G., the roofing sheets 1/16 inch steel, the door sheets No. 14 B. W. G., and the floor No. 10 B. W. G., with one thickness of tar paper between joints The body bolsters are cast steel of the two piece type, secured to the center sill by top and bottom cover plates. The cars are



END VIEW AND SECTION THROUGH TRUCK, ALL STEEL BOX CAR UNION PACIFIC R. R., SHOWING CONSTRUCTION OF BOLSTER AND SIDE FRAMES.



PLAN AND ELEVATION OF TRUCK, ALL STEEL BOX CAR, UNION PACIFIC R. R., SHOWING ANDREWS CAST STEEL SIDE FRAMES.

equipped with Sessions type "C" draft gear. The trucks have Andrews cast steel side frames with 600 pound wheels mounted on M. C. B. standard 50 ton axles. Wooden running boards are provided with safety rails placed 3 feet each side.

As these cars represent the extreme development in the application of steel to cars of this type, their performance will be watched with a great deal of interest. The designs were prepared under the direction of Mr. W. R. McKeen, Jr., Superintendent of Motive Power and Machinery, to whom we are indebted for the illustrations presented.

One Side of the Sixteen Hour Rule.

During the past three weeks officers of a certain railway have been quietly testing the proposed sixteen-hour working law for employes of the train service. Though the train crews have not been advised that shorter working time was being experimented with, the management of the road has proceeded as though the measure now before Congress were a law.

The scheme is to ascertain just what the employes think of the bill—whether they desire to work as long as they feel capable, earning extra money, or have an impassable limit placed upon their labor time.

Some interesting results have accompanied the tests. One freight train had consumed the allotted sixteen hours when it reached a point six miles from the end of the run. The crew was notified that the sixteen hours were up and that the train must be sidetracked for eight hours, the time required by the proposed bill for rest.

The trainmen were indignant and said they would walk home. The officers said they must not leave their train. With this particular crew the proposed law will never be popular. Officers of the railroad assert that the experience of this train and crew would be a common one under the law.

Communications

Transfer Tables for Locomotive Shops.

Editor Railway Master Mechanic:

The very pertinent question is asked "Should the modern locomotive shop be equipped with a transfer table in addition to the large crane provided for wheeling and un-wheeling locomotives."

Very strong arguments have been advanced for and against the transfer table, some of which are the additional cost of installation and maintenance; the extra number of doors in the erecting shop, increasing the amount of cold air admitted to the shop, and the fact that the same transfer table may be placed on the crane runway, where it may be used for general service on the erecting floor.

The transfer table advocates favor the transverse shop and cite in its favor, delivering the engine on the pit where it is to be repaired without interfering with the light crane operation on the erecting floor; the possibility of testing and completing all classes of engines ready for service before they leave the shop, running them on to the transfer table under their own steam, without interfering with the other operations on the erecting floor; the use of the space occupied by the center track for additional machinery and for an extra repair pit. The transfer table gives a positive means of transferring material the full length of the shop without interruption. This service is not always possible with the light shop crane as the heavy crane will interfere with the light crane passing the full length of the shop, particularly while engines are being wheeled and un-wheeled.

If we consider a transverse shop with 22 working pits and one large crane with an out-put of two locomotives to be delivered to and from the shop on one track over the turntable, the engine is first delivered on the center track under the large crane, raised and deposited on the track where the repairs are to be made, and to do this all parts on the forward end and under the deck of the engine that interfere with the crane sling and cradle, must be removed before taking the engine in and cannot be applied until the engine is returned to the center track.

On certain classes of engines, particularly where the air drum is located under the deck where it would interfere with the crane sling, it is necessary to hold the engine on the center track until the drum is applied, the piping completed and the engine tested. The small crane cannot operate in this section while the engine is being moved to and from the center track and experience proves it is difficult to keep the men at their work while engines are passing over, owing to the danger of small loose parts falling from above.

The next operations are removing of the rods, taking wheels out, replacing the wheels, replacing the rods, and delivering the engine to the center track, a total of six operations for each engine, with two engines per day, this makes a total of twelve operations per day for the large crane, not to mention the movement of boilers to and from the boiler-shop for the engines and the moving of the engine frames in and out of the shop.

Where the daily schedule is delayed, which occurs in all shops, and the weekly out-put is maintained, it requires expert dispatching to avoid collisions. At times it is necessary to return an engine to the shop and lift it over with the crane on account of some defect that developed while the engine was being broken in; to do this requires additional stripping, cutting off the tender and its accompanying interference.

With the transfer table, engines are delivered to and from the shop, moved by cable for removing and applying the rods, giving the continuous service of the large crane to the wheels and stripping gang, reducing the operations of the large crane to two per engine instead of six per engine. With an auxiliary hoist on the large crane, we have the use of the large crane for light work when not engaged otherwise.

While excellent results may be obtained with the modern shop where it is well organized, there is certainly no question but what better results may be obtained with a transverse shop and transfer table.

Yours truly,

M. D. Franey,

Supt. of Shops, L. S. & M. S. Ry.,

Collinwood, O.

Bent Flexible Staybolt.

Editor Railway Master Mechanic:

The bent flexible staybolt illustrated on page 342 of the October issue of the Railway Master Mechanic, 1906, presents a peculiar condition which is not commonly met with. In regard to the groove that is shown around the bolt, next to the outer sheet, I would think it is entirely improbable that this groove was worn by a forward and backward movement of the bolt and on account of it coming in contact with the neck of the sleeve around the head. Considering the fact that this bolt was in the boiler four years I would say this groove was caused by corrosion; that the movement of the bolt was enough to keep the scale off so the corrosive action of the water could attack it. You will pardon me if I repeat here that by corrosive action of the water, I do not mean some dark, deep, mysterious acid, but rather the simple elements oxygen and carbonic acid gas that are always present in all natural waters in more or less quantities, and as a rule, the purer the water the larger the per cent of oxygen present.

Practically all the corrosion that takes place in a boiler is the same as the simple action that takes place when a piece of iron rusts in the atmosphere. It seems to be so hard for some railroad men to appreciate this. Also that the purer the water and the cleaner the sheets are kept the more will be the corrosion. I have heard about acids in water all my railroad experience, but the first actual case I have ever run across is the Monongahela river at Pittsburgh. This river does at times contain a very small per cent of free sulphuric acid. A small amount of either lime water or carbonate of soda takes it up and destroys its bad effects.

Yours truly,

M. E. Wells,

Ass't Master Mechanic, Wheeling & Lake Erie R. R.

Massillon, O.

The Future Engineer.

Editor Railway Master Mechanic:

In considering various methods of increasing the efficiency of engineers, it is well to give a great deal of thought to the question of firemen, for these men are the future engineers. Our firemen are taken from the ranks of young men who are employed to work around roundhouses at cleaning fires, ash pans, wiping engines, firing up, or any other duties that may be assigned them. For this work we try to hire bright, likely young men with fair educations. As a rule they remain as handy men in the roundhouses from one to two years. For this work they are paid about $40 per month and are given understand that if they prove competent, they will be promoted to firemen.

Forty dollars a month may seem small pay for what these young men do, but a close study of the situation will prove that a man who will work for from one to two years for this pay because he is ambitious to become a fireman has the right stuff in him and will make a valuable man on an engine.

There have been instances where we have hired young men with college educations and sent them out to learn to fire, but this class of men soon become satisfied to try some other work when they discover that firing is no snap, while the men who have gone through the roundhouse know what hard work and small pay are and when their ambition to become firemen is realized they go at it with a will and a determination to earn further advancement.

Another advantage of making a practice of promoting men from the roundhouse is that every man that starts there at the bottom feels that if he shows himself competent, he will be promoted and that some outside man with no experience will not be put in to fire over his head. This also does away with the demoralizing effect that bringing in men from the outside to learn to fire has on the men who have been laboring faithfully at small pay just for the opportunity of promotion.

From my experience I would say that the best way to increase the efficiency of enginemen is to increase their confidence in the road they work for. The road foreman of engines or traveling engineer should be a man competent to instruct and get good work out of men who are willing to take advantage of his experience.

To bring about this closer relationship road foremen of engines or traveling engineers should not be required to assign enginemen to runs or to discipline them for infraction of rules. It might be all right for the road foreman of engines or the traveling engineer to make recommendations in this line but he should not be expected to carry them out himself as his usefullness depends largely upon the good feeling that exists between him and the men from whose ranks he has risen. He is continually with the men and is looked upon as their instructor and their advisor. They tell him their troubles and he knows all the difficulties they have to contend with, but if he is in a position to grant favors or discipline the men, they soon begin to regard him more as an informer than as a man who is there to help them increase their efficiency and thereby gain advancement, and they are less liable to receive his instructions in the right spirit and profit by them. When the enginemen look upon the road foremen of engines as their friend who will act as intermediary between them and their superior officers in times of trouble and who is doing all he can to make them more competent they will seek and follow his advice and then if he is the right man in the right place he will in time make competent men out of the most inefficient.

John M. Lynch,

Traveling Engineer, C. G. W. Railway.

St. Paul, Minn.

Motor Baggage Trucks.

There have been placed in use in the Broad Street Station of the Pennsylvania Railroad in Philadelphia, baggage and mail trucks which are in themselves miniature automobiles. Those in use now are, in a sense, experimental, but the satisfaction which they have given points clearly to the fact that they will ultimately take the place of the old hand-pulled trucks in the larger stations.

It is not an uncommon thing to see several baggage porters pushing and tugging at one ordinary heavily loaded hand-truck in their effort to deliver its burden within the allotted time. Today one may be attracted by a heavily loaded truck running along at a good speed and controlled wholly by a man who holds the tongue and guides it simply by pushing a button as easily as he would if he were actually pulling the load.

The general appearance of the trucks is similar to that of the old hand-pulled affairs, but beneath the platform are boxes containing a storage battery and one electric motor.

In order to do work satisfactorily, these trucks must be safe. They must neither run away nor get beyond control if accidentally left for a minute. In this respect they have proved highly satisfactory, for their speed is controlled from a small lever on the tongue by which they are steered, and it is further arranged so that if this tongue is dropped or let down, the current is shut off and the brakes are put on. A catch is also provided, so that the tongue can be fastened up against the front of the truck, in which position the current is also shut off and the brakes are on the same as when it is on the ground.

Four of these trucks are now in use, three built by the Pennsylvania Railroad and one by an outside concern. Their operation is being very carefully watched by railroad men and before long improved models will be gotten out which, it is believed, will even surpass these in point of efficiency.

Combustion of Fuel With Relation to Locomotive Firing

**Sixth of a Series of Articles on this Subject.*

OVER 2,000 of the 45,000 locomotives in the United States are burning crude petroleum or fuel oil at this time, and this number is being steadily increased. So far as the author is aware, there has been but one example of a locomotive having been provided with a boiler especially designed to burn this fuel. This is a locomotive on the A., T. & S. F. Ry., and it resembles the Vanderbilt type, being entirely "constituted of barrel." It has three corrugated fireboxes (Morrison tubes), each 28 ins. in diameter. These end in a common combustion chamber 40 ins. long. Beyond this, the barrel is filled with boiler tubes in the usual manner. While it has given satisfactory service for over four years, the noise from the burners thus brought up into the cab has been so great as to cause considerable objection from the engine crews. Notwithstanding the imperfections of this single experiment it would seem that the boilers of locomotives intended for steady service with oil fuel could be especially designed therefor to considerable advantage in some particulars. However the general practice is to equip the ordinary locomotive for the use of fuel oil by taking out the front end netting and substituting a petticoat pipe for the deflector, replacing the grates with some special arrangement of brickwork, providing an oil burner and its concomitants and using the coal space on the tender for an oil tank.

The oil tank on the tender is provided with a steam coil to enable the oil to be heated to an extent which will cause it to flow readily. This coil is sometimes arranged so as to admit steam directly into the oil, but the consequent addition of the water of condensation is a detriment. With the light oil of Texas, this is not necessary in the south in summer, but it is general good practice to provide for the heating. Because of the inflammable gases arising from the surface of the oil and the consequent danger of explosion and fire in examination through the manhole by means of a torch, a gauge rod in a separate well (of pipe) is provided for ascertaining the depth of oil in the tank at any time.

From the tank the oil flows to a connection with a cut-out cock under the engine deck. The plug of this cut-out cock is provided with a rod extending up through the deck to a graduating handle—on the order of the old time pump lazy cock. This affords regulation of the oil supply to the burner. Adjoining the location of this regulating handle of the oil cock is located the handle of a steam valve in a line of steam piping to the burner. This general arrangement is shown in Fig. 1, which is the A., T. & S. F. Ry. equipment.

There are many types of burners, but all seek merely the one object of spraying the oil into the firebox by means of steam, or air, or both. The Booth burner shown in Fig. 2, used on the A., T. & S. F. Ry., may be taken as an example in general locomotive use. The steam emerges from the lower or steam chamber in a thin sheet, slightly wider than the orifice of the oil chamber lying above it. The oil flowing out of this upper chamber falls on this sheet of steam and is thus sprayed out into the firebox. The burner is sometimes placed at the front mud ring, but generally is located at the rear. The firebox is bricked up in many different ways, of which the best arrangement has not yet been settled, but the A., T. & S. F. Ry. arrangement shown in Fig. 1 may be accepted as having been in extensive use. The floor is bricked over solid, with the exception of a damper controlled small air opening near the forward end of the combustion chamber. There is also an air space around the burner, this also being sometimes provided with a damper.

The fire is started by throwing a piece of lighted waste in front of the burner and starting the burner—steaming from the shop blower, blower line being attached to the steam line of the burner if the locomotive is cold. After the locomotive has become hot, however, the arch has become so hot that the impinging oil spray will generally relight of itself in case of a merely temporary interruption. After the engine is once hot, the flame should be kept going until the engine is put into the house again, for even with care in closing the dampers, and the amount of heat thrown off for awhile by the arch, abolition of the flame is very liable to allow the tubes to start leaking, particularly in bad water districts. The amount of the flame can be cut down when the engine is not working, to an extent which will allow the popping to be sufficiently controlled by the injector.

When the engine is working, the fireman must closely follow every movement of the engineer, for every change of the throttle or reverse lever must be immediately followed by a corresponding adjustment of the steam and oil valves and possibly the damper. A very little practice will enable this to be done almost by instinct, but there can be no relaxation of watchfulness. Before the adjustment can generally be made complete, however, there is almost always a dense cloud of the black smoke denoting an imperfect state of combustion. With this fuel there is with this phase the change of working an attending deposition of soot in the boiler tubes which rapidly clogs the tubes. It has been found that the pouring into the firebox of a few pounds of sand will clean off this deposit it being picked up by the draft and carried through the tubes. It is generally necessary to resort to sand several times a trip, hence a supply of sand and a suitable distributing scoop is carried on the tender.

While the fireman is not concerned with the reduction of the projecting crown bolt heads, lap joints, and such projections in the firebox, he is likely to be very intimately concerned with the leaking which invariably follows any carelessness of his with respect to regulation of the flame to suit the conditions the working of the engine may involve—and leaking with an oil burner is as much more difficult when compared with a coal burner as the latter is when compared with a wood burner. This may be readily conceived if it is reflected that coal has had practically but 14,000 heat units per pound, while fuel oil has from 18,000 to 20,000 per pound—and the number of pounds of oil which can be burned at a given rate in a locomotive depends practically upon the size or number of burners. And with the sizes of burner and intensity of draft generally used it is possible to direct fully 25 per cent more heat against the heating surfaces. Hence, while the fireman has it within his power to greatly increase the steaming capacity of the locomotive, and hence its maximum working rate, at the same time the possibilities of heating surface are limited and more vigilance and judgment are required of him in return for the reduction of his physical exertion. For with this powerful heating apparatus at his disposal it is easy to greatly damage the boiler by raising steam too quickly, where the pressure has been allowed to drop through carelessness. In fact, the author has lately noticed complaint from firemen on a line where the burners have been reduced considerably in size, as a result of the abnormal amount of damage caused by this carelessness of the firemen.

On the other hand, in oil burning, the careful fireman is not troubled with leaking tubes or firebox, because of his easy ability to maintain constant temperatures (or rather, a constant amount of expansion) in the firebox, he is not troubled with dirty fires and filling of the front end, he can easily clean his own tubes and, above all, he can fire any size of locomotive with equal ease. Hence, the excess of vigilance required would seem little enough return for the abolition of work and dirt.

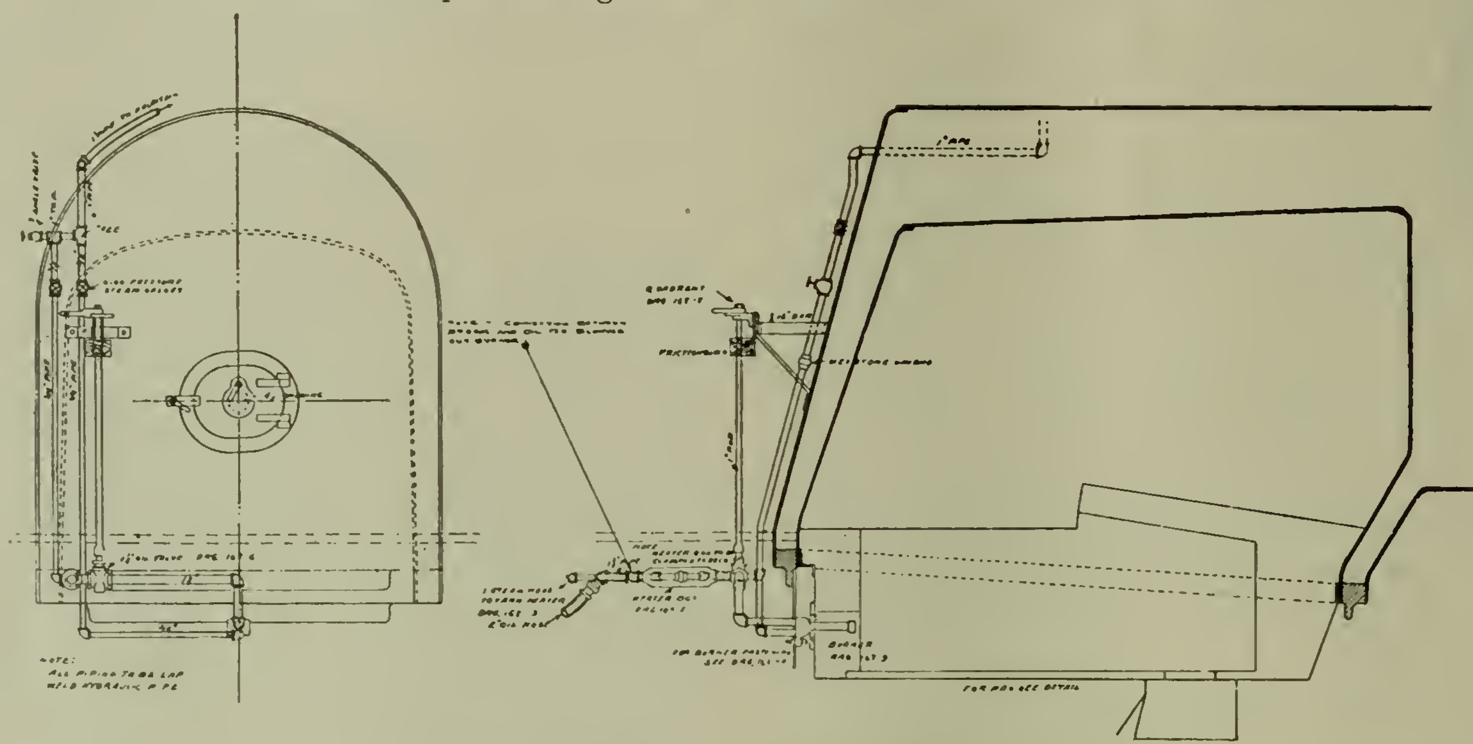


FIG. I GENERAL ARRANGEMENT OF OIL BURNING EQUIPMENT.—A. T. & S. F. RY.

APPENDIX.

As there has been occasion several times in the course of these remarks to use the words "evaporation per pound of coal," it has been thought well to add a few words on this point, as follows:

In locomotive practice, it has been found practical to burn coal up to the rate of 200 pounds of coal per hour for each square foot of grate surface—though it may be remarked that the higher rates of combustion require such an intensity of draft as to cause the gases to pass the heating surfaces at a speed which does not allow them time enough to give up the desired portion of their heat. Obviously, the less the draft, the slower will be the passage of the gases and hence the greater proportion of their heat will be absorbed by the heating surfaces from the gases of combustion. The temperatures generated in the firebox by the burning of coal at the different rates have been shown in a previous table.

Now suppose we take a bituminous rate of burning of 120 lbs. of coal per hour as a desirable maximum amount. If we are using 13,500 B. T. U. coal this will provide us with $13{,}500 \times 120 = 1{,}620{,}000$ heat units per hour for each square foot of grate area. With this rate of combustion and the grade of coal, if any excess of this amount of heat units desired, it will be necessary to provide an equivalent greater number of square feet of grate area upon which to burn the coal. But, we may consider 6,000 lbs. of coal per hour in passenger service and 5,000 lbs. of coal per hour as about all that can be handled by an ordinary man in regular road service—in other words, these firing rates cannot be exceeded in practical service.

Hence we are limited to the production of $\frac{1{,}620{,}000 \times 6000}{12} = 81{,}000{,}000$ heat units per hour in passenger service and, similarly, 67,554,000 heat units in freight service.

Obviously, the greater the extent of heating surface provided for these heat units to pass over before their opportunity of exit into the front end, the greater number of them are likely to pass into the iron and be absorbed by the water. But the iron of this heating surface not only limits its extent in locomotive service by reason of its weight, but also by reason of its falling off in value as its distance from the fire increases. As seen in D. K. Clark's table of the previous chapter, the temperature of the gases of combustion of 14,700 B. T. U. coal pass over the fire at a 120 lb. combustion rate, is 2,097 degrees Fahr. In the P. R. R. St. Louis tests the temperature in the front end of N. Y. Central locomotive No. 3000 when burning coal at 120 lbs. per sq. ft. of grate area per hr. was 630 degrees. Hence the temperature of the gases by the time they approached the forward end of the tubes was very considerably less than the firebox temperature, therefore the surface of the forward end of the tubes received considerably less heat per sq. ft. than did the sheets of the firebox, or the forward tube heating surface was of considerably less value than that of the firebox.

Experiments made in France and Germany have proved that in a locomotive boiler of normal proportions practically one-half of the total amount of water evaporated into steam is evaporated by the firebox sheets. A specific instance gives 45 per cent of the total evaporation being accomplished by the firebox and each tenth of flue length to have an evaporative value as follows, decreasing with the distance from the firebox; 9.92, 8.43, 7.35, 6.25, 5.41, 4.6, 4.05, 3.42, 3 and, last 2.57 per cent. The formula:

$$\frac{\text{Tube heating surface}}{\sqrt{\text{Tube length}}} + \text{Firebox heating surface}$$

is generally used to thus equalize all the heating surface.

Since the amount of heating surface we can provide is thus limited, as well as our combustion and firing rates, we have fixed practical limits of the amount of evaporation we can obtain from a locomotive boiler—or, in other words the amount of heat units we can practically extract from the amount produced by firing. The New York Central locomotive mentioned had 49.9 sq. ft. of grate area and 3,457 sq. ft. of heating surface, or 69.3 sq. ft. of heating surface for each sq. ft. of grate area. When burning 14,000 B. T. U. coal at a combustion rate of 120 lbs. of coal per sq. ft. of grate area per hr., 1,680,000 heat units per hr. were consequently produced by each sq. ft. of grate area; and these evaporated 924 lbs. of water per hr., hence it took 1,818 heat units for the evaporation of each pound of water to the 220 lbs. steam pressure. To illustrate the effect of a slower rate of combustion with the consequent less rapid passage of the gases it may be noted that at a combustion rate of 60 lbs. of coal per sq. ft. of grate per hr. only 1,458 heat units were required to evaporate one lb. of water. But, since the grate area and heating surface was the same, not so great a total quantity of water was evaporated.

We often hear of tests showing an evaporation of a certain quantity of water per pound of coal. Such statements are valueless unless the quality of the coal and the combustion rate are given. For instance, in the test here mentioned the results were as follows, with 14,000 B. T. U. coal:

Firing rate per hr.	1,000	2,000	3,000	4,000	5,000	6,000
Combustion rate per hr.	20	40	60	80	100	120
Pounds of water evaporated per lb. of coal	11.8	10.6	9.6	8.9	8.2	7.7

This shows the falling off in the evaporation as the firing rate is increased, or, the lessened absorption of the heat units as the draft is increased. But as the firing rate and consequent combustion rate (and intensity of draft) is increased the temperature of the gases is some-

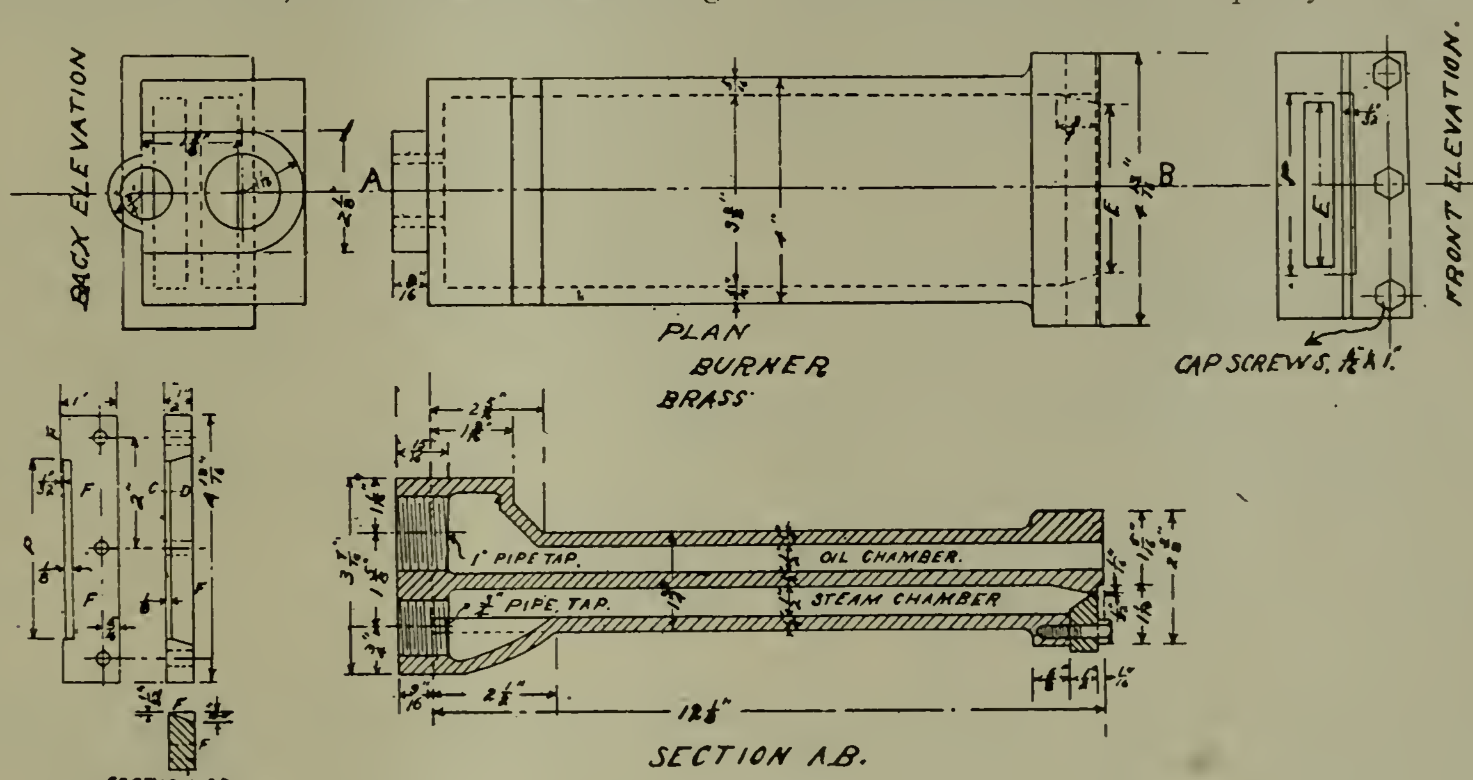


FIG. 2. BOOTH OIL BURNER.—A. T. & S. F. RY.

what increased, as has been shown, and the total quantity of water evaporated from a given amount of heating surface is increased by this "harder working" of the engine and boiler. So that as we are limited in the size of the boiler we can put on a given size of engine we must make some sacrifice of economy in getting its full capacity in steaming. The judgment of the designer is shown in balancing the limitations in the various directions here shown, but when the locomotive has been constructed and is put into the hands of the crew, all has been done by others that can be done and the final results in both power and economy is entirely in the hands of the engine crew. It has been the aim of the author to present this proposition fairly, and if he has succeeded in so doing to any extent he will feel his purpose has been accomplished, for after all, the key of railway efficiency is the doing of the square thing by both the management and the men. And there is no class of men whose sense of fairness is more keen than the engine crews of this country.

Heavy Consolidation Locomotive with Narrow Firebox

Western Pacific Railway.

THE Baldwin Locomotive Works have recently completed an order for 20 heavy consolidation locomotives for the Western Pacific Railway, which are among the first to be received by this road.

There are no unusual features in the design of these locomotives as they represent established practice and all the proportions are based on conservative designs. A narrow firebox over the frames is somewhat unexpected at the present time in a boiler 80 inches in diameter with 3,141 square feet of heating surface but boilers of this type have given excellent results both in regards economy and repairs. The grate area of 33.6 square feet is relatively small so that the rate of combustion per square foot will be proportionately high when the engine is working hard, but should show a good average performance.

The cylinders are 22 by 30 inches with balanced slide valves, actuated by the Stevenson link nation. The driving wheels are 57 inches in diameter and the steam pressure 200 pounds which will give the engine a tractive force of 47,120 pounds. The firebox is radial stayed with sloping crown and roof sheets and vertical throat and back head. The curves in the sides sheets have large radii thus avoiding abrupt changes in the contour of the water legs. The total weight of the engine is 201,330 pounds with 186,330 pounds on the drivers.

Some of the principal ratios of the design are as follows:

$$\frac{\text{Weight on Drivers}}{\text{Tractive Effort}} = 3.95$$

$$\frac{\text{Total Weight}}{\text{Total Heating Surface}} = 64.0$$

$$\frac{\text{Firebox Heating Surface}}{\text{Total Heating Surface}} = .68$$

$$\frac{\text{Tractive Force} \times \text{Diameter of Drivers}}{\text{Total Heating Surface}} = 855$$

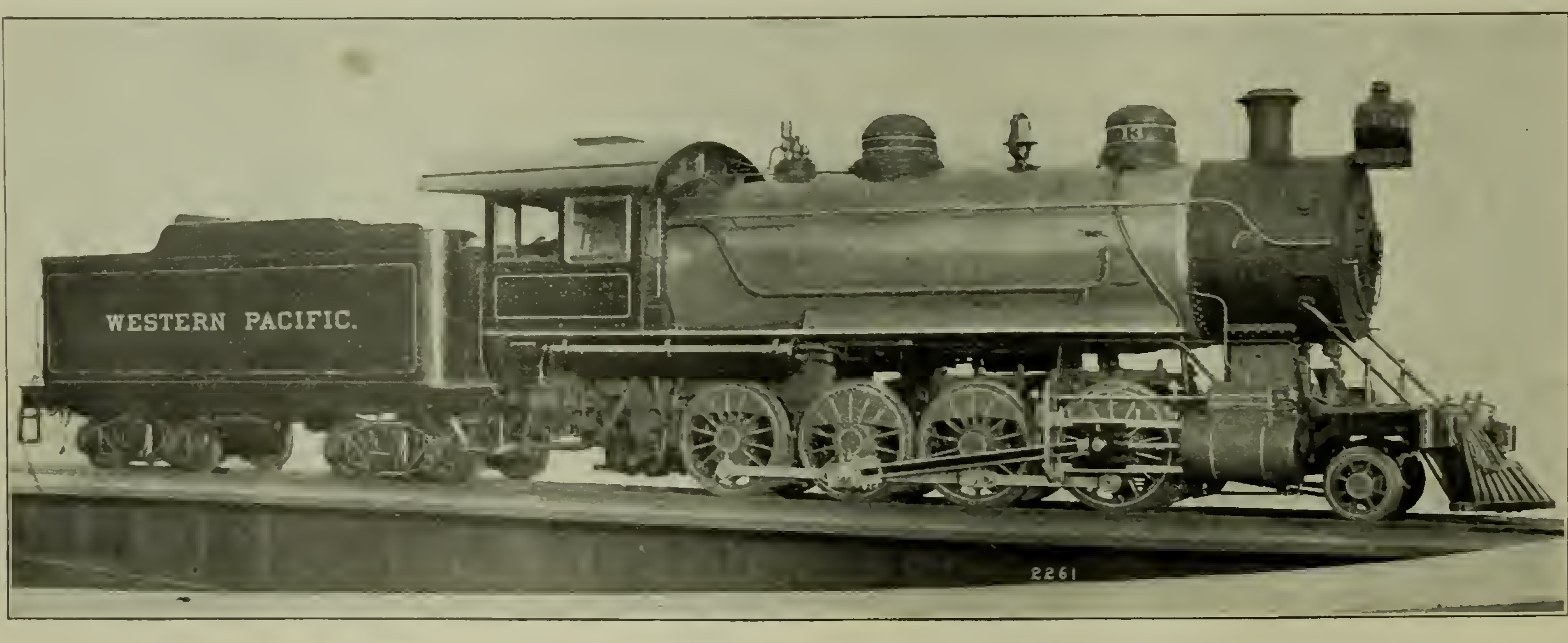
$$\frac{\text{Total Heating Surface}}{\text{Grate Area}} = 93.5$$

$$\frac{\text{Total Heating Surface}}{\text{Volume of Cylinders}} = 475$$

$$\frac{\text{Grate Area}}{\text{Volume of Cylinders}} = 5.08$$

The principal dimensions and specifications are as follows:

Type of engine........................Consolidation
Service ....Freight
Fuel ....Soft coal
Tractive force...........................4,712 lbs.
Gauge ....4 ft. 8½ in.
Cylinders ....22 in.x30in.



HEAVY CONSOLIDATION LOCOMOTIVE WITH NARROW FIREBOX —WESTERN PACIFIC RY.

Valves, kind .... Balanced slide

BOILER.

Type .... Straight
Working pressure .... 200 lbs.
Diameter, first ring .... 80 in.
Thickness of sheets .... 13/16 in.
Material .... Steel
Staying .... Radial

FIRE BOX.

Material .... Steel

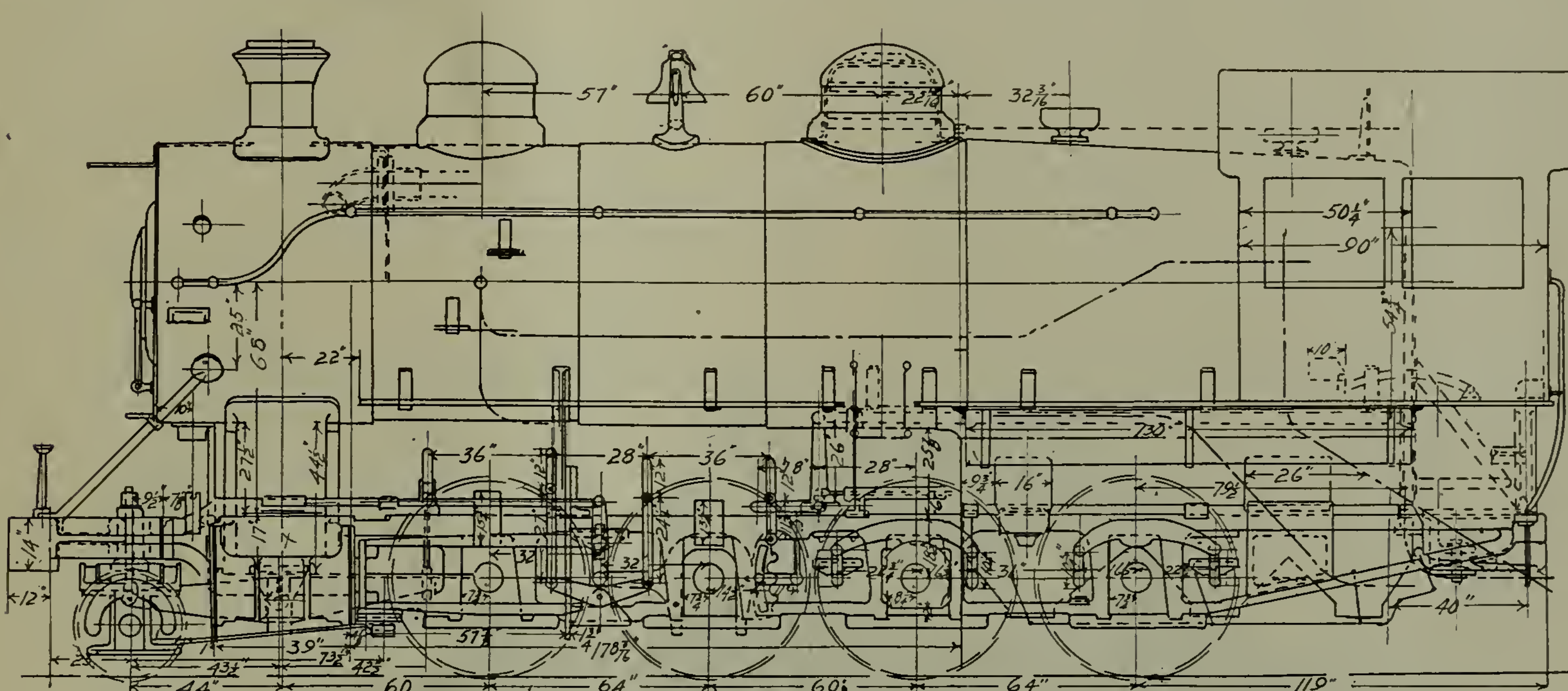
Total engine .... 24 ft. 4 in.
Total engine and tender .... 57 ft. 11½ in.

WEIGHT.

On driving wheels .... 186,330 lbs.
On engine truck .... 15,000 lbs.
Total engine .... 201,330 lbs.
Total engine and tender about .... 350,000 lbs.

TENDER.

Wheels, diameter .... 33 in.
Journals, diameter and length .... 5½ in.x10 in.



ELEVATION OF HEAVY CONSOLIDATION LOCOMOTIVE WITH NARROW FIREBOX.—WESTERN PACIFIC RY.

Length .... 121 in.
Width .... 40 in.
Depth, front .... 80½ in.
Depth, back .... 78½ in.
Thickness of sheets, sides .... ⅜ in.
Thickness of sheets, back .... ⅜ in.
Thickness of sheets, crown .... ⅜ in.
Thickness of sheets, tube .... ½ in.

WATER SPACE.

Front .... 4 in.
Sides .... 4 in.
Back .... 4 in.

TUBES.

Material .... Iron
Wire gauge .... No. 12
Number 390
Diameter .... 2 in.
Length .... 14 ft. 5 in.

HEATING SURFACE.

Firebox .... 214 sq. ft.
Tubes .... 2,927 sq. ft.
Total .... 3,141 sq. ft.
Grate Area .... 33.6 sq. ft.

DRIVING WHEELS.

Diameter, outside .... 57 in.
Diameter, wheel centers .... 50 in.
Journals, main, diameter and length..... 10 in.x12 in.
Journals, others, diameter and length ...... 9 in.x12 in.

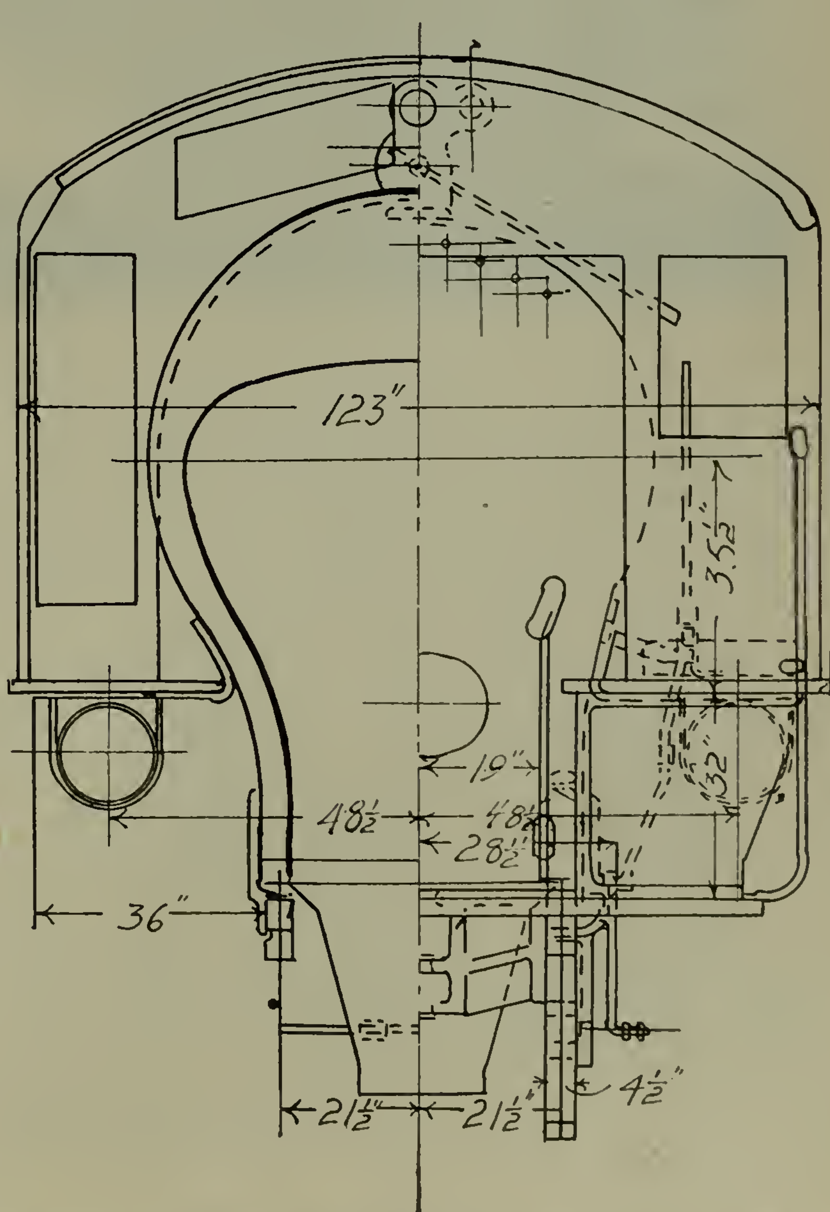
ENGINE TRUCK WHEELS.

Diameter, engine truck .... 30 in.
Journals, engine truck, diameter and length 6 in.x12 in.

WHEEL BASE.

Driving .... 15 ft. 8 in

Water capacity .... 8,000 gals.
Coal capacity .... 14 tons



END VIEW AND SECTION THROUGH FIREBOX, CONSOLIDATION LOCOMOTIVE WESTERN PACIFIC RY.

50-Ton Electric Locomotive—Kansas City and Westport Belt Railway.

THE American Locomotive Company in conjunction with the General Electric Company, have recently completed a 50-ton electric locomotive for the Kansas City and Westport Belt Railway. The locomotive is designed for freight service and is carried on two four-wheel motor trucks of the equalized type, with a total wheel base of 22 feet, and a rigid wheel base of 6 feet 6 inches. Each truck is equipped with two General Electric Company's type 55 H direct current motors. The motors are inside hung, half the weight being carried on the axle and half by nose suspension from the truck frame. The rated maximum tractive effort is 16,400 lbs. When exerting its rated draw-bar pull, the motors will take a current of 160 amperes per motor and will operate a train of 320 tons on a 2% grade, at approximately 8 miles per hour. At a current of 215 amperes per motor, the locomotive will exert a maximum instantaneous effort for starting purposes of 25,000 lbs., and will haul the same weight of train on the level at a speed of 13 miles per hour. The locomotive is provided with type M single unit control, with 5 steps in series and 5 in parallel. It is equipped with General Electric Company's combined automatic and straight air brakes, operated by one centrifugal pump 23 air compressor, with a piston displacement of 50 cubic feet per minute when delivering at a pressure of 90 lbs. It is fitted with one U. S. trolley, suitable for collecting a current of 500 volts. The frame is of 10-inch channels with cast-iron bumpers and floor plates of 3/8 inch steel. The cab is of the steeple type with one main motorman's cab and two auxiliary cabs. A passageway is provided around the cab with handrails outside, for the convenience of motormen, and is a feature not found in many of the previous designs of electric locomotives.

Some of the principal dimensions are as follows:

Length over all	31 feet 1 inch
Height over cab	11 " 9 inches
Width over all	9 " 6½ "
Total wheel base	22 "
Rigid wheel base	6 " 6 "
Driving wheels	36 in. in diameter

50-TON ELECTRIC LOCOMOTIVE.—KANSAS CITY AND WESTPORT BELT RAILWAY CO.

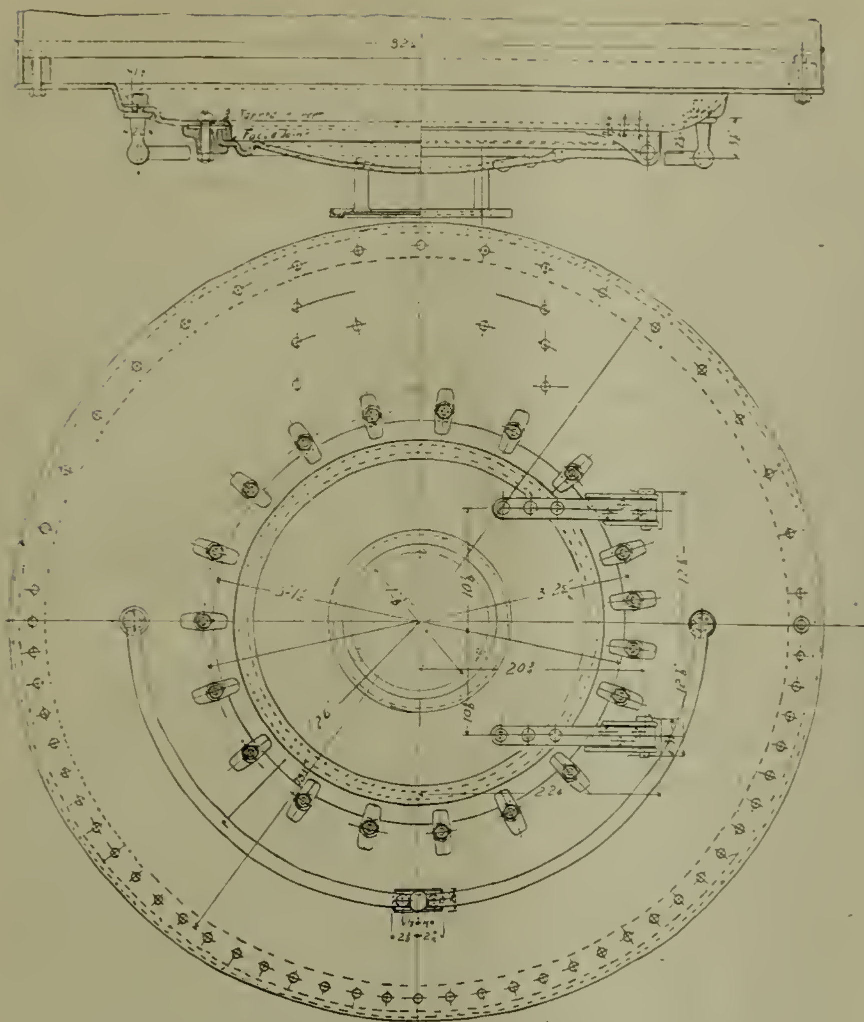
Standard Smoke Box Front Pennsylvania Railroad.

IN standardizing the locomotive equipment on the Pennsylvania railroad the treatment of smoke box fronts and doors is noteworthy as representing a departure from the usual practice. The various sizes and styles of fronts adapted to the different classes of locomotives have been discarded, and a special design of front substituted that can be fitted to any class.

The standard front is shown in the illustration and while it does not present any special features of design the method employed in applying it to the smoke boxes of various diameters is original and interesting. The front is made of ½-inch pressed steel and sufficiently large to fit a smoke box 82 inches in diameter, which is the largest on the Pennsylvania system. For smoke boxes of smaller diameters, the front is cut down in a boring mill to suit the sizes of the various classes of locomotives according to tables provided for this purpose. The outside bolt holes are laid off from a templet and drilled and the front is then applied in the usual manner.

The front is adaptable to all smoke boxes from 82 inches down to 63 inches in diameter and the sizes given include the principal classes of locomotives on the Pennsylvania system.

It is apparent that this plan presents a number of advantages over the usual method. Only one die is necessary for pressing plates, a provision which simplifies work in the flanging room, and has the further advantage of reducing the number of fronts carried in stock at the various shops and store houses.



STANDARD SMOKE BOX FRONT AND DOOR.—PENNSYLVANIA RAILROAD.

An improvement in the general appearance of locomotives in so far as symmetry is concerned, is obtained by fitting them with fronts and doors of the same design. The method offers an advantage in obtaining fronts for disabled locomotives at outlying roundhouses, as the front desired, can be sent finished from the main shop on receipt of information stating the class of locomotive the front is wanted for. It is obvious that in building new locomotives the method can be successfully applied with a saving of both time and expense.

Locomotive Blocking Jack—Pittsburgh and Lake Erie R. R.

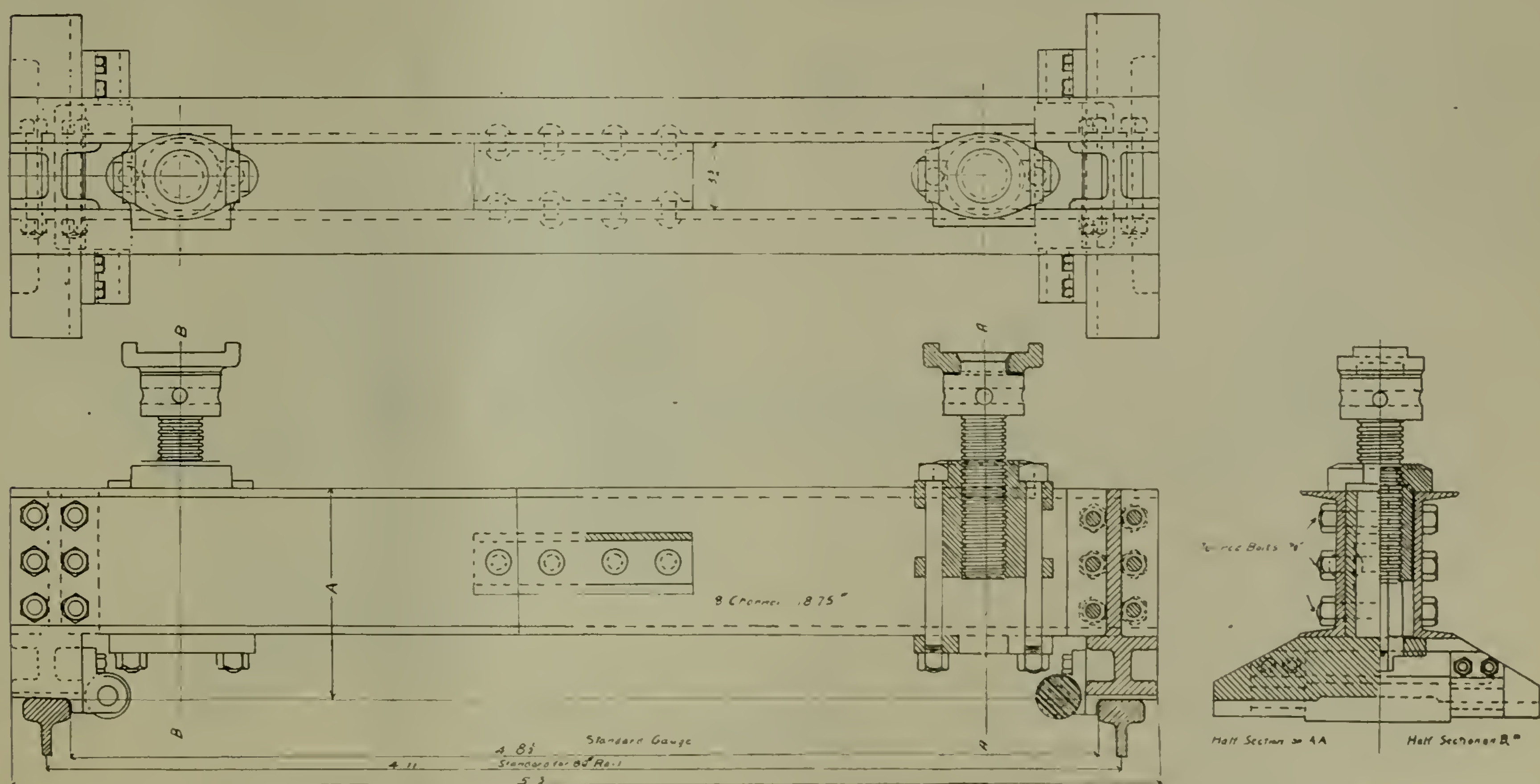
A locomotive blocking jack which does away with the objectionable features of the ordinary wooden blocking, has been designed by the P. & L. E. R. R., and is in use in their shops at McKees Rocks, Pa. Reference to the drawing shows that the device provides for supporting the locomotive on screw jacks mounted on channel irons, which rest upon the rails of the track.

The frame work consists of two steel base castings to which are bolted two 8-inch channels 5 feet 3 inches long, and spaced 3¾ inches apart. The base casting rests upon the rail and has a flange on the inner face which prevents any lateral movement—of the jack channels.

Two screw jacks are mounted between the channels and are so designed that they can be moved to accommodate any spread of frames. The jacks have steel screws 2½ inches in diameter, 9¼ inches long and 3 threads per inch with a special design of steel head. The nuts are cast steel, 6¼ inches long and 3⅝ inches wide with supporting flanges 1½ inches thick on the upper end. This gives ⅛ inch clearance between the nut and channels and allows the nut free movement back and forth between them. Two 1-inch bolts are run through the nut to a plate below the channels for the purpose of clamping the nut in any desired place.

A steel roller 2½ inches by 7 15-16 inches is placed inside of the base casting and a little below the flange, so that the jack can be rolled from place to place.

The jack is a great improvement over the old method of blocking up locomotives. It takes up little room, is adjustable, and there is no settling of the locomotive after remaining on the jacks for a time, as is the case when wooden blocking is used.



[GE]NERAL PLAN, SIDE ELEVATION AND SECTION, LOCOMOTIVE BLOCKING JACK.—MCKEES ROCKS SHOPS, P. & L. E. R. R.

Personal Mention.

Mr. H. H. Hale has been appointed superintendent of motive power and consulting engineer of the Nevada Railroad and the Nevada Consolidated Mining & Milling Company, with headquarters at No. 11 Front St., San Francisco, Cal. Mr. Hale was formerly assistant master mechanic of the Pere Marquette R. R. at Grand Rapids, Mich.

Mr. F. P. Mooney has been appointed master mechanic of the Trinity & Brazos Valley R. R., with office at Teague, Texas, to succeed Mr. W. C. Burel resigned.

Mr. Warren Fogwell and Mr. D. F. Gonware have been appointed road foremen of engines of the Wabash R. R. at Decatur, Ill. Mr. J. S. Sweeney, who has held a similar position has resigned.

Mr. R. B. Watson has been appointed engineer of tests of the Erie and the New York, Susquehanna & Western Railroads, with office at Meadville, Pa., to succeed Mr. J. G. Platt, resigned.

Mr. P. J Colligan has been appointed acting master mechanic of the Chicago, Rock Island & Gulf with headquarters at Fort Worth, Tex., to succeed Mr. J. E. Holtz, resigned.

Mr. J. J. Flynn has been appointed general foreman of shops of the Louisville & Nashville R R. at Nashville, Tenn. Mr. Flynn has heretofore been general foreman of the shops of the company at Mobile, Ala.

Mr. E. A. Williams has resigned as general mechanical superintendent of the Erie Railroad, and the office has been abolished.

Mr. G. M. Ellsworth has been appointed chief motive power clerk, and Mr. O. A. Cherry assistant motive power clerk, of the Pennsylvania R. R., with office at Altoona, Pa.

Mr. R. W. Burnett is appointed assistant master car builder, Canadian Pacific Ry., east of Port Arthur, succeeding Mr. S. King, resigned.

Use of Crude Oil Burners in Railroad Shops.

For a number of years the gasoline burner has been used in round houses and shops for tire heating and all purposes where heat was required. It makes a satisfactory fuel for general purposes, but the danger incident to its use combined with the expense, has led to the introduction of other materials for this purpose. Kerosene and fuel or crude oil has been experimented with the most and the results obtained by the latter have led to a wider application of its use to all classes of railroad work. Owing to the introduction of more efficient appliances for handling crude oil, its natural advantages are being more clearly shown and its superiority over gasoline demonstrated without any doubt.

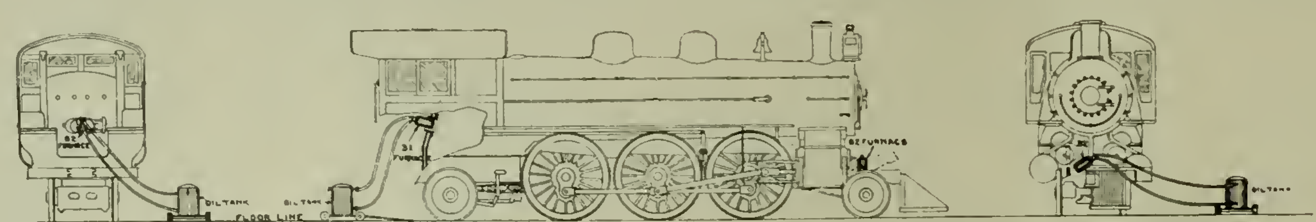
A comparison of the calorific values of gasoline and crude oil will show why the latter is the most economical fuel to use in burners of all kinds. Gasoline has a calorific value of 14200 B. T. U. per pound, and one gallon weighing 5.9 pounds represents a total calorific value of 83780. B. T. U. at a cost of approximately 14 cents, or at the rate of 5984 B. T. U. per one cent. Beaumont, Texas, crude oil has a calorific value of 19060 B. T. U. per pound and one gallon weighting 7½ pounds, represents a total calorific value of 142950. B. T. U. at a cost of approximately 3½ cents, or at the rate of 40598 B. T. U. per one cent. Thus 32220 more B. T. U. are obtained for one cent from crude oil than gasoline, which represents an approximate saving of nearly 400 per cent. This demonstrates clearly that if crude oil is used in a high grade burner, that it is much more economical than gasoline.

A number of satisfactory burners have been developed for crude oil, among which is the B-2 furnace manufactured by the W. N. Best American Calorific Company, New York. The interior construction of this furnace consists of two segments of highly refractory material, which is encased by iron. To this, the burner and regulating valves are attached, and the valves of same are coupled to a portable oil tank by means of the necessary lengths of hose. The shop air line is attached to the hose connection, and after the oil tank has been filled with crude or fuel oil, the furnace is ready for operation. Means are provided whereby the furnace can be held in any convenient position required for its operation.

The furnace is adaptable to a number of various uses in the roundhouse, of which a few are shown in the illustrations. For firing up locomotives the furnace is inserted in the fire door and the flame directed downward on the coal which is spread evenly over the grates. This method is much quicker and more economical than firing up with wood and is more satisfactory than firing up from below the grates as there is no liability of burning off the grate connections.

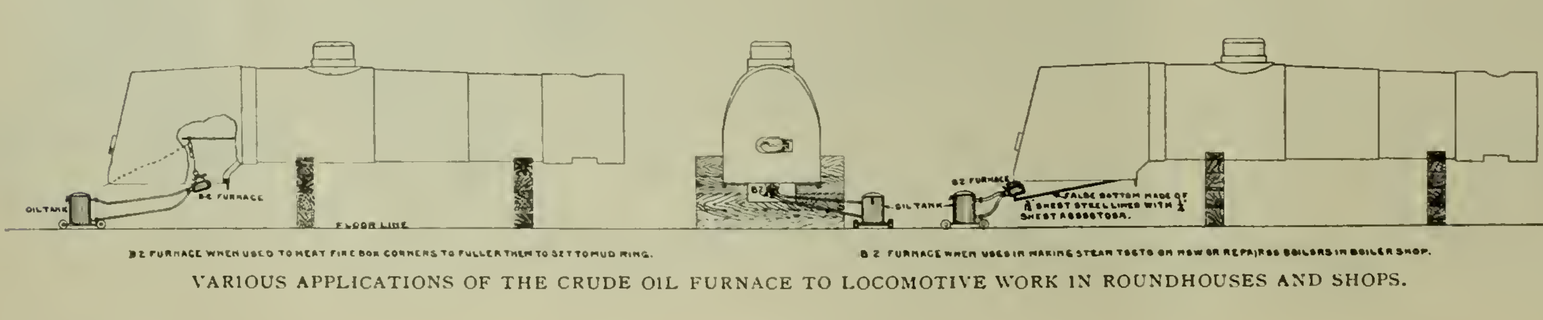
The furnace is readily adaptable to boiler work and is an excellent means of heating fire box sheets for straightening and fitting. The illustration shows the application of the furnace in heating fire box corners when fulling the sheets, and also shows how it can be used as a means of heating the water in a boiler for testing under steam.

One of the more general uses of the furnace will be found in heating bent frames, so they will not have to be removed from under the engine. Sufficient heat can be generated by the furnace to make frame welds and do other large work which



B-2 FURNACE WHEN USED TO FIRE UP LOCOMOTIVES.

B 2 FURNACE WHEN USED TO STRAIGHTEN FRAME AFTER A WRECK.



B 2 FURNACE WHEN USED TO HEAT FIRE BOX CORNERS TO FULLER THEM TO SET TO MUD RING.

B 2 FURNACE WHEN USED IN MAKING STEAM TESTS ON NEW OR REPAIRED BOILERS IN BOILER SHOP.

VARIOUS APPLICATIONS OF THE CRUDE OIL FURNACE TO LOCOMOTIVE WORK IN ROUNDHOUSES AND SHOPS.

would be very expensive to remove and handle in the blacksmith shop.

A novel use of the furnace is shown in the illustration when applied to bending 10 and 12 inch pipes. It is possible to bend pipes of this size without buckling or filling with sand by properly using the furnace. There are many more ways of using

USING THE CRUDE OIL FURNACE FOR BENDING LARGE PIPE

the furnace to advantage in round houses and shops, which the progressive foreman would take advantage of.

The safety of the crude oil furnace and its simplicity, combined with the high efficiency and low cost of operation have demonstrated that crude oil is the most satisfactory fuel for general round house work.

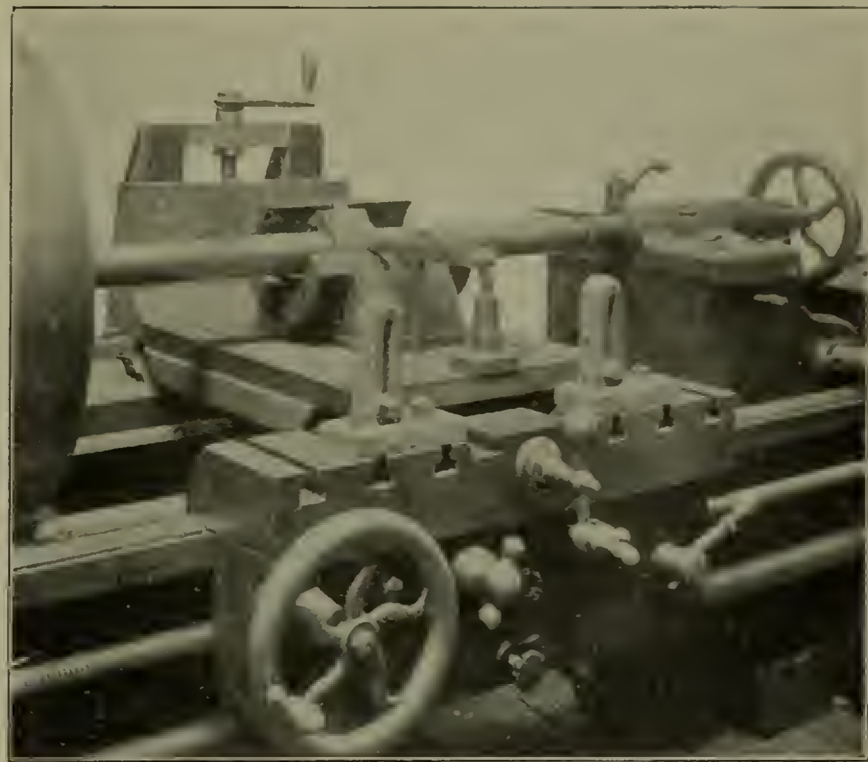
Boring Attachment for Lathe.

In small shops, especially where the number of machine tools is limited, the boring attachment shown in the illustrations would be a very handy accessory. The attachment is for the purpose of converting a lathe into a horizontal boring mill and when so converted, the out-put of the lathe is equal, within its range, to that of a regular boring mill, both in quality and quantity.

The attachment as shown by the illustration is of simple construction and can be made for any sized lathe. It consists of a lower plate with an angle plate projecting down and fastened to the back of the carriage. This is planed true with other parts of the attachment, so that the work is held correctly in relation to the machine. The bed on which the work is placed can be adjusted in any desired position vertically by means of the handle screw.

A special boring bar is also furnished for use in a lathe with the attachment and is easily adjusted and operated. The only changes to be made in the lathe for receiving the attachment is drilling and tapping two holes in the back of the carriage. The attachment is quickly adjusted in position on the lathe and can be readily taken down, so that only a few minutes are necessary for converting the lathe into a boring mill and changing back

ATTACHMENT FOR CONVERTING A LATHE INTO A BORING MILL, MANUFACTURED BY H. B. UNDERWOOD & CO., PHILADELPHIA, PA.



VIEW SHOWING BORING MILL ATTACHMENT FOR LATHE IN SERVICE.

again. The attachment which is manufactured by H. B. Underwood & Co., Philadelphia, Pa., makes a desirable addition to the railroad machine shop not equipped with its full quota of tools.

Crucibles, their Care and Use.

The above is the title of the handsomest as well as the most comprehensive book ever published on the subject of graphite crucibles, which are also known as plumbago or black lead crucibles.

It is a book which should be in the hands of every one interested in the melting of the various metals. It should be placed in every public library and in the library of every college that has a mechanical department. The author of this very complete work is Mr. John A. Walker, Vice-President, Treasurer, and General Manager of the Joseph Dixon Crucible Company, Jersey City, N. J.

Mr. Walker has been connected with the Joseph Dixon Crucible Company for forty years, and for thirty-nine has been an officer and director of the company and its general manager. He is thereby thoroughly fitted by his long years of experience in crucible making to be an authority on the subject, as he certainly is.

The purpose of the book is to instruct users of crucibles as to their proper use, and the dangers of abuse of crucibles. It tells what graphite is, and why crucibles are made of it. It tells why crucibles must be made of flake graphite. It tells why some crucibles are dark and others light, and the importance of that fact.

It states that most crucibles are perfect when they reach the user, and that much of the trouble that comes is due to the fault of the user. It gives rules for annealing crucibles, and tells why all of them should be carefully followed. It tells why crucibles should be bought in quantities, it tells the use of tongs for handling crucibles and their misuse by careless melters. It tells of the proper shape of tongs and how they should be handled, and how the metal should be placed in the crucibles, and how the crucibles should be placed in the fire.

The book fully describes the various fuels used in melting metals, and their effect on the crucibles. It speaks of the importance of perfect combustion.

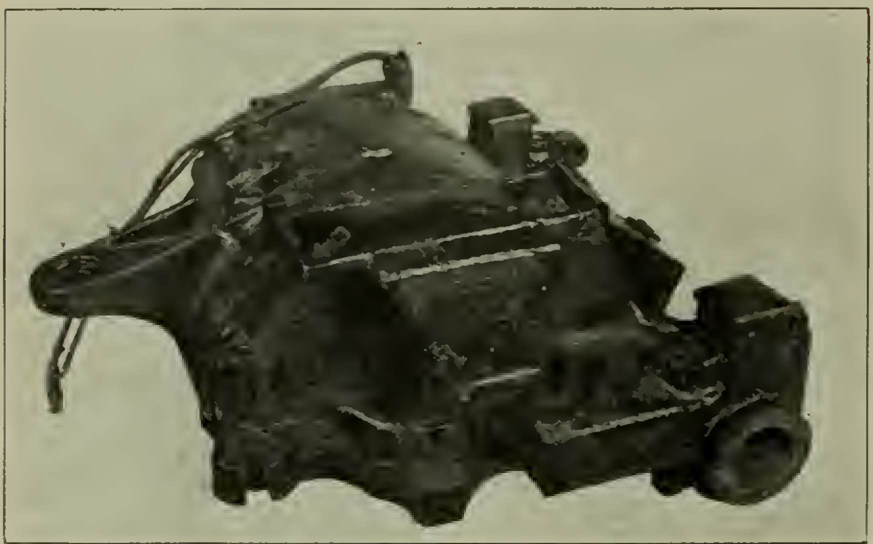
The book also carries much allied information, it gives the proportions of metal in commonly-used alloys. It tells the freezing, fusing and boiling points of various substances. It gives the specific gravity of various metals and other commodities. It gives the comparative value of fuels, and much other information of value in the foundry.

The double page center of the book carries one of the most vivid and realistic foundry scenes ever presented. The illustrations throughout the book are the highest specimens of photographic art, and the book in its entirety is a credit to its well known author and to the printers, the Bartlett-Orr Press.

Patching Locomotive Castings.

It frequently happens that an expensive locomotive casting is broken in such a way as to be practically worthless, making it necessary to replace the casting by a new one. A satisfactory method of patching such castings would save a great deal of money and a correspondingly greater delay in waiting for new material. A method of this kind would be especially adaptable to railroad work in repairing broken castings of locomotives coming from wrecks, as in many cases the castings are not carried in stock and a serious delay would occur to the locomotive in waiting for casting to be machined and fitted.

The accompanying illustration shows a street railway motor casing broken in several places as indicated by the arrows, which was mended in such a way as to be perfectly serviceable, by the



BROKEN STREET RAILWAY MOTOR CASING REPAIRED BY THE FERROFIX BRAZING PROCESS. THE ARROWS INDICATE THE FRACTURES

Ferrofix Brazing Process. The process, which is manufactured by the American Ferrofix Brazing Company, Philadelphia, Pa., is readily adaptable to round house and shop work and by its use a saving could be effected in repairing broken parts instead of scrapping them.

The Donnelly portable oil torch which is a feature of the Ferrofix process is fitted with several burners which makes it possible to treat any size or shape of casting. The brazed castings are as strong as the originals so that breakages will not occur again in the same place unless from a force which is greater than the strength of the material. It is believed that this process would find many uses in round houses with a consequent saving in expense and delay to locomotives.

Velox Car Cleaner.

A satisfactory car cleaner which will quickly remove dirt and not destroy varnish is a necessity recognized by every railroad company. There are a number of different cleaning compounds in use possessing more or less merit, but the No-Dust Chemical Co., 184 La Salle St., Chicago, have a preparation called the Velox Car Cleaner for which many claims of superiority are made.

It is shown that Velox will clean a railroad passenger coach in one-half the time it takes any other cleaner on the market today, and that its action is instantaneous and requires nothing further than a washing with plenty of cleaner, and afterward wiping with dry waste. Dirt, oil, grease, soot, etc., can all be raised without brushes or special instruments, and with no injury to the varnish or loss to the polish.

Notes of the Month.

John F. Allen, 370-372 Gerard avenue, New York City, is in receipt of an order for eight "Allen" boiler riveters, of 108 inch reach, designed expressly for the American Car & Foundry Company for its new plant now in the course of erection at Milton, Pa. This plant now has 17 "Allen" riveting machines of this type, of 96 inch reach, which with the present order will make a large and very complete equipment. The eight machines just ordered are to be used on oil tanks for cars.

The James B. Sipe & Co., Allegheny, Pa., manufacturers of Sipe's Japan Oil, etc., has been reorganized and incorporated under the laws of Delaware, with a capital stock of $175,000. The officers of the company are, president, James B. Sipe; vice president, Benson E. Brown; treasurer, George T. Sipe; secretary, W. L. Ferguson. The company is erecting a new manufacturing plant at Bower Hill, Pa., near Pittsburg, which is to be in operation by June 1. The company will continue to operate its old factory at Allegheny, Pa., in conjunction with its new one at Bower Hill. Mr. Benson E. Brown, besides being vice president is also sales manager for the company's railway department.

Mr. W. W. Hoit, who for a number of years has been general yardmaster of the New York Central & Hudson River R. R., at West Albany, has become connected with the Quincy, Manchester, Sargent Company, with headquarters at the New York offices in the West street building.

The Youngstown Car Mfg. Co., Youngstown, O., recently received an order for 15 30-ton coal cars from the Morrissey, Fernie & Michel Railway.

The Pilling Air Engine Company of Detroit, Mich., is getting out plans and specifications for a new factory building, which will more than double the present capacity, and has purchased two acres of land sufficient to expand along other lines identified with hoisting machinery and railway equipment. Mr. J. C. Fleming is president and manager of the company. The Pilling Air Engine Company has just furnished complete equipment for the American Car & Foundry Company's steel car plant at Madison, Ill., to replace electric racking trolleys and hoists; also complete equipment for the same company in its new St. Louis steel car plant. The car company is now using in all its plants Pilling hoists and trolley racking devices over pit riveters.

The downtown offices of the Chicago Railway Equipment Co. have been removed from the Great Northern building to suite 413 Fisher building, Chicago.

The charter of the Ross Valve Company, Troy, N. Y., having terminated, Mr. George Ross, his sons, William Ross, John C. Ross, and Adam Ross, 2nd., will continue the business as successors, under the firm name of The Ross Valve Manufacturing Co.

The Independent Pneumatic Tool Co., First National Bank Building, Chicago, Ill., recently received a large order for Thor piston air drills and pneumatic hammers from the Wisconsin Engine Co., Corliss, Wis.

The Safety Car Heating and Lighting Co., formerly at 160 Broadway, New York, announces the removal of its general offices to the United States Express Building located just west of Trinity Church at the corners of Trinity Place, Rector and Greenwich streets, New York City. The offices will occupy the entire seventeenth floor of the building, and command an excellent view of the city, river and bay. The company states that all of its six factories are now crowded to the limit with orders, due in large measure to the demand for the new mantle lamp which has proved such a magnificent success. As with the Pintsch mantle lamp it is possible to secure a threefold greater illumination without additional consumption of gas, and the lighting equipment of over 29,000 cars, already equipped with the Pintsch system is available for the new system by replacement of simply the lamps, the popularity of the new fixtures is easily understood. In a letter recently received from Mr. Henry Gerdes, Technical Director. of the firm of Julius Pintsch, Berlin, Germany, he writes that a large number of trains are now using incandescent gas lighting and that the lighting effect is a very good one. Acetylene has been found very much more expensive than oil gas and, as there are so many incandescent gas lights with mantles in use and the illumination produced is so sufficient, the Directory of the Prussian State Railway has concluded, as a result of trial, to change the equipment of all cars to incandescent gas lighting before the end of the year 1909; and after that date they will manufacture only Pinsch gas and not Pintsch gas enriched with acetylene. All new cars to be built during 1907 (about 3,800 large cars) will be equipped with mantle lamps. The General Direction of the Saxony Imperial State Railway have adopted the same method of lighting. The Pintsch lighting equipment is now applied to over 140,000 cars throughout the world.

"Ten-wheel Type Locomotives" is the title of a pamphlet just issued by the American Locomotive Company, which illustrates and describes ten-wheel locomotives weighing over 150-000 pounds. It is a sequel to the pamphlet issued last month by the same company describing lighter designs of this type. Thirty different designs are illustrated and the principal dimensions of each design given. The designs presented range in weight from 152,000 to 201,000 pounds and are adapted to a wide variety of road and service conditions. This is the sixth of the series of pamphlets which is being issued by this company, and which now includes pamphlets on the Atlantic, Pacific, Consolidation and Ten-Wheel types of locomotives.

"Light Locomotives," is the caption of a pamphlet recently issued by the American Locomotive Company, and illustrates and describes light locomotives both steam and compressed air, adapted for the use of contractors, mines, logging roads, plantations and industrial plants and for a wide range of service on light rails and poor road bed. The pamphlet contains thirty-one illustrations of different designs and types and on the page opposite each illustration is a table giving the principal dimensions of designs of progressive weights and hauling capacities of the type illustrated. The last part of the pamphlet is devoted to engineering data and contains a number of very useful tables and formulae. The pamphlet is a complete record of the production of the company in locomotives of light power.

Technical Publications.

"Air Brake Catechism." By Robert H. Blackall.—The twenty-fifth edition of this work is a thorough revision of the previous editions with additional chapters on the latest air brake equipment. The book offers a complete study of the equipment manufactured by the Westinghouse Air Brake Company, including the Schedule ET locomotive brake equipment; the K quick service triple value for freight service and the cross compound pump. The operation of all parts of the apparatus is explained in detail and a practical way of finding their peculiarities and defects with a proper remedy is given. It contains nearly two thousand questions with their answers, giving a detailed description of all the old standard and improved equipment and also all the necessary information to enable a railroad man to pass a satisfactory examination on the subject of air brakes. Two colored educational charts are included with the book giving the Westinghouse standard equipment for both passenger and freight locomotives and cars. The book contains 400 pages with over 130 illustrations.

Price $2.00. Published by Norman W. Henley Publishing Co., New York.

"Practical Lettering." By Thomas F. Meinhardt.—The object of this book is to show the author's system of spacing letters in order that a uniform optical effect will be produced. The system, which is patented, is based on a unit found by dividing the height of the letter in 16 spaces, the chart showing the number of units to be used between the letters. The importance of properly spacing letters is shown by the fact that poorly shaped letters, properly spaced, will produce a better optical effect than more perfectly formed letters improperly spaced. Charts are given with guides for showing the proper spacing with other instructions for obtaining the correct proportions of letters. Hints on pen work and duplicating with alphabets of various styles are shown to aid the beginner. The book is a practical treatise on spacing.

Price 60 cents. Published by Norman W. Henley Publishing Co., New York.

"Twentieth Annual Report of the Interstate Commerce Commission."—This report is complete review of the work of the Commission for 1906. It includes decisions and rulings of the Com- of the Commission prior to August 28, 1906. Complaints and hearings, with cases settled and discontinued are also reported with Court decisions on cases of all kinds. Statistics of railways are discussed at length with chapters on safety appliances and accidents.

Published by the Interstate Commerce Commission, Washington.

"The Chemistry and Technology of Mixed Paints." By Maximilian Joch.—This is the first book ever written on the subject of mixed paints and is not a compilation of matter hitherto published but is largely the result of original research of the author. The volume is intended for the student in chemistry who desires to familiarize himself with paint, or the engineer who desires a better knowledge of the subject, or for the paint manufacturer and paint chemist as a work of reference. The various chapters deal with the manufacture of mixed paints, the white pigments, the oxides of lead, the red pigments, the yellow, blue and green pigments, inert fillers and extenders, paint vehicles, special paints, and analytical analyses of paints. This book contains 166 pages, with 60 photo micrographic plates and illustrations.

Price $3.00. Published by the D. Van Nostrand Company, New York.

"Eighteenth Annual Report on the Statistics of Railways in the United States."—This report is prepared by the division of statistics and accounts under the direction of the Interstate Commerce Commission and is a complete compilation of statistics of all kinds relating to railroads for the year ending June 30, 1905.

Published by Interstate Commerce Commission, Washington.

"Railroad Pocketbook." By Fred H. Colvin.—This little book 4 by 6 inches in size, with limp cloth covers, has been prepared with the idea of gathering together in compact form the information and data which is constantly used in the different branches of railroad service. While the information given is brief, it is clear and easily found when wanted. The subjects are arranged alphabetically, and the index abandoned. This book is full of reliable tables, formulæ, etc., relating to locomotive practice with numerous illustrations and diagrams. It is the most compact volume considering the amount of information given than any which has yet appeared. It should be in the hands of every practical railroad man.

Price $1.00. Published by the Derry-Collard Company, New York.

"Annual Report of the Smithsonian Institution."—The report of the Smithsonian Institution for the year ending June 30, 1905, is an interesting collection of scientific data and historical research covering a broad and comprehensive field. Among the subjects treated may be named, Photographing Lightning with a moving camera, Progress in Radiography, History of Photography, Liberia, The Fight against Yellow Fever, etc.

Published by the Institution, Washington.

Railroad Paint Shop

Edited by
J. H. PITARD
M. C. Painter, M. & O. R. R.

Devoted to the Interests of
Master Car and
Locomotive Painters

Official Organ of the Master Car and Locomotive Painters' Association

New Paint Shop at Kingsland. D. L. & W. R. R.

The new D. L. & W. passenger car shops are located at Kingsland, N. J., seven miles west of New York City. The accompanying views give an idea of the interior arrangement in paint shop, varnish room and paint stock room.

Fig. 1 shows a completed car on the transfer table. The latter will take care of the shifting of cars as well as locomotives upon completion of the new locomotive shops a portion of which shows in the upper left hand corner of the picture. This company has a passenger equipment of 835 cars which it is aimed to overhaul once every twelve or thirteen months.

Fig. 2 gives an idea of the paint shop proper and the scaffolding used in connection with the painting on exteriors of cars. It consists of metal eye-beams placed in a vertical position one end imbedded in a square of concrete upon a solid foundation. These eye-beams are thoroughly braced and at the top of each is placed a sheave over which runs the steel cable supporting the staging on one side and the counter balance weight on the other. The staging-brackets as well as the counter weights are held in position by lugs which clasp around either side of the projecting wings of the eye-beams. The apparatus is held in position by metal pins fitting into corresponding holes in brackets and eye-beams. The floor is of vitrified brick with pitched joints. Light is supplied from above by a monitor running the length of building aided by an auxiliary flat skylight and numerous side windows. The paint shop is composed of two large rooms, each containing six tracks, the latter accommodating three cars each, or a total paint shop capacity of thirty-six cars.

FIG. 1. COMPLETED CAR ON TRANSFER TABLE.—KINGSLAND PAINT SHOP, D. L. & W. R. R.

The varnish room as shown in Fig. 3, has a floor space of 68'x125', with an adjacent wash room, size 47'x68'. On the right will be seen the sash racks, the slides being made of galvanized iron bent to shape and nailed in position. Rack room to accommodate sashes for sixty-four cars is provided. On the left is shown the door and stop racks built entirely of iron tubing. Portable work benches as shown in center of illustration are used. The floors in these rooms are of concrete.

Fig. 4 shows interior of paint stock room, size 38'x62'. On the extreme left is the dispensing counter which runs the entire length of the room and before which the workmen line up to receive their materials and tools. Three marble slabs for mixing, size 30"x30" are distributed along the top for use in connection with pallette knives. On the right is a row of fourteen tanks holding sixty gallons each. These are built of steel and are used for taking care of liquid materials such as varnish, oils, turpentines, etc. A steel Coburn track runs over head the entire length equipped with a crane hoist. This is used in emptying barrels of material in to the tanks. In the centre are shown two rows of ten gallon galvanized iron buckets twelve to a row. These are bow shaped, bulging outward near the centre at which point they swing from pivots. A spout is provided to pour from and a lid covers the entire top excluding all dust. They are used in connection with dispensing all ready mixed materials such as priming, surfaces, truck color, roof color, inside baggage color, etc., etc. The stirring is done by a paddle suspended in each bucket, experience having taught us that to agitate by air pressure is impractical on account of the unavoidable introduction of moisture.

FIG. 2. INTERIOR OF KINGSLAND PAINT SHOP, D. L. & W. R. R., SHOWING TYPE OF SCAFFOLDS USED.

In the background will be seen a system of fifty-six drawers used in the careful filing away of all pounce, stencil and master patterns. An index book is maintained making the location of all patterns an easy matter. Brushes are kept by being suspended in square galvanized iron cans in a vertical position from wires placed through conveniently bored holes in the brush handle.

FIG. 3. INTERIOR OF VARNISH ROOM.—KINGSLAND PAINT SHOP, D. L. & W. R. R.

The floor in this room is also of concrete and in the basement directly underneath, (size 38'x85') are kept all barrelled materials in a moist atmosphere to prevent leakage.

In the construction of buildings and fixtures no efforts have been spared to make them fire proof. Brick, steel and concrete being used wherever practical. The roofs are of the last-named material reinforced with expanded metal.

The interests of the painting department are looked after

F.G. 4. INTERIOR OF STOCK ROOM.—KINGSLAND PAINT SHOP, D. L.W & R. R.

by a foreman-painter, an assistant and a man in charge of the varnish room work. The master painter who looks after the different interests in the painting line in the various departments of the road, also makes this his headquarters.

B. E. Miller,
Master Car Painter, Kingsland, N. J.

Meeting of the Advisory and Executive Committees.

The annual meetings of the Advisory and the Executive committees of the Master Car and Locomotive Painters' Association were held at the Grand Hotel, Cincinnati, O., Friday, February 22, 1907.

The Advisory Committee meeting was called to order promptly at 9 a. m. by the chairman of the committee, who welcomed those present in a very cordial and pleasant manner and remarked that it was very pleasant to see so many familiar faces of the Association in response to the circular issued, inviting as many of the members as could to attend and lend their aid to the committee in formulating the subjects for discussion at the next annual convention, and remarked also. that suggestions from visiting members would be gladly accepted and the utmost consideration tendered them.

With this invitation those assembled practically formed themselves into a committee of the whole, and while harmony prevailed, enthusiasm ran high, as suggestion followed suggestion with almost rapid fire of discussion. At the conclusion of the business for which the Advisory Committee meeting had been called, Mr. Lanfersick thanked the members for their prompt attendance and fine work, expressing himself as being very much pleased at the interest taken by members outside of the committee, many having travelled many miles at their own expense to be in attendance, showing, as it does, loyalty to the Association among its membership which is truly commendable.

The committee then adjourned and the Executive Committee, which the revised constitution and by-laws of the Association created, was called to order for the first time by President Houser. This committee consists of the officers of the Association, together with the Advisory Committee, making a committee of nine. President Houser called for a report of the Hotel Committee, which was read by Mr. George Warlick of Chicago, Chairman, and after a few remarks which were indorsed by Mr. Harry Quest of the Heath & Milligan Co., a member of the committee, it was unanimously voted that the Association hold its 38th annual convention at Hotel Ryan, St. Paul, Minn., Sept. 10—13, 1907, and that the Hotel Committee as now represented be continued until the close of the 38th Convention that they be given full powers to make with management of Hotel Ryan satisfactory arrangements for headquarters, rates, etc. It was also voted that the Hotel Committee act as a reception committee during the convention to adjust all complaints and to see that members and associates receive proper attention.

A vote of thanks was tendered to the manager of the Grand Hotel for his very kind attentions and courtesies shown the committees and members present during the meetings, also to the supply men present for their generous hospitality in their efforts to make the committee and members feel "at home" by very pleasureable entertaining.

Business of the committees for which the meetings were called, having been concluded, adjournment was made to the banquet hall, where a bounteous repast had been prepared and was enjoyed by all.

Forty-four were seated around the tables, showing a continued increase in numbers attending these meetings which are fast becoming as they should, an important factor in the advancement and welfare of the Association.

There is nothing more important than the selection of subjects for discussion, which should not be chosen haphazard or at random, but from experiences, and studied thought, for the best interests of all concerned, and we might add, with a sprinkling of diplomacy.

A few started for their homes Friday evening, but the majority attended theatre and spent a very enjoyable evening with John Drew in "His House in Order."

The annual meeting of these two prominent committees was counted a success and au revoirs were heard; "to meet you at St. Paul in September."

Following is a list of the subjects and queries, selected by the advisory committee together with names of members chosen to prepare and present papers.

SUBJECT No. 1.

The Painting of Steel Passenger Equipment.

(A) How should the interior be treated.

(B) How should the exterior be treated.

The above to be a composite paper by

John D. Wright, B. & O. R. R., Baltimore, Md.
H. M. Butts, N. Y., C. & H. R. R. R., Albany, N. Y.
R. J. Kelly, Long Island R. R., Brooklyn, N. Y.

Essay: Plainness, Problems, Perplexities and Prophecies pertaining to the present day Railway Paint Shop. By Charles E. Copp, B. & M. R. R., Lawrence, Mass.

SUBJECT No. 2.

Disinfecting Passenger Cars at Terminals.

What is the most improved method of disinfecting passenger equipment at terminals to comply with State laws.

H. E. Smith, Chemist, L. S. & M. S. Ry
R. W. Mahon, Chemist, N. Y., C. & H. R. R. R.
A. J. Brunning, Louisville & Nashville R. R.

SUBJECT No. 3.

The Cleaning, Coloring and Lacquering of Metal Trimmings, Lamps, etc., for Passenger Equipment Cars.

B. E. Miller, Lackawanna R. R.
George Warlick, C. R. I. & Pacific Ry.
E. F. Bigelow, N. Y., N. H. & H. R. R.

SUBJECT No. 4.

Painting Locomotives and Tenders.

(A) What parts should be varnished?

(B) What parts can be treated with enamels to advantage?

(C) Is it advisable to use asphaltum or oil paints?

John H. Kahler, Erie R. R.

W. A. Buchanan, Lackawanna R. R.

Eugene Daly, C. C. C. & St. L. Ry.

SUBJECT No. 5.

To what extent may the various Linseed oil substitutes and drying oils be used in the painting of cars and locomotives?

W. O. Quest, Pitts. & L. E. Ry.

W. H. Smith, Southern Ry.

QUERIES.

NUMBER 1.

Have you found any material or coating that will resist the action of rust?

Discussion opened by Charles E. Becker, C. C. C. & St. L. Ry.

NUMBER 2.

Denatured Alcohol—Is it a satisfactory substitute for pure grain alcohol, for railroad painters' use?

Discussion opened by W. J. Orr, Erie Railroad.

NUMBER 3.

Is it advisable to apply three coats of body color to a car, if two coats will cover?

Discussion opened by John Gearhart, Pennsylvania R. R.

NUMBER 4.

Can the lasting qualities of light colored freight car stencil paints be improved?

Discussion opened by Walter Bailey, B. & M. R. R.

NUMBER 5.

From a painter's standpoint, is pressed fibre as durable as a three ply wood veneer headlining, for a passenger equipment?

Discussion opened by O. P. Wilkins, Norfolk & Western R. R.

NUMBER 6.

What should be the nature of detergent for railway paint shop use?

Discussion opened by B. E. Miller, Lackawanna R. R.

It was voted that a committee of five be appointed by the chair to determine the best method of applying and painting canvas roof and report to the next annual convention. The committee appointed consists of: John D. Wright, chairman, B. & O. R. R., D. L. Paulus, Barney & Smith Co., H. M. Butts, N. Y., C. & H. R. R. R., W. J. Orr, Erie R. R., B. E. Miller, Lackawanna R. R.

The members present consisted of: President J. W. Houser, 1st Vice President B. E. Miller, 2nd Vice President George Warlick, Secretary and Treasurer A. P. Dane, John F. Lanfersick and Mrs. Lanfersick, David A. Little, John D. Wright, A. J. Brunning, W. J. Orr, D. L. Paulus and Mrs. Paulus, George Schumpp, Thos. Byrne, A. R. Lynch, H. M. Butts and Mrs. Butts, Mr. Hibbard, J. J. Sherrin, J. H. Kahler, John Gearhart, D. W. Smith, Eugene Daly, C. B. Harwood and Mrs. Harwood and Miss Downing, O. P. Wilkins, Fred Heizel, Fred Kautter.

The following representatives and associate members were also present at the meeting: William Marshall, Anglo Amer. Var. Co., H. G. Taylor, The Ball Chemical Co., Harry Quest, and W. R. Parker, Heath & Milligan Co., D. B. Vail, Buffalo Varnish Co., H. W. Kittredge, Kay & Ess Co., Harry Kuhns, Flood & Conklin Co., R. T. Brydon, Wadsworth-Howland Co., James A. Gohen, Cleanola Co., Thos. Murray, Protectus Co., W. A. Kelly, Keystone Varnish Co.

Importance of Clean Railway Cars.

In view of the fact that we are a nation of travelers, railway sanitation has become one of our most important problems. In *The Railway Surgical Journal* (Chicago, vol. xiii, No. 1) Dr. H. M. Bracken, secretary of the Minnesota Board of Health, points out that general sanitation can not deal with this problem satisfactorily and that the incentive to action must come from railroad representatives if the greatest amount of good is to be accomplished. Cleanliness, while cars are in service and at the cleaning-station, is regarded by Dr. Bracken as most important, and he insists that expectoration and the throwing of refuse on the car floor should be strictly prohibited and the prohibition rigidly enforced. The sweeping of cars during transit he characterizes as unsanitary and filthy and maintains that, when it is at all necessary to clean cars en route, some material, such as wet or oiled sawdust, should be used upon the floor to lay the dust. "A car should only be cleaned in transit," he says, "at some station where a long stop is made, when passengers can disembark is so disposed. But even then the dry system of sweeping should not be permitted."

Another feature of importance in car sanitation is the nature of the upholstery. Plush, Dr. Bracken thinks, should not be used for this purpose. In the cleaning of cars at terminals the vacuum system, by which the dust is drawn instead of blown from the article cleaned, is stated to be the latest and best method. It is now in use in the best-equipped cleaning-yards and, altho not yet perfected, will undoubtedly be in general use in the near future.

That the problem of car ventilation can be solved, says the writer, has been demonstrated by one or two railway companies, notably by the Pennsylvania, in whose system fresh air is introduced into the car under the seats instead of through overhead transoms. While he declares that successful heating must go hand in hand with successful ventilation, he insists that rules and regulations governing employees will not secure results unless there is a constant supervision by responsible parties. Speaking to his fellow railway surgeons and emphasizing the necessity of a supply of pure drinking-water for the use of the railway employees as well as the passengers, the doctor writes: "It must be a fact well known to you all that in many instances the drinking-water, in day-coaches at least, is from a contaminated water supply," a frank admission that will certainly startle the traveling public.

Preserving the Old Surface.

When the exterior of a passenger car has been repeatedly varnished until the accumulation has become of a certain thickness, cracking and blistering is the natural result, then, according to present methods of coach painting, burning off is resorted to, and the surface, whether it be good or bad is removed along with the varnish. This method on its face is apparently an unwise proceeding. It is like cutting off both limbs when one is injured beyond surgical repair.

It is frequently the case that the varnish on a car reaches a condition requiring removal, when the surface is unimpaired and capable of several years further surface provided it could be freed of the varnish coatings without injury. But this is a rather difficult operation, and the methods usually pursued are almost as costly as burning off. So far as known, ammonia is the best agent for this purpose, and it is not altogether certain that it does not work injury to the under coats, and the process is somewhat slow. If a surfacing material were devised that could not be affected by varnish remover, the work could be cheaply and quickly performed. It is a subject worthy of the attention of expert color makers, and which if effected, would greatly reduce the cost of painting, and in fact would be quite an evolution in coach painting and maintenance.

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Contents

The Mallet Compound as a Helper Engine.

ABOUT eight months ago the Great Northern Railway purchased five Mallet compound locomotives for helper service on the mountain divisions. While little was known at that time regarding this type of engine in this country, it was believed that it was particularly adapted to helper service. The results of the performance of the locomotives purchased by the Great Northern during the time they have been in service would indicate that they have fully justified expectations and made a record which would seem to warrant a more general adoption of the Mallet type to helper service.

The tests of engine 1800 on the Cascade division of the Great Northern, published on another page of this issue, clearly show the economy of the Mallet engines in comparison with those of the simple consolidation type formerly used in helper service. The average saving of over 12 tons of coal on one trip of 32 miles of heavy grade, represents the approximate economy of the Mallet engines and the increase in tonnage from 500 to 1,350 tons gives an idea of their performance as compared with that of the consolidation engines.

The enormous boiler capacity of the Mallet engines in addition to their great starting power and economy in the use of steam render them especially fit for helper service where they must be worked to the maximum, for long continuous periods.

Surprise Signal Tests.

IT is the practice of a number of railroads to conduct surprise tests in order to keep a proper check on the way signals are being observed and obeyed by engineers on the road. This method has resulted in increasing the efficiency of the signaling system as the percentage of signals disregarded or disobeyed by engineers has been materially reduced and the movement of trains in accordance with signals, made much more certain.

In 1906 the Chicago & Northwestern Railway conducted 1625 tests of blocking signals with not a single instance recorded where engineers failed to obey the signals. They also conducted 1,621 other tests with Hall signals, torpedoes, etc., which resulted in 16 cases where engineers did not bring their trains under proper control in accordance with the rules. The engineers who failed to properly observe the signals were promptly disciplined.

In the last three months 97 surprise tests have been made on the Pennsylvania Railroad, during which time 2,252 trains were tested. The results show that 97 per cent of the engineers complied with the rules of the company and 3 per cent. brought their trains to a stop but not until after passing the signals. The tests were conducted by division officials of the company, who at unusual time and places, set signals at caution or danger, extinguished signal lights, displayed fusees or placed torpedoes on the track. Failure to observe any of the rules regarding the use of signals was reported and discipline promptly administered.

The results of these surprise tests show that the signals are seen by the enginemen in all cases, but that they are not always properly observed. The number of instances recorded where trains were not brought to a stop inside the signal may be partly explained by the habit of enginemen approaching signals which are usually clear or expected to be, at a speed which is not regulated by the possibility of a stop position being displayed. This system of running is not justified, yet it is a product of the fast schedule and is a practice which has been practically forced on the engineer in the struggle to make the time. The surprise tests show a high average of efficiency on the part of the engineers in obeying signals, and it is reasonable to expect under the present system of education that failures to properly obey signals will soon be almost unknown.

Automatic Connectors for Air and Steam.

AT the last convention of the Master Car Builders' Association, the committee appointed to prepare standard dimensions for automatic couplings (connectors) for steam heat, air brake and air signal lines, did not feel warranted in making a recommendation in view of there being two general types and because of the patent situation seeming to be in favor of one of them.

Since that time several new connectors have been experimented with and some of these have been so far perfected that it is expected to place them on exhibition at the coming conventions at Atlantic City. With the number of designs of automatic connectors that are being developed, it is probable that the efforts which have been made to perfect such connectors will soon place several of them on the market.

Should those connectors exhibited this year impress the committee favorably as possessing features of practical merit, it would be fair to the manufacturers, as well as of assistance to the railroads, for the committee to determine upon certain dimensions and contour lines to which all connectors must conform, based upon the designs of the most practical devices and the requirements for this class of work.

By approving of certain definite specifications which all makers of connectors will have to meet, the committee should establish a principle by which the various manufacturers will be guided and the roads will be provided with some understanding of the devices which they will have to consider.

It is not consistent for the committee to recommend any patented device, but it is a fact that if certain general principles are established, much of the struggle which existed several years ago in connection with the drawbar coupler will be avoided.

The most essential feature to be considered is the provision that each type of connector shall interchange with any other type and that any automatic connector shall be capable of being coupled with the ordinary hose couplings now in service in order that cars not equipped with the automatic devices may be cut into a train with cars having the automatic connectors.

In order that the connectors on different cars shall couple automatically it is evident that they must be carried above the center line of the track. Also they must be at the same height above the rail. A dimension, then, that should be determined upon is the height of center of connector above rail. The size of port holes and distance between them should be made standard so that all makes of connectors will provide the same sized port holes, the same distance apart.

The several conditions governing the use and maintenance of connectors as well as the experience of those who have been experimenting with them would lead to the conclusion that the most practical method of attaching connectors is to secure them to the drawbar and beneath the drawbar, to maintain a solid connection. The lost motion between the cars due to the elasticity of springs, the wear of parts, irregularity of track, curves, etc., should be taken care of by hose or knuckle joints and not by the connectors. This will require a certain amount of flexibility to provide for a motion between two cars of at least 12 inches, or 6 inches on each car, in the direction in which cars tend to pull apart, as well as for the other various movements between the ends of the cars.

These conditions are met by different methods in the several devices designed as connectors and while it will not be necessary for all connectors to be identical in design, it is absolutely necessary that all of them should conform to certain general contour lines that will make them interchangeable and the sooner these lines are determined upon the more satisfactory will be the results obtained.

Roundhouse Facilities.

WHEN motive power is in such demand as it is at present time, the necessity for ample roundhouse facilities is of first importance. When these facilities are not furnished, the movement of locomotives through terminals is slow and costly. Often times the roundhouse organization is blamed for this and methods are questioned—perhaps some one is discharged. A certain master mechanic whose organization is now under suspicion—because locomotives are not turned as promptly as desired, makes this statement of conditions. "We are handling from 50 to 55 engines a day with a 10 stall roundhouse. The number of engines owned by the road has been increased 40 per cent in the last 5 years and the business has quadrupled, but the facilities for handling engines have not been improved. A new roundhouse is now under construction and I hoped that it would be in readiness for next winter, but now money is so tight, the work is shut down and we may have to put in two more winters in this congested place. The prospect is not very encouraging." This raises the question of who is really to blame for the delays and slow movement of engines through this terminal.

The indications are, that the master mechanic will soon be succeeded by another man.

The Atlantic City Conventions.

THE most interesting and notable event of the year among the railroads is the convention of the American Railway Master Mechanics' and Master Car Builders' Associations at Atlantic City, June 12 to 19. This meeting has been held every year for many past and each year with growing interest and enthusiasm. This fact is natural and in keeping with the spirit of progress and the enormous growth of the railroad business. While each convention has been larger than the last, it would seem that the one to be held next month will show a much greater increase in attendance than any previous one.

The reasons for this are the great natural growth of the railroads and the increasing value and advantages derived from the meeting of the associations which has been demonstrated each year.

The regular annual conventions were held at Atlantic City last year. The facilities and accommodations for members have been much improved and it is an assured fact that the success of last year's meeting, although great, will be surpassed this year.

The arrangements for the exhibits on the steel pier this year have not only been much improved by reason of experience, but greater effort has been made to make them more attractive by the construction of artistic and suitable booths. The area devoted to this feature has also been increased to over 70,000 sq. ft., and it is believed even this will not be sufficient space to give all as much room as they desire. Besides this large area of floor space on the pier, there will be extensive track exhibits of cars and locomotives.

The benefit derived from attending this convention is more easily appreciated by seeing it. The opportunity to examine practically every new device and all of the latest machinery used in railway operation, can hardly be overestimated. Nearly every manufacturer of railway equipment or machinery will attend this convention and will show his product whether it be large or small, from the heaviest locomotive built and the large shop machine weighing 10,000 lbs. to the smallest and latest device.

The educational value of this convention to the railway official is most far reaching. It is impossible to enumerate all of the new devices many of which have never been shown, which will be exhibited here, but a few can be mentioned. There will be the latest developments in axle lighting, pneumatic hammers and drills, roller bearing journal boxes, ventilating systems for cars and shops, cast steel construction of all descriptions, track exhibits of the latest locomotives and steel cars, trucks and bolsters, draft gear and couplers, side bearings, air brakes, springs, self-measuring oil and storage tanks, automatic steam and air hose coupling, water purification, blow-off valves, car heating and car lighting systems, car cleaning, acetylene, gas and electric car lighting, watchmen's clocks, iron and woodworking shop machinery, jacks, staybolts, high speed steel, smoke jacks, rolling shutters, tool holders, lubricators, paint, roofing, asbestos, tube rattlers, shearing and punching machinery, packings, steel tubes, brass goods and innumerable other devices.

It is from this collection of what is latest and best that the busy railway official will derive benefit aside from the discussions in the sessions of the associations. He will have leisure to look at and investigate new devices he has seen advertised. He can observe them in practical operation and decide which are best for his needs. The value of association whereby new questions are raised and new ideas developed, is the greatest incentive for this convention. Association with the new machines or devices and their manufacturers as well as fellow officials, accomplishes this.

No convention has yet been held that will equal this in the number, variety and extent of the exhibits displayed, and while expense has not been spared by the association to make it a success, never before has so little money been expended in building booths for the exhibits. These are most artistic and will at the same time give an appearance of stability, permanency and individuality to each exhibit and enable the manufacturer to display his machine or device to the best possible advantage.

All this has been done to make this convention attractive. While the convention lasts but one week, it is by far the best opportunity that could be offered the railway official to see all the latest and most improved devices. Every facility therefore has been offered manufacturers to bring their products here and display them.

No railway official in the whole country can afford to miss this meeting. No matter how closely he may study conditions and improvements in railway operation he will get new ideas here. He will see new machinery that has not yet gotten into general use, new tools that are still in the experimental stage and new devices of which he has only heard. These will be shown in actual operation and here he will have time to go into the details of their practical operation. The advantages to be derived and knowledge gained will be greater than if the manufacturer were to call at the official's office. Here he will be entirely free to devote his time to any device or tool in which he may be interested and he can quickly compare one device with another for they will be almost side by side. Compare this with the labor, time and expense necessary in going from the plant of one manufacturer to another and the economy of the convention to the railway official is at once apparent.

The vast interests represented at this convention can scarcely be grasped. The combined capital of concerns exhibiting would pay the national debt and then some. The meeting lasts a week but its cost including all expenses runs into hundreds of thousands of dollars. Exhibitors spend months in labor and preparation building their best and latest machinery to bring hundreds of miles.

To see this exhibition is to realize the progress and development of the railroads, the greatest commercial organizations of the age. This exhibit represents in concentrated and compact form the source from which these vast interests draw their supply of material. You will find here manufacturers who make anything from a lock nut to a locomotive, from a brass tack to a steel frame mahogany and plush finished palace car, from a tiny packing ring to enough "paint to cover the earth."

This convention is recreative in its effect. It is true, the railway official gives much attention to the reports and discussions during the meetings and spends much time examining devices and machines but even this has charm and interest for he is entirely free from office routine and the daily duties of his position. Outside of the convention it is an enjoyable holiday and Atlantic City needs no comment as a summer resort. Its many features of interest are at hand. Besides, there are the special arrangements for entertaining members of the convention by a committee appointed for this purpose and among these are receptions, balls, outings, and other affairs which combine to make the week one of pleasure for the official and his family as well.

No railroad official should miss such a convention as this. To those who have attended in former years this will be a surprise, to those who have never attended before it will be a revelation. It will prove far more valuable and beneficial than a week spent in any other manner. It will produce new thoughts, originate ideas broaden the knowledge and excite the interest of railway men in ways and along lines that no other means could.

Thousands will attend this convention. In railroad circles it is the biggest and most important event of the year. None will regret having gone. No one can fail but see many things that will be remembered long after the convention is past that will make for far better results in shop practice and economy in car construction or repair. Though the cost of holding it is great, the railroads themselves will be enormously benefitted, for it means greater interest, more experience and enthusiasm in the work of officials.

These are some of the reasons why the June convention merits the attention and expense which are incurred. Nothing else in railway meetings of the year compares with it, so it can be readily comprehended why such efforts are put forth to make this a success. The best commentary on it is what will be heard from one who has been there. No railway official can attend this convention and come away without being refreshed in body and mind and inspired with the spirit of progress.

The Four Cylinder Balanced Compound in Actual Service

By H. A. F. Campbell.

MR. L. H. FRY in a paper "The Future of the Locomotive" published in Cassiers, January, 1907, shows the present day tendency in passenger locomotive design. The characteristic curves shown would indicate that at high speed, the resistance of the machinery and of the frontal wind pressure reduces the tender draw bar pull out of all the proportion to the work developed in the cylinders.

The limit of height and width, unless the whole system of track arrangement is changed, has been nearly reached. The present aim however should not be to produce a larger and heavier high speed engine by crowding every inch of loading gauge with a huge boiler and massive machinery. It should be rather to perfect the present type of Atlantic locomotive, moderate in size and of a total weight of engine and tender not exceeding 155 tons. Within this weight, develop a greater and more uniform horse power at the cylinders and crank pins.

Divide the work into four units distributed through the machinery so that the parts can be made correspondingly light. This will reduce the wear and tear on the whole engine and reduce the resistance per ton weight unit of work done. Save losses through wind resistance where possible. The product will be a greater and more uniform tender draw bar pull. Such a locomotive will show a true economy not only in coal and water but also in the life of its own machinery.

It has been claimed that the compound locomotive in passenger service is a failure both mechanically and economically, but the illustrations shown in Mr. Fry's article show that foreign locomotive engineers do not think so. One American railroad even purchased a French balanced compound in order to better study its design in all details, and it is no misstatement I believe, to say, that this engine for its size and weight has proved most efficient both mechanically and economically. America, however, is surely adopting these same European principles re-designed to suit American conditions. Since 1902 the balanced compound has been steadily increasing in demand. The following list gives the number of Baldwin 4 cylinder compounds now in service. All but four roads have duplicated their orders, and more for 1907 are to be built.

Atchison, Topeka & Santa Fe	193
Chicago, Burlington & Quincy	20
Central of Brazil	2
Erie	2
Great Northern	10
Chicago & Eastern Illinois	2
Harriman Lines	19
Missouri, Kansas & Texas	2
New York Central	1
Nashville, Chattanooga, St. Louis	4
New York, New Haven & Hartford	2
National of Mexico	1

Pennsylvania R. R.		2
Chicago, Rock Island & Pacific		8
Total		268

It is the intention of this paper to present the records made by 4 cylinder balanced compound Atlantic locomotives in actual service and not to re-state the many theoretical advantages which can be claimed for this type of locomotive. The following records will bear study because they represent as a good average what can be done with an engine having only 4 coupled wheels and within the 155 ton total weight limit.

In 1905 beginning February 2nd and ending May 24th, the C. B. & Q. carried on set of compartive tests. They were made between Chicago and Galesburg, Ill., 162.46 miles mostly with trains No. 55 and No. 56 but a few runs with Nos. 1, 2, 5 and 12.

The trains were from 8 to 11 cars varying in total weight from 325 tons to 519 tons and making from 4 to 7 stops.

There tests embodied the taking of a great deal of data by a large staff of men, and that this work was carried on by the C. B. & Q. testing laboratory speaks for its thoroughness and accuracy.

The object of the tests was to determine the comparative, 1st Boiler efficiency; 2nd, Cylinder efficiency; 3rd, Engine resistance, and 4th, the engine economy as a whole including the first three items. These results, giving the average figures for all tests together with the type of engines and its principal dimensions, are shown on Fig. 2.

The tests show that at practically the same speed, the compound gave a higher draw bar pull, with a consequently greater ton mileage. This was done on 11.7 per cent. less water per cylinder horse power and on 19.88 per cent. less coal per draw bar horse power.

In regard to the internal friction of the balanced engine, although 4 piston heads and main rods are used, the resistance at 45 miles per hour was 15 pounds per ton weight of engine, or practically the same as the average resistance of the 3 single expansion engines. The added parts, however, balancing themselves, both in the vertical and horizontal plane, produce that smooth and steady running which is one of the balanced compounds great points of superiority. The tests do not show the reduced wear and tear to the track and bridges due to this last fact. If this amount could be known its results should be added, in favor of the balanced engine.

The above runs were made on a comparatively level stretch of road where it was possible for the single expansion engines to handle their train loads on time and to their best advantage.

Another set of runs made in July, 1904, on the C. B. & Q. Ry. from McCook to Akron show quite a different result also in favor of the compound.

Following the profile shown on Fig. 3, the first 90 miles is on an average rise of 5½ feet per mile, the next 27 miles are on rise of 37 feet per mile, and the last 26 miles are on a rise of 21 feet mile, a total climb of 2,044 feet in 143 miles. The regular train hauled by the single expansion engine, is 7 cars. Three stops are made at Benklemen, Wray and Yuma. The average

Engine No.	Name of Road	Type of Engine	Size of Cylinders	Dia of Drivers	Weight: Engine	Weight: Tender ½ Load	Weight: Total	Heating Surface: Tubes	Heating Surface: F. Box	Heating Surface: Total	Grate Area	Weight on Drivers	Tractive Effort: Single Expansion	Tractive Effort: Compound	Factor of Adhesion: Sing. Exp.	Factor of Adhesion: Comp.	Wt. of Eng. per Sq. ft. Heating Surface	Equiv. Single Expansion Cylinder	Ft. lbs. Work at Cyl. per 1 Sq. ft. Heat Sur. for 1 Rev.	Volume 2 Cyl. Cu ft	Total Heating Surface ÷ vol. 2 Cyl.
1069	Gr. Nor.	10 Wheeler	19×28×210	73	82 Tons	45 Tons	127 Tons	2076	172.67	2248.67	31 9	134000	24700	——	5.42	—	72 95 lbs	——	66.8	9.19	244
1741	C. B. & Q.	Prairie	21×26×200	69	91 "	39 "	130 "	2914.4	141.1	3055 5	42	134500	28300	——	4.75	—	59 5	——	53.2	10.42	293
		Atlantic	20½×26×210	79.18	92 "	50 "	142 "	2653	161	2814	54¼	118300	24700	——		—	65	——	57.6	9.94	283
3701	C. B. & Q.	Atlantic	20×26×210	84½	87 "	39 "	126 "	2835	156	2990	44¼	92000	22100	——	4 16	—	58.2	——	51.7	9.46	316
2520	C. B. & Q.	Atlantic	20⅝×26×210	78.4	94 "	41 "	135 "	2835	155.5	2990.5	44.14	91250	23800	——	3.83	—	62.5	——	51.7	9.46	316
Balanced Compounds																					
2700	C. B. & Q.	Atlantic	15/25×26×210	78	102 "	40 "	142 "	3056.75	166.4	3223.15	44.14	101200	25300	21400	4 0	4 7	63	18¾"	43 2	8.31	387
2706	C. B. & Q.	Atlantic	15/25×26×210	77.6	98 "	42 "	140 "	3051	155 5	3206 5	44 14	101200	25300	21400	4 0	4 7	61	18¾"	43.2	8.31	387
515	Atchison	Atlantic	15/25×26×220	79	97 "	59 "	156 "	3025	190	3215	49 5	101000	26200	22180	3 87	4 5	60¼	19"	45	8 31	387
1048	Rock Isl.	Atlantic	15/25×26×200	73	100 "	50 "	150 "	3015	194	3209	50.2	105500	25700	21790	4.10	4.84	62	19"	41.3	8.31	386

FIG. 1—TABLE SHOWING PRINCIPAL DIMENSIONS OF THE SIMPLE AND BALANCED COMPOUND LOCOMOTIVES OF WHICH TESTS WERE MADE.

Data: Engine No	Name of Road	Builder	Type of Engine	Size of Cylinders	Type of Valve	Dia. of Drivers	Steam Pressure	Heating Surface in Sq ft.	Grate Area in Sq ft	Weight on Drivers	No. of Tests	Results: Resistance: Wt Eng & ½ Ld Tender	Resistance: Av Speed M P H.	Resistance: Lbs Per Ton	Boiler Economy: Lbs of Water Per lbs Coal	Boiler Economy: Lbs of Water Per Sq ft H.S.	Cylinder Economy: Lbs of Water Per Cyl H.P per Hour	Total Engine Economy: Lbs of Coal per Draw Bar H.P per Hour	Averages: Cylinder H P	Averages: Draw Bar H.P.	Averages: Draw Bar Pull
Single Expansion Locomotives																					
1069	Gt. Nor	Rogers	oo OOO	19×28	Bal. Slide	73	210	2248	31.9	134000	7	127	46 38	15.6	6 58	13 44	28 60	8 35	730	485	3916
		Am. Loco.	oo OOo	20½×26	12" Piston	79	210	2814	54 23	118000	15	142	45 8	15 38	6.24	12 45	30.00	8 97	781	516	4210
2520	C. B & Q.	Rogers	oo OOo	20½×26	12" Piston	78.4	210	2995	44 14	91250	11	135	46 25	14.75	7 17	11.56	30.7.	7.82	764	516	4231
							Averages of 3 Engines						46.14	15 24	6 59	12 48	29.77	8.38	758	506	4119
Baldwin Balanced Compound																					
2706	C B & Q	Baldwin	oo OOo	15/25×26	15" Piston	77.6	210	3200	44.14	10200	19	140	45 6	15.6	6.95	9 63	26.65	5.99	803	541	4410
Results of Tests																					
The Single Expansion Engines used more Water per Cyl H. Power by																	11 7%				
" " " " " " Coal per Draw Bar H. Power by																		19 88%			
The Balanced Compound at ½% Less Speed Produced more Cyl H.P Draw Bar H.P. Draw Bar Pull by																			5.93%	7%	7%

FIG. 2—TABLE SHOWING DIMENSIONS OF LOCOMOTIVES AND COMPARATIVE PERFORMANCE OF SIMPLE AND BALANCED COMPOUND LOCOMOTIVES IN TESTS BETWEEN CHICAGO AND GALESBURG, C. B. & Q. RY., 1905.

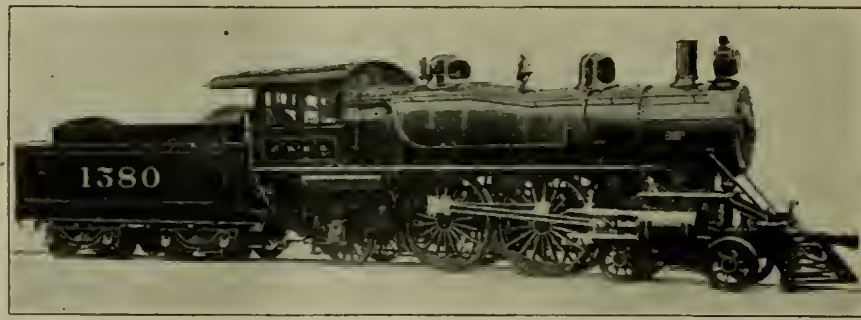
schedule speed, including stops is 39.7 miles per hour, and excluding 14 minutes for delays is 42½ miles per hour. Three types of engines were tried against the compound. The following table in Fig. 4 gives the principal dimensions of the locomotives and the results. The profile of the road and the schedule speed with the actual speed maintained by the balanced compound with 10 to 12 car trains are shown in Fig. 3.

It will be noted that the compound evaporated less water per pound of coal fired than the single expansion engines. The low boiler economy is accounted for by the fact that the engine was fired by a new man on each run and sometimes by several on the same run. The

SIMPLE TEN WHEEL LOCOMOTIVE—GREAT NORTHERN RY.

later set of tests, already recorded, show what should have been obtained if the firing had been light and even. If the tests with the 12 car train, which over-loaded the compound, had been left out of the results given, the water per cylinder horse power would have averaged 22.86 pounds. This low water rate is without doubt a record for an American locomotive in high speed road service.

That the C. B. & Q. compound used 24 per cent. less



SIMPLE ATLANTIC TYPE LOCOMOTIVE—CHICAGO, BURLINGTON & QUINCY RY.

water per cylinder horse power hour and 30 per cent less water per draw bar horse power hour means a big saving. What the single expansion engine would have used hauling a 10 and 12 car train at the same speed is not worth considering. But what may mean more to some motive power men is that the balanced compound always made its schedule time with the single expansion locomotives train of 7 and 8 cars. The balanced compound then far outclassed the single expansion engines by hauling a 10 car train in 28 minutes under the schedule time and a 12 car train at an average speed of 42½ miles per hour or on schedule time. A 142 ton Atlantic engine with 101,000 pounds on 4 drivers of any design, hauling a train of 579 tons on a continuously rising grade at the above speed, represents a very fine locomotive performance. Such engine work can rank with the very best obtained from the De Glehn balanced compound abroad.

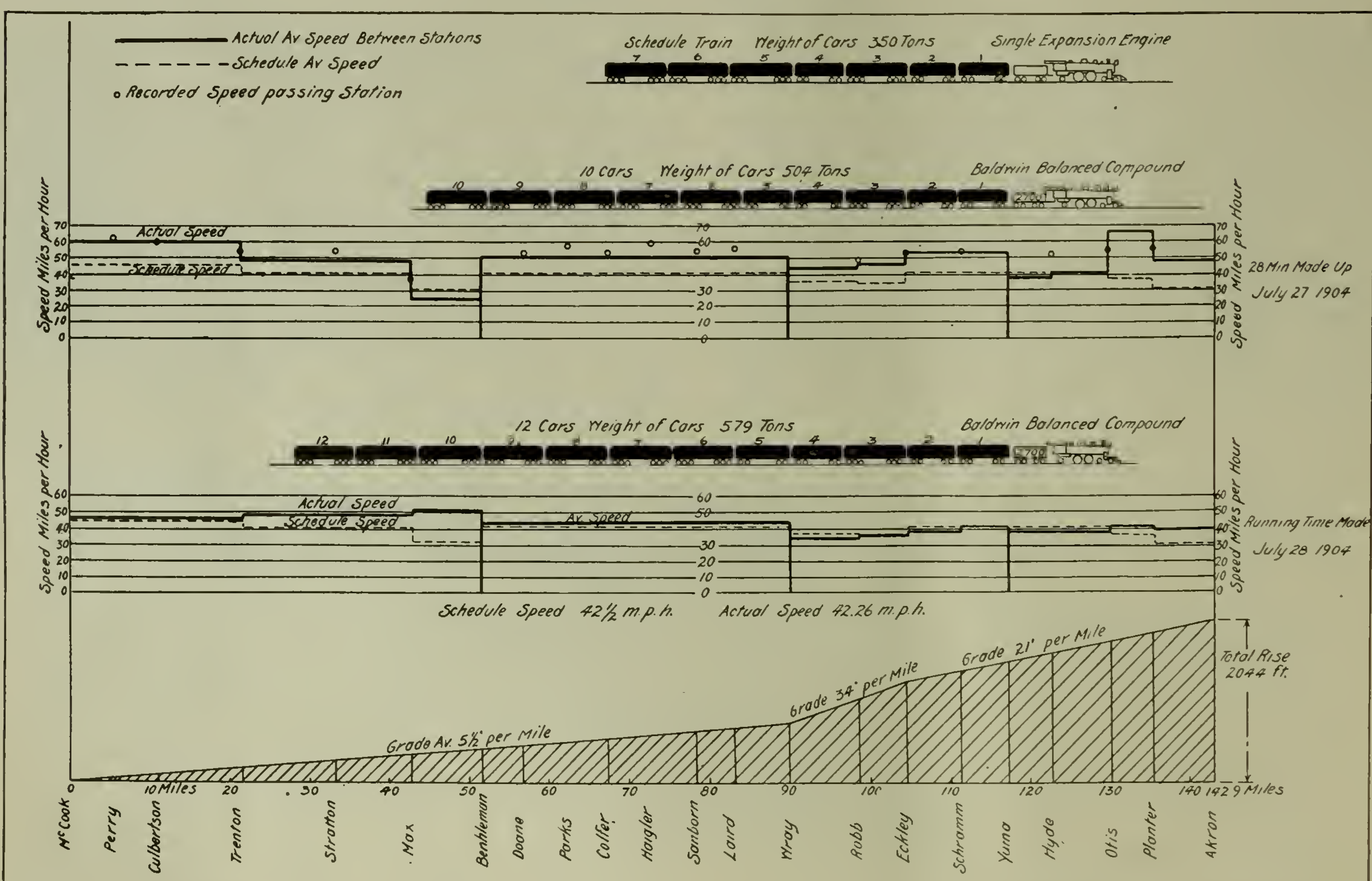


FIG. 3—DIAGRAM SHOWING PROFILE OF DIVISION AND SPEED CURVES OF TRAIN NO. 7, ON JULY 27 AND 28, 1904. BALDWIN BALANCED COMPOUND NO. 2700. CHICAGO BURLINGTON & QUINCY RY.

The Atchison, Topeka & Santa Fe Railway has for some years realized the advantage of the compound locomotive for both in freight and passenger service. In 1902 the road ordered four 4 cylinder balanced Atlantic engines for trial. These engines proved so successful that more were ordered. Today the road owns 193, 4 cylinder balanced compounds consisting of 96 Atlantic, 41 Pacific and 56 Prairie type locomotives. Twenty-five more Atlantic and 30 Prairie type engines are ordered for 1907 delivery. These engines are distributed over the system as follows: The Atlantic type engines, Illinois, Missouri, Kansas City, Middle Western and Albuquerque divisions; the Pacific type engine on the Albuquerque, Arizona and Los Angeles division, and the Prairie type engines on the Missouri division. The Pacific engines are used on the western end of the road and perform service that single expansion engines have never been able to do even moderately well. The Prairie type engines are very large machines and have been designed for fast freight service.

For all around economical work the Atlantic type 4 cylinder balanced compound is considered the company's most satisfactory engine. All important express trains are handled by them.

Their regular work is to haul trains of from 7 to 16 cars weighing from 450 tons to 875 tons. The schedules

FOUR CYLINDER BALANCED COMPOUND, ATLANTIC TYPE LOCOMOTIVE —CHICAGO, BURLINGTON & QUINCY RY.

call for 45 miles per hour with 7 sleeping cars and 41 miles per hour with 10 and 12 cars over divisions 200 miles long. Coming east these engines are called upon very often to make up lost time. As an example the company records show a run made with a train of 7 sleeping cars weighing 450 tons where 62 minutes was made up on a schedule of 45 miles per hour over a division 200 miles long. Fast runs by these Atlantic type

Schedule Time	Distance From Chicago	Station	Actual Time	Time Lost
Lv 8 40 am	0	Chicago	Lv 9.0 0 am	
				4½ Min Chicago Yards
				2 " New Track
				2 " O. S. Joliet
Lv 9 35 a.m	41 4	Joliet	Av 9 59½ Lv 10 4½	5 "
	62 8	Coal City		1 " Signal
Lv 10 47 a m	93 8	Streater	Av. 11 2 0 Lv 11 11 0	9 " Diner Attached
	114 1	Toluca	Av 11 37¼ Lv 11.38½	1¾ " Coal Engine
	120.1	La Rose	Av 11.47.0 Lv. 11.52½	5½ " Wait for #4
	130.8	Holton		1½ " Freight
Lv 11.45 am	134 3	Chillicothe	Av. 12.11 pm Lv. 12.16½	5½ "
Lv 12.54 Pm	182.2	Galesburg	Av. 1.15.0 Lv 1.20.0	5 "
		Miss Bridge		1 "
Av. 2.60 p.m	237 4	Ft Madison	Av 2.12.0	
5 H. 26 m.			5 H. 12 m	43¾ Min Lost

FIG. 5—RECORD OF DELAYS OF COLORADO FLYER, SEPT. 24, 1905. BALDWIN BALANCED COMPOUND NO. 515. A. T. & S. F. RY.

engines have come to be so common that little notice is given them by the road.

To illustrate the regular work of these Santa Fe engines, the log of the run from Chicago to Ft. Madison has been selected.

Train No. 9 the "Colorado Flyer," leaves Chicago daily at 9 a. m. In 1905 this train was scheduled to start at 8:40 a. m. and was scheduled from this time of start at an average speed including all stops of 43.7 miles per hour for the 237 miles to Ft. Madison. The twenty minutes delay at the start was to connect with the eastern mails. The train at Chicago was made up of 7 cars and a diner was attached at Streator. The cars and their weights are as follows:

1. Postal Car No. 49.........101,000 lbs.
2. Baggage Car No. 2246..... 60,000 lbs.
3. Smoker No. 619 .... 63,100 lbs.
4. Day Coach No. 705........113,000 lbs.
5. Tourist Car .... 90,000 lbs.
6. Sleeper "Vasona" ....125,000 lbs.
7. Observation Car "Ben Vorlick" ....127,000 lbs.
8. Diner ....127,000 lbs.

Data												Results					
Engine No.	Name of Road	Builder	Type of Engine	Size of Cylinders	Type of Valve	Dia of Drivers	Steam Pressure	Heating Surface in Sq ft	Grate Area in Sq ft	Weight on Drivers	No of Tests	Boiler Economy: Lbs of Water Per lbs Coal	Boiler Economy: Lbs of Water Per Sq ft H S	Cylinder Economy: Av Cyl H Power per Hour	Cylinder Economy: Lbs Water per Cyl H P per Hour	Total Eng Economy: Lbs of Water per Draw Bar H P per Hour	Ability to make up Time
Single Expansion Locomotives																	
1741	C. B. & Q	Baldwin	oOOOo	21×26	Piston	69	210	3080		134500		7 8	13 55	906	30 10	46 11	With 7 Cars always late at McCook 1½ to 6½ min made up
3703	C. B & Q	Rogers	oOOo	20×26	12" Piston	78	210	2995	44.14	91250		7 4	12 75	895	30 41	49 54	With 8 Cars 1½ min made up once 8 Cars 2 to 8 min lost on all Tests
	C B. & Q	Rogers	oOOo	20×26	12" Piston	84¼	210	2990	44.14	90000		7 22	13.78	927	30 45	48 30	With 6 Cars 6½ min 7½ m made up " 9 " 11½ " "
							Average of 3. Engines					7 41	13.36	926	30 31	47 98	On all runs Extra stop for Water
Baldwin Balanced Compound																	8 Cars 16 min made up 10 " 28 "
2700	C B & Q	Baldwin	oOOo	$\frac{15}{25}$×26	15" Piston	78		3212	44.14	101200		6 78	11 96	1122	24 37	36 78	12 Cars Running Time made
Results of Tests																	
The Balanced Compound Produced more Horse Power at Cyl by														21%			
" " " used less Water per Cyl Horse Power by															24%		
" " " " " " " Draw Bar Horse Power by																30%	

FIG. 4—TABLE SHOWING DIMENSIONS OF LOCOMOTIVES AND COMPARATIVE PERFORMANCE OF SIMPLE AND BALANCED COMPOUND LOCOMOTIVES IN TESTS BETWEEN MC COOK AND AKRON, C. B. & Q. RY., 1904.

SIMPLE PRAIRIE TYPE LOCOMOTIVE—CHICAGO, BURLINGTON & QUINCY RY.

Weight of cars..........806,150 lbs. or 403 tons
Engine No. 515 Tender (half loaded)........156 tons
Passengers, Baggage, Mails (Est.)........... 20 tons

Total weight of train.................579 tons

As stated, the time table calls for a start from Chicago at 8:40 a. m. and arrival at Ft. Madison at 2:06 p. m. or 326 minutes for 237.4 miles. On Sept. 24th, 1905, the train left Chicago at 9 a. m. and arrived at Ft. Madison at 2:12 p. m. or in 312 minutes, 14 minutes under schedule time. The average speed was 45.66 miles per hour. As 43¾ minutes were lost in stops and delays, the actual running time was only 268¼ minutes and the average speed 53.14 miles per hour. The record of the trip showing cause for delays is shown on Fig. 5.

Following the grade line and speed curve shown on Fig. 6 the first 41 miles to Joliet was broken by 2 stops and a slow down. Starting from Joliet the next 42.4 miles to Ransom are on a steady up grade, but the speed averaged 55 miles per hour from Ransom to Chillicothe 50½ miles, 2 stops were made, but the average speed was 50 miles per hour. From Chillicothe the heaviest pull is encountered where for 6 miles the grade is 58 feet per mile and in conjunction with a bad reverse curve. From Edelstein to Galesburg 39.9 miles the average speed was 60 miles per hour and one mile was made at the rate of 85 miles per hour. The last stretch of 55 miles to Ft . Madison on was made at an average speed of 64.7 miles per hour.

During the run about eight tons of coal were burned, or 3,200 pounds per hour. This represents moderate work for the fireman who never kept more than 6 inches of fire on the grate. The engine steamed well at all times.

It may be mentioned that the speed maintained by these engines is very deceptive. The running is so smooth and the pull so even that at 60 miles per hour this actual speed is not credited unless a few miles are clocked off.

In considering the work performed, it must be remembered that at starting, the balanced compounds in question can exert a tractive effort equivalent to that of a single expansion cylinder 21 inches in diameter by 26 stroke, but when running compound at slow speed they exert a tractive effort equivalent to a single expansion of cylinder 18¾ in. and 19 in. dia. x 26 in. stroke.

The measure of work that has to be produced in this last sized cylinder per square foot of heating surface or the B. D. value is very low in comparison to what the single expansion engines detailed, have to produce. The boilers supplied to the balanced compounds are therefore really large in proportion and possess an ample reserve steaming capacity.

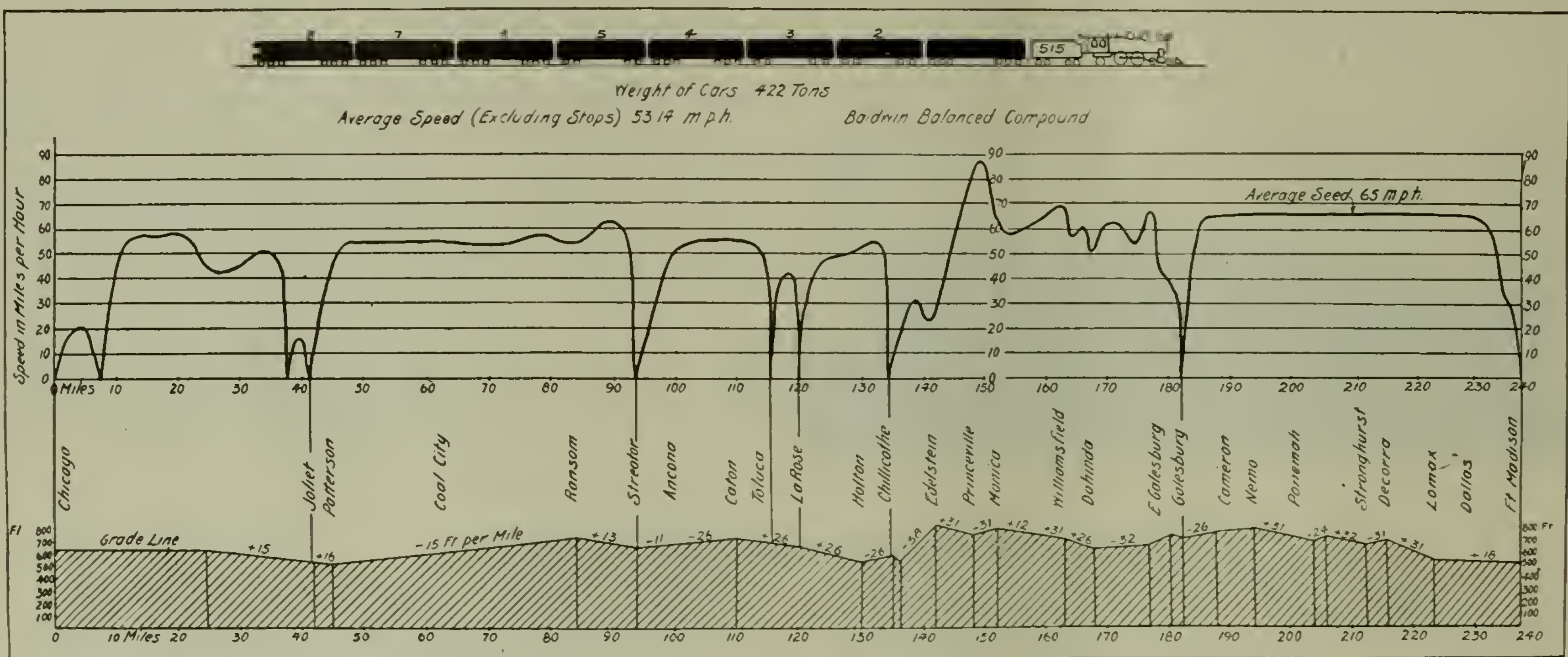
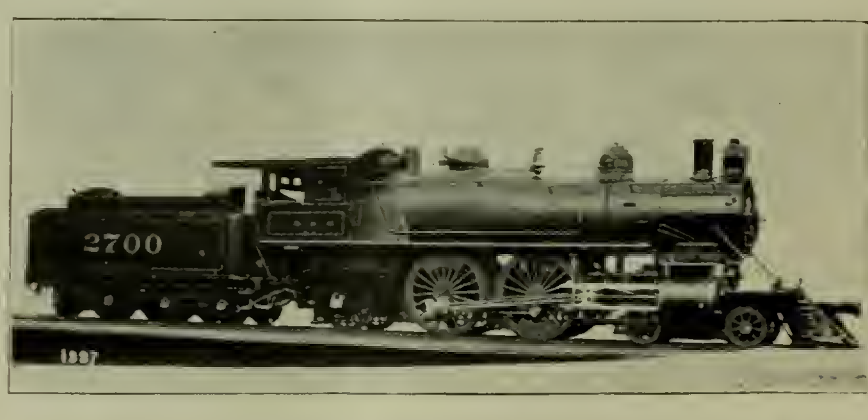


FIG. 6—DIAGRAM SHOWING PROFILE OF DIVISION AND SPEED CURVE OF THE "COLORADO FLYER" SEPT. 24, 1905. BALDWIN BALANCED COMPOUND NO. 515. ATCHISON, TOPEKA & SANTA FE RY.

On the Chicago-Galesburg tests with the balanced compound 1 pound of coal evaporated 6.95 pounds of water from and at 212°, but each square foot of heating surface only evaporated 9.63 pounds of water.



FOUR CYLINDER BALANCED COMPOUND, ATLANTIC TYPE LOCOMOTIVE —CHICAGO, BURLINGTON & QUINCY RY

FOUR CYLINDER BALANCED COMPOUND, ATLANTIC TYPE LOCOMOTIVE—ATCHISON, TOPEKA & SANTA FE RY.

The compound was not being worked to nearly its full capacity as the compound was too large for the particular work to be done.

On the McCook tests, the average evaporation was 11.98 pounds of water per square foot of heating surface which is the result expected. The coal consumption on these same tests by the compound averaged 4.30 pounds per cylinder horse power. The average cylinder horse power was 1,122, so that 4,822 pounds of coal were burned per hour and the rate of combustion per hour was 109 pounds per square foot of grate area. For the high average work done this coal rate is low.

The three single expansion engines on the same tests averaged 4.88 pounds of coal per cylinder horse power, and produced 929 average cylinder horse power, so that they burned 4,530 pounds of coal per hour or at a rate of combustion of 103 pounds per square foot of grate per hour. With almost this same rate of combustion the balanced compound produced 20 per cent. more work.

For light weight trains of 6 and 8 cars on very fast schedules a lighter Atlantic balanced compound with smaller cylinders than any of those detailed would have performed the same work and with even more economical results. In all cases but more so in that of a compound the design of the engine in relation to the work to be performed must be very carefully considered.

The performance of the balanced compounds on the Chicago Rock Island and Pacific Railroad will next be considered. Train No. 6 from the west is made up of 11 to 15 cars, 6 or 8 being sleepers. It is due to leave Rock Island at 2:55 p. m. and to arrive in Chicago at 7:25 a. m. or 4½ hours for the 181 miles, with five regular stops on the schedule. The last 16 miles from Blue Island to Chicago often takes 30 or 40 minutes owing to stops at three grade crossings and for signal blocks. The average scheduled speed (excluding stops) is thus 44 1-3 miles per hour. As this train comes through from the Pacific Coast it is often late and on the eastern divisions the locomotives are called upon to make up all the time that safety will permit.

The single expansion Atlantic and Pacific type loco-

FOUR CYLINDER BALANCED COMPOUND ATLANTIC TYPE LOCOMOTIVE—ATCHISON, TOPEKA & SANTA FE RY.

motives, some equipped with superheaters do not handle this train satisfactorily on time.

In October, 1905, the C. R. I. & P. ordered 2 Baldwin balanced compound Atlantic type locomotives for trial. Engine No. 1048 is shown in the illustration and its dimensions and proportions are given in Fig. 1. These two engines soon demonstrated their ability to handle train No. 6 on time and often to make up time on the schedule.

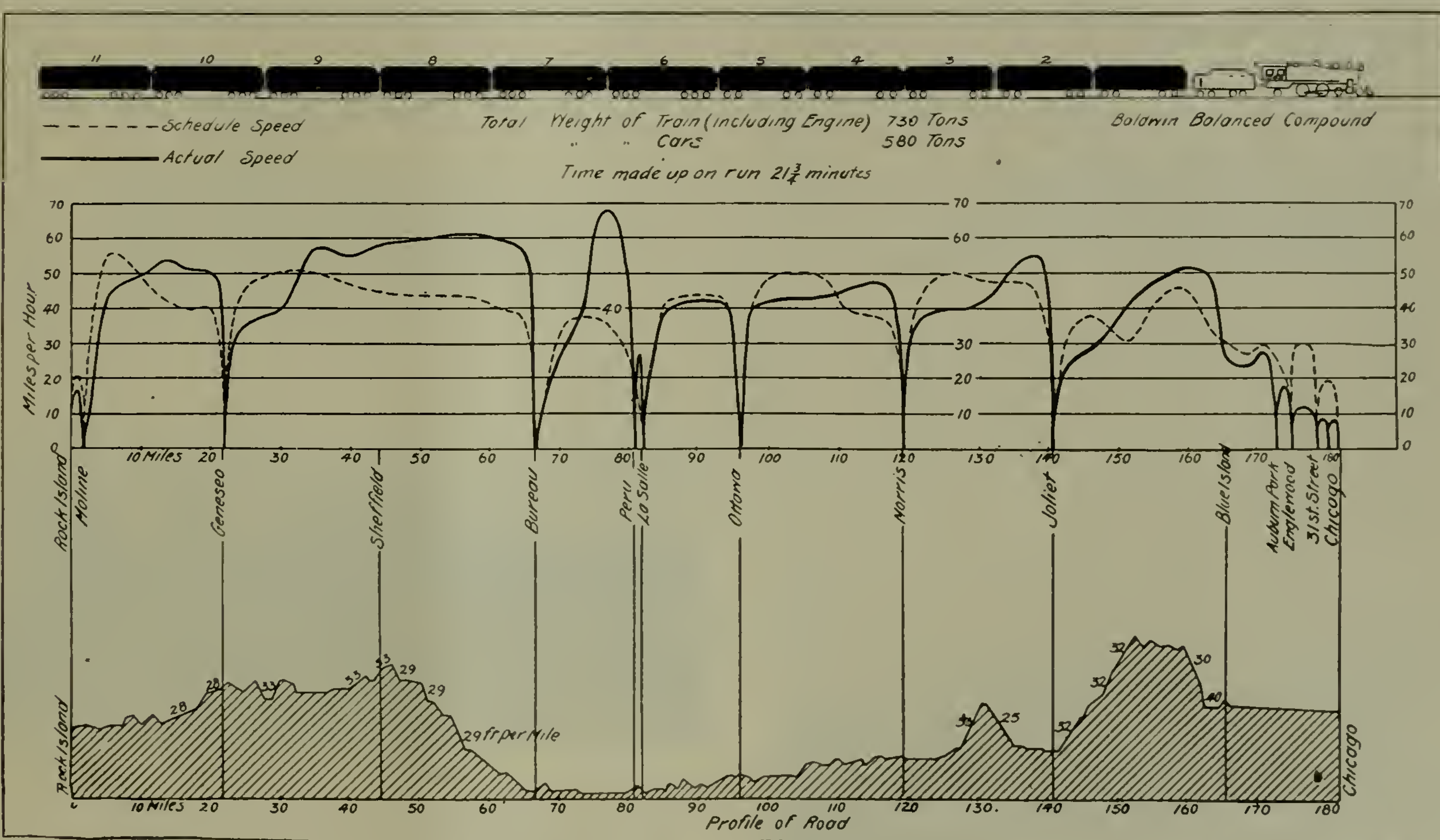


FIG. 7—DIAGRAM SHOWING PROFILE OF DIVISION AND SPEED CURVE OF TRAIN NO. 6, DEC. 12, 1905. BALDWIN BALANCED COMPOUND NO. 1048. CHICAGO, ROCK ISLAND & PACIFIC RY.

The profile of the division illustrated in Fig. 7 shows two fairly heavy and one long grade going east or west. Coming east there is a continual rise on easy grades from Rock Island to Sheffield and for most of this distance the line is perfectly straight. From Sheffield down to Bureau there is a sharp drop on a continuous grade of 29 feet per mile and the run into Bureau is on a long reverse curve. From Bureau to Joliet the road is level but has many bad curves and in many places is not suitable for very high speed. Starting from Joliet with a stop

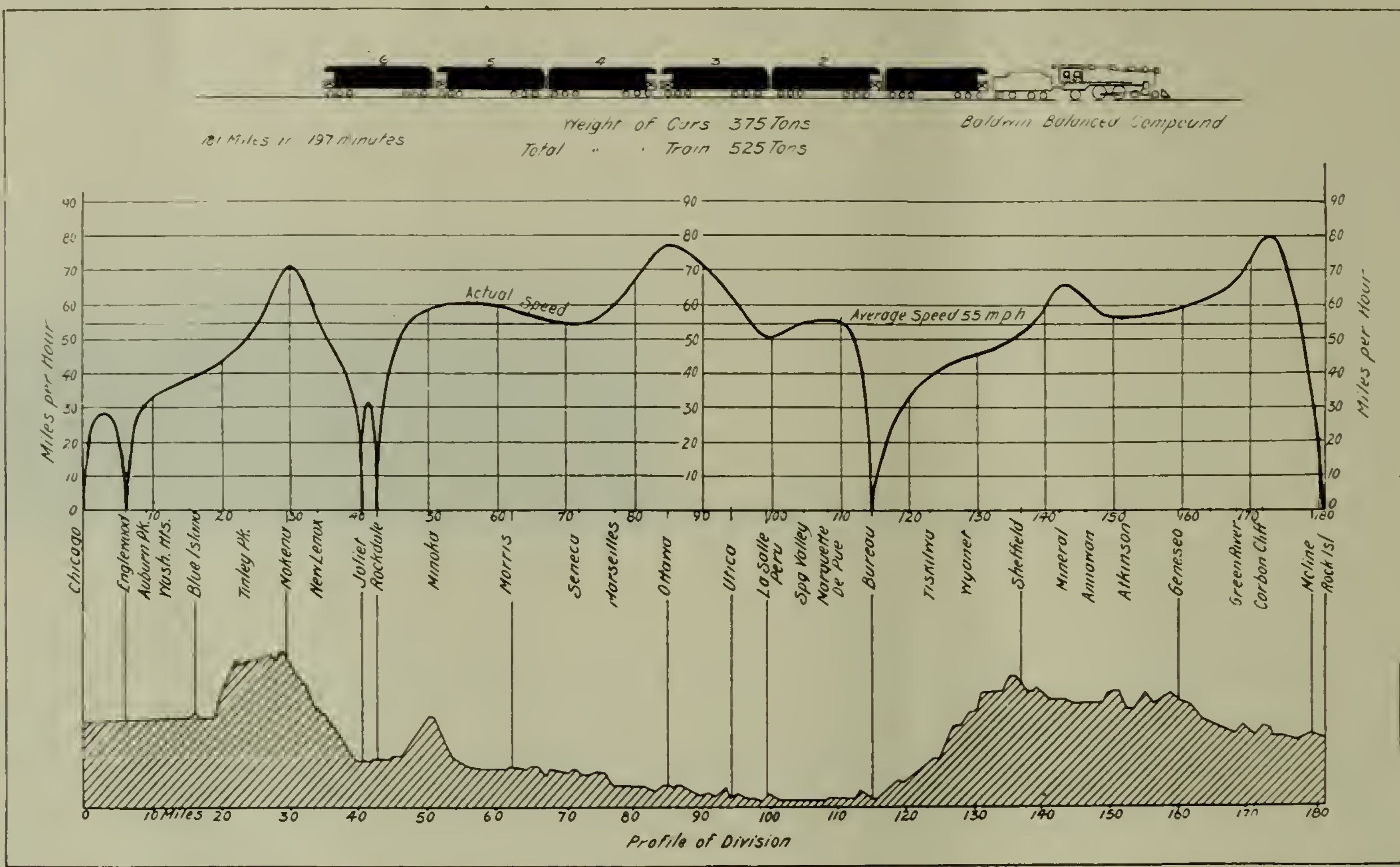


FIG. 8—DIAGRAM SHOWING PROFILE OF DIVISION AND SPEED CURVE OF "DIRECTORS SPECIAL", DEC. 3, 1906. BALDWIN BALANCED COMPOUND NO. 1047, CHICAGO, ROCK ISLAND & PACIFIC RY.

at Alton and Santa Fe crossings there is a continual rise for the next 9 miles to Mokena, the maximum grade is 40 feet per mile. A drop on grades of 40 feet per mile as a maximum for 14 miles down to Blue Island ends the fast running. On the remaining 16 miles into Chicago there are frequent delays and stops, and it often happens that all the time made up over the first 165 miles is lost on these last 16 miles.

On December 12, 1905, Train No. 6 had only 11 cars, 6 being sleepers. The weight of the cars was 580 tons. The train hauled by engine 1048 left Rock Island on time, but instead of the 5 scheduled stops, 12 stops were made as shown. The train however passed Blue Island at slow speed as it was ahead of time. In all 21¾ minutes were made up over schedule running time. A curve of the actual speed maintained and of the required schedule speed has been plotted and shown on Fig. 7. At Joliet a good illustration is shown of the balanced compounds ability to accelerate a heavy train. Starting at the foot of the 9 mile grade from a dead stop, the speed was accelerated all the way, and at the top of the grade had reached 45 miles per hour.

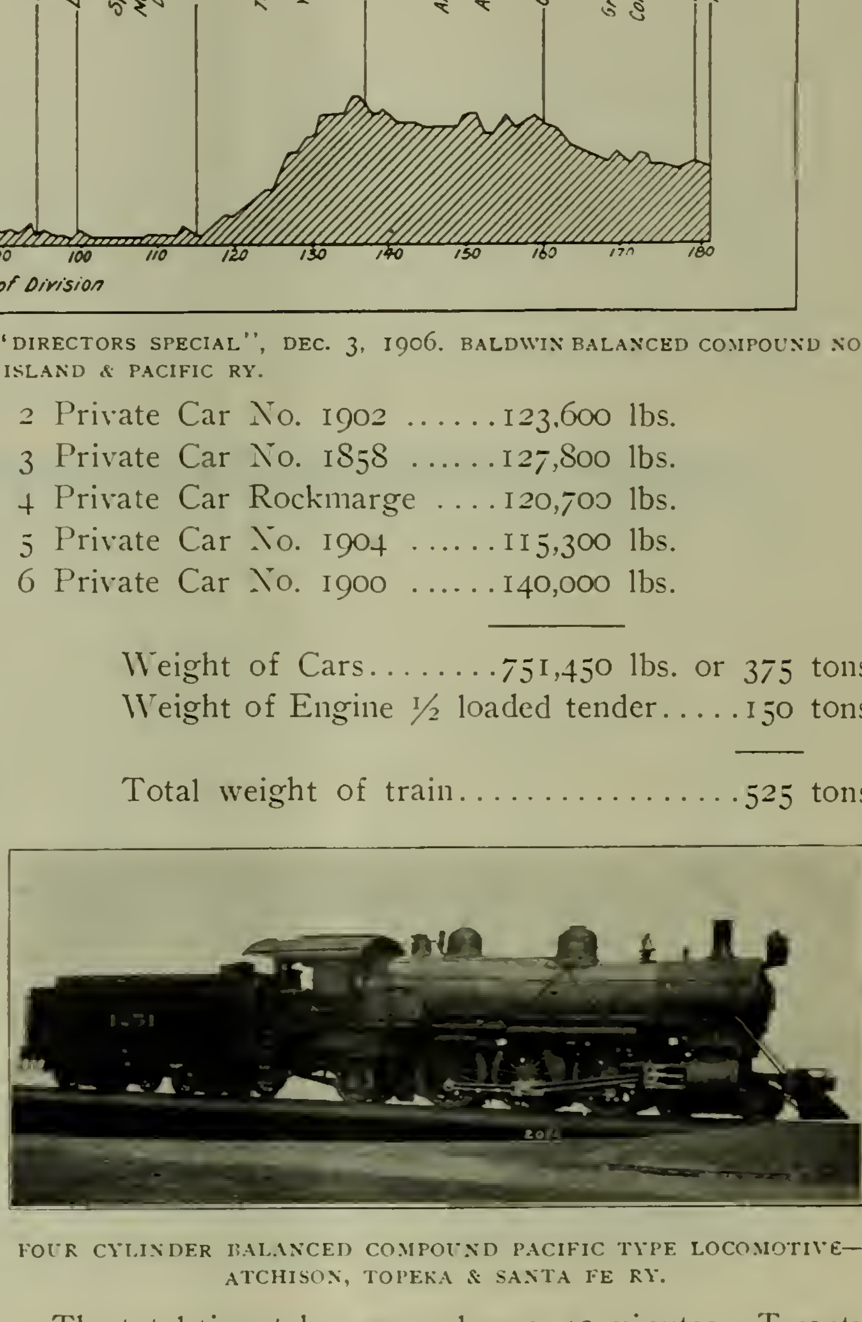
Early in 1906 six more Baldwin balanced Atlantic type compounds had been delivered and they have proved themselves superior to any of the single expansion engines of the same weight on drivers.

In order to demonstrate that these compounds could reduce the time of the fastest schedule between Chicago and Rock Island, a special run was made on Dec. 3, 1906. The train was hauled by balanced compound No. 1047 (similar to engine 1048 already referred to) and consisted of 6 private cars and was known as "Director's Special." It was made up as follows:

1 Private Car No. 100 ......124,000 lbs.
2 Private Car No. 1902 ......123,600 lbs.
3 Private Car No. 1858 ......127,800 lbs.
4 Private Car Rockmarge ....120,700 lbs.
5 Private Car No. 1904 ......115,300 lbs.
6 Private Car No. 1900 ......140,000 lbs.

Weight of Cars........751,450 lbs. or 375 tons
Weight of Engine ½ loaded tender.....150 tons

Total weight of train.................525 tons



FOUR CYLINDER BALANCED COMPOUND PACIFIC TYPE LOCOMOTIVE—ATCHISON, TOPEKA & SANTA FE RY.

The total time taken was 3 hours, 42 minutes. Twenty minutes were lost by extra stops and delays, so that the

FOUR CYLINDER BALANCED COMPOUND, PRAIRIE TYPE LOCOMOTIVE —ATCHISON, TOPEKA & SANTA FE RY.

181 miles were actually run in 197 minutes on at average speed of 55.1 miles per hour. It was stated after this run that the compound could have further reduced this time by 12 or 15 minutes making a speed of a mile a minute for the entire distance. This statement was proved to be fully true on a subsequent regular run. The log of the "Director's Special" run is shown on Fig. 8.

Based on the result of this last run the schedule of the cars as an extra Southern Pacific private car was added. The train was made up as follows:

Southern Pacific private car...	90,000 lbs.
Sleeper	120,000 lbs.
Diner	100,000 lbs.
Diner	120,000 lbs.
Diner	120,000 lbs.
Diner	120,000 lbs.
Observation car	130,000 lbs.

Weight of cars........810,000 lbs. or 405 tons
Weight of Engine ½ loaded tender.....150 tons

Total weight of train (empty).........555 tons

Leaving Chicago at 9 p. m. the train reached Rock Island at 12:41 a. m., 4 minutes ahead of time, and passed Blue Island at 9:41 p. m., 16 minutes late owing to delays and stops over the first 16 miles. Three more minutes were lost at Lockdale over the schedule stop, so that the run was actually made in 23 minutes under schedule

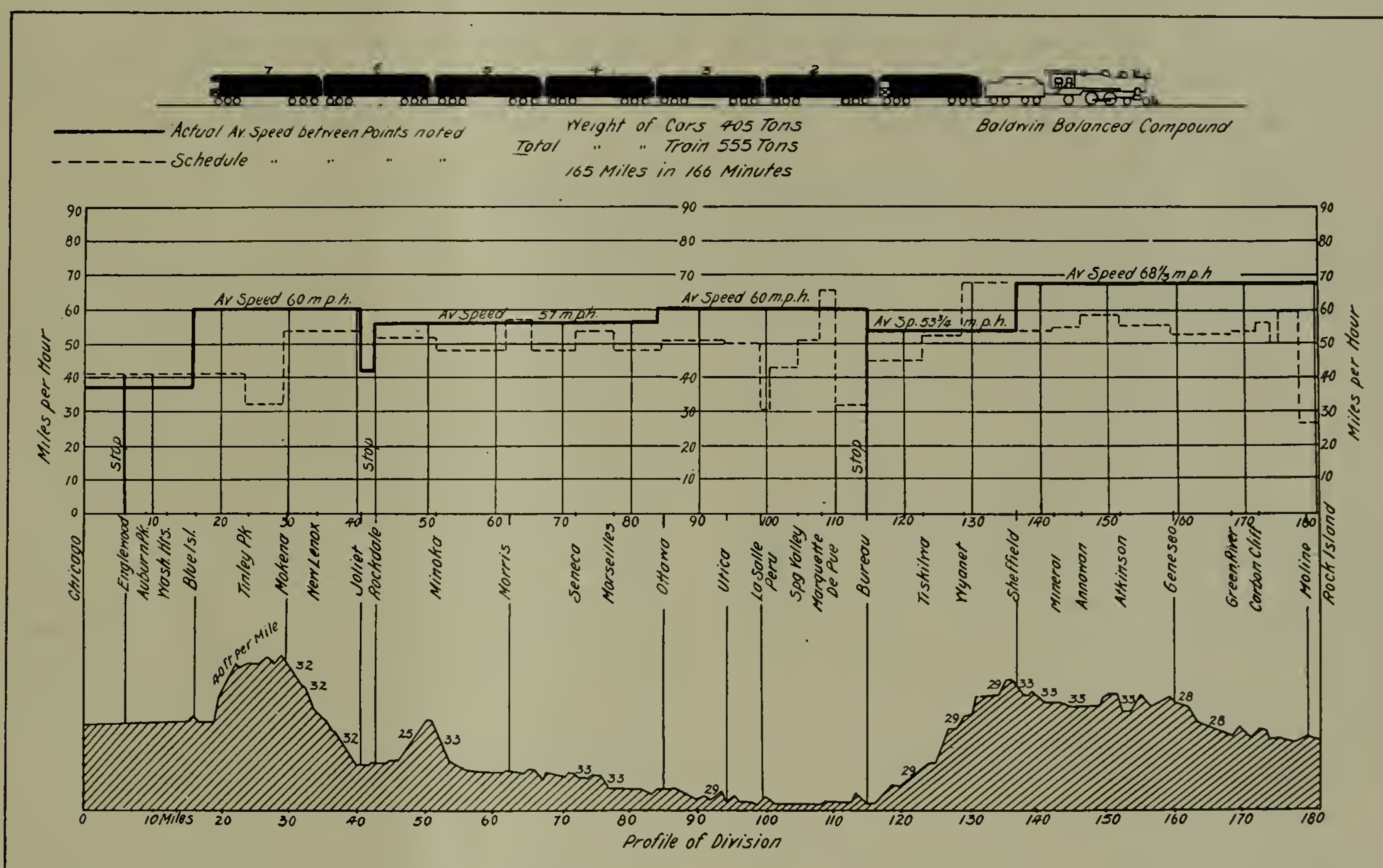


FIG. 9—DIAGRAM SHOWING PROFILE OF DIVISION AND SPEED CURVE OF "GOLDEN STATE LIMITED," DEC. 20, 1906. BALDWIN BALANCED COMPOUND NO. 1047; CHICAGO, ROCK ISLAND & PACIFIC RY.

"Golden State Limited" for the 1907 season has been shortened. Leaving Chicago at 9 p. m. the train is due in Rock Island at 12:45 a. m. or 3 hours and 45 minutes for the 181 miles. Three stops are scheduled at Englewood, Rockdale for coal and water, and at Bureau. Deducting 18 minutes for stops, the average scheduled speed is 51¼ miles per hour, a very fast schedule considering the weight of train. The train consists of 6 cars, one diner, four sleepers and an observation car. The train made its first run December 16th. Three new single expansion Atlantic engines were tried on the first four runs. On the fourth run the train was 21 minutes late. Baldwin balanced compound No. 1047 was put on December 20th for the fifth run. The train consisted of 7 time. The last 165 miles were made in 166 minutes or at an average speed of practically 60 miles per hour. A plot of this run is shown on Fig. 9. The average

FOUR CYLINDER BALANCED COMPOUND ATLANTIC TYPE LOCOMOTIVE —CHICAGO, ROCK ISLAND & PACIFIC RY.

speed as given by the company's time card between points is shown and plotted as a straight line. The actual average speed from observations taken on the train has been plotted between the points shown. It has to be drawn as a straight line as a sufficient number of points necessary to draw a smooth speed curve were not taken. Many miles must have been made at 70 miles per hour. It is the high average speed that enables a locomotive to handle a train successfully on a fast schedule and with a type of engine which will maintain an average speed of 50 miles an hour, up hill and an average speed of 60 miles an hour down hill the phenomenal bursts of speed which are daily proving so dangerous to human life will not be necessary.

One of the problems before most motive power men is this. To haul a weight of cars of 400 tons on a mile a minute schedule, and a weight of cars of 500 to 600 tons on a schedule of 45 to 50 miles per hour over divisions with grades not exceeding 1¼ per cent.

The large single expansion, Pacific and Prairie type engine may do this work, but the first cost of such engines is high, the great size and weight of their moving parts produce a wear and tear that neither the engine nor the permanent way can stand, and their reserve boiler power when put right to it is very limited. The work of firing such engines has reached a point where no fireman can do it economically.

The locomotive performances given in this paper show that an Atlantic type, not exceeding an engine weight of 150 tons, is also capable of doing this work. But it is an Atlantic type of such design, that within this weight the maximum amount of power, coupled with the least losses due to internal friction can be produced. Its driving wheels cause no sudden and excessive shocks to the rails. Its boiler has a very large reserve power. Its rate of combustion of coal is slow and even, and it will be found that its failure due to frame breakage and loose cylinder saddles is very small.

As this balanced compound Atlantic type of engine can do this work, and do it economically in relation to itself, the fireman and the coal bill, it is certainly the most desirable type to be used in high speed passenger service, and the writer feels sure that a fair trial will prove the truth of his statement.

In concluding, I wish to thank Mr. Young, of the Burlington, Mr. Allison, of the Santa Fe, and Mr. Kilpatrick, of the Rock Island, for the data and information that they have so kindly furnished.

Railway Records

By U. H. Clarke.

(*Third of a Series of articles on Accounting and Office Records of the Motive Power Department.*)

As I have stated in a previous article, to my mind the store house is the key note to successful operation of railroads, not only of the machinery departments but of other departments to a large extent also.

For all branches of railroad service require material, and upon the prompt receipt and quality of material, in a great measure depends the prompt and economical promotion of the work at hand. And strange to say, the store house department as a rule receives less consideration at the hands of railway managements than almost any branch of the service. The local or division store house is as a rule under the jurisdiction of the master mechanic, who with the multiplicity of other duties falling to his lot has not the necessary time to devote his personal attention. As an assistant he has, what is termed a division store keeper, who is in position where he has no more authority than that of an ordinary clerk, and who is not paid a sufficient salary to induce a man to retain the position after he has obtained sufficient experience to make him valuable elsewhere. Thus the large interest involved in division operation, so far as receipts and disbursements is concerned depends entirely for results, upon an overworked master mechanic, who has not much time to devote to store house matters, and an underpaid store keeper who has no authority to do anything other than to write out requisitions for material when requested to do so by foremen.

The process of making requisitions and getting them approved is too slow and cumbersome to be considered practicable by any up-to-date business house, though it is the common practice among railroads. The first step is, the foreman brings an order to the store keeper, who makes the requisition and puts the same on the master mechanic's desk for his personal signature. Should the master mechanic happen to be out on his division as he frequently is, this probably makes a delay of two or three days at the start, then in turn the requisition goes to the superintendent, who may also be out on the line, after passing the superintendent it proceeds in regular order through the offices of most of the official roster each of whom affixes a personal signature or signature of some designated party in his office force. Now when we consider the fact that probably at least 75 per cent of the material represented on this requisition are articles that have already been purchased and paid for by the company and held in the general store house stock, and that the requisition represents nothing more than an order to transfer the company's own material from one place to another, the humorous feature of the situation is apparent.

Without wishing in the least to trespass upon the question of Lese Majeste, I question seriously as to whether there is any benefit, from any conceivable point of view, in having requisitions approved through so many sources. There seems to be a sort of superstition existing in railroad employees that anything approved by a higher officer is all right, and nothing without it is at all right, but to reduce it to a cold hard modern business proposition, we know that no railroad official however capable can merely look over the large volume of requisitions necessarily passing through his hands and tell the first thing about whether the material was needed or not, or whether the quantity was right, or whether previous requisitions had not already been placed for similar articles, unless each office was provided with record books and clerical force sufficient to keep up a complete record of everything ordered and received. No practical man would think for a moment it would pay to do this. The signing of requisitions by various officials will not benefit the situation, and it undoubtedly delays the requisitions in reaching the source from which material comes, as it is a fortunate requisition indeed that makes the rounds and reaches the general store keeper in a period of ten days to two weeks. In the meantime the fellow on the ground needs the material.

When a delay occurs to any valuable equipment or important work from waiting on material correspondence is usually started by some one, which after picking up considerable volume and variety of complimentary phrases usually lands upon the division store keeper with the more or less emphatically expressed information that he could have prevented the whole trouble by anticipating his wants sufficiently in advance to have ordered material in time to have it on the ground when needed. This is all right as a means of closing up a set of correspondence, but let us consider the matter purely from the division store keepers' standpoint, and see if it would be possible to do this in all cases. Doubtless at times he does "fall down" in ordering something which he might have anticipated need of earlier, but my experience has been that much more of his trouble is due to "system" than to any minor shortcomings of his own. In the first place we must consider the delay already mentioned of requisitions, in reaching the general store keeper, then for the part of his material which the general store keeper does not have in stock, he makes another requisition upon the purchasing agent, which has to run the same gauntlet of official signatures as the other. With only this handicap, considering the large variety of material he is required to supply, it would require a store keeper of almost Machiavellian ingenuity to always anticipate all possible needs, but when we consider a perhaps still greater handicap which he has, to the lay mind it would seem little less than marvellous that he succeeds in getting the results he usually does.

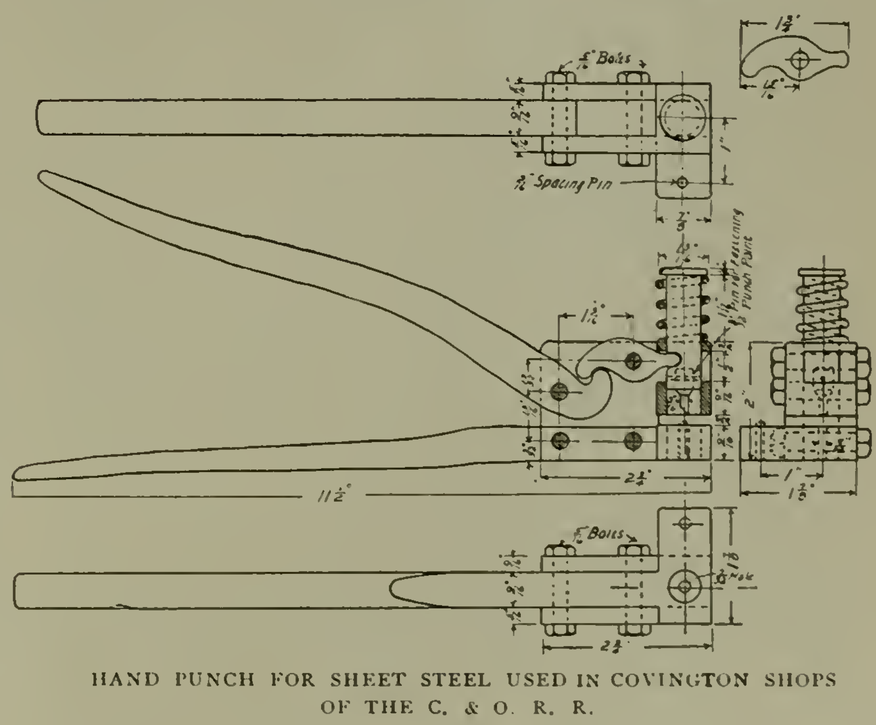
Up until a few years ago it was the custom on most railroads (with some it is the custom yet) to order everything in any quantity which the fancy of the local contingent might dictate, and as a current months requisitions were usually made up largely by copying that of the previous month, it would frequently occur that an article perhaps originally ordered in quantity several times larger than necessary, would be duplicated several times, until perhaps the pile would grow so large that someone would fall over it, and would precipitate a crisis that would stop future orders. In order to show the uselessness of official signatures as regards results, I should mention that the requisitions at that time were also signed by the entire roster of officials. The result of this system was that at most division shops there would be a large accumulation of material some of which had probably been obsolete for years, which the company would be carrying in stock as new material. At length it dawned upon the minds of some of the powers that be, that large sums were being lost annually in interest on dead stock, and a crusade in the reverse direction was then started, and instructions went out to reduce surplus stock. A percentage of disbursements was established, which required a monthly disbursement of 40 per cent to 60 per cent of the stock on hand and received, and the luckless store keepers falling below the minimum had to explain why.

The crusade toward reducing stock was undoubtedly a step in the right direction, and large sums in interest have been saved, but since the shop organizations have been pretty well educated out of the old rut into which they had gotten, of allowing useless stock to pile up, I think the question of providing a really adequate stock to facilitate the best movement of the business should be carefully gone into.

To my mind the duties of a store keeper are literally what his title designates, that is to "Keep a Store" at which anything the business needs can be furnished at the time it is needed. If the stock he is allowed to carry is to be fixed upon any percentage, it should be upon a percentage of the value of the equipment for which he has to provide, or the amount of business done on his division, rather than upon an arbitrary per cent of disbursement of amount of stock on hand and received, which is in reality no criterion as to the amount of stock necessary.

Small Hand Punch for Sheet Steel.

A SMALL hand punch suitable for punching sheet iron jackets, etc., which can be easily made in any shop is shown in the accompanying illustration. The construction of the punch is simple, with a small



HAND PUNCH FOR SHEET STEEL USED IN COVINGTON SHOPS OF THE C. & O. R. R.

number of parts arranged in a manner which makes a practical and satisfactory tool for light work.

The length over all is 11½ inches with a 3/16 inch jaw opening and a plunger arranged to receive punch points of various sizes. The lower lever is attached firmly to the head casting and the upper lever is pivoted in connection with a secondary lever which operates the punch plunger. A coiled spring returns the punch to a clearance position when the lever is raised and a 3/16 spacing pin is provided for properly spacing the holes when a series of holes is punched. The punch has been in use in the Covington shops of the Chesapeake & Ohio Railroad for some time and has proved to be a handy and useful appliance. We are indebted to Mr. E. A. Murray for the illustration presented.

Road Performance of Mallet Compound Locomotives.

Great Northern Railway.

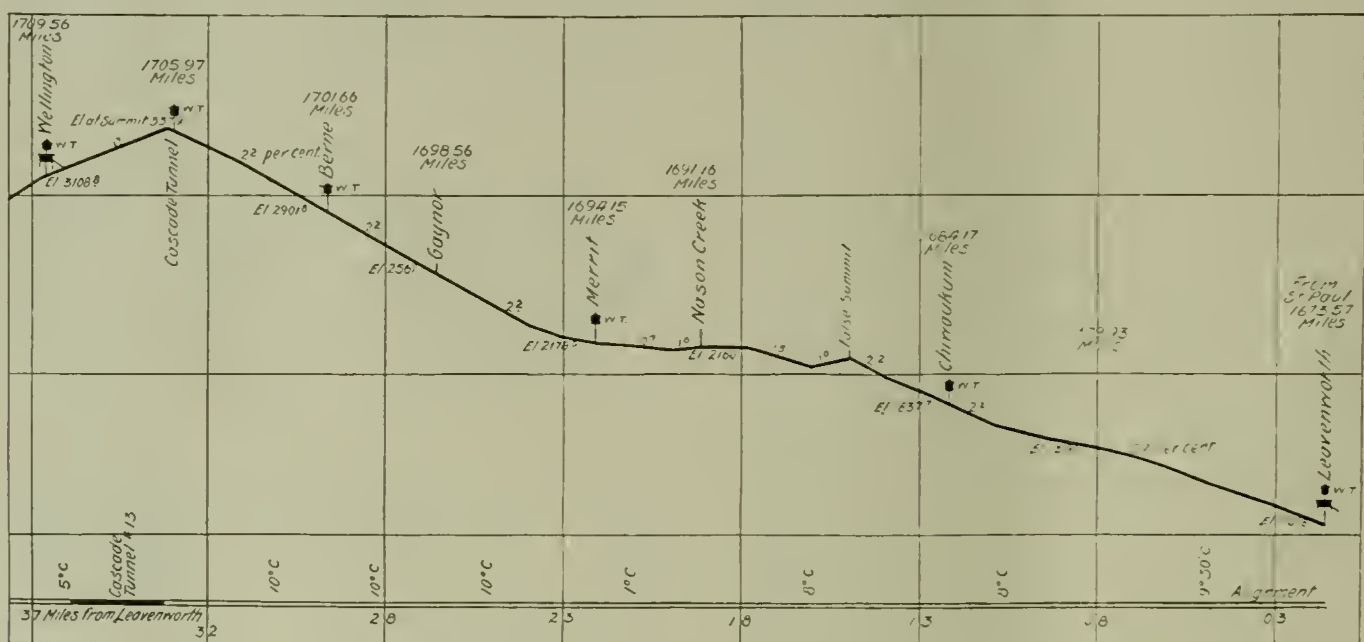
During the latter part of the summer of 1906 the Baldwin Locomotive Works delivered a consignment of five Mallet articulated compound locomotives to the Great Northern Railway. These were the first turned out by that company and differed to a large extent from the one existing type of articulated compound in this country, built by the American Locomotive Company in 1904 and now in service on the mountain division of the Baltimore & Ohio Railroad.

The Great Northern locomotives were placed on the Cascade division of the Western District, where the heaviest power of the road has always been required. From Leavenworth, on the eastern slope of the Cascade Mountains, the grade is, with few breaks, a steady climb of 2.3 per cent for a distance of 32 miles. At this point the grade is overcome by means of the famous Cascade tunnel, which penetrates the mountain for almost three miles with a slight slope toward the west finally emerging on the western side at Wellington.

In order to determine the actual road performance of the Mallet compounds in regard to consumption of coal and water and relative efficiency of engines and boiler, a series of tests were recently made with engine No. 1800 in regular daily helper service between Leavenworth and Cascade Tunnel. The profile of this section of the road, giving the character of grades and curvature is shown by the illustration. Of the 32 miles there is practically 30 miles of grade of which the large percentage is the maximum of 2.2 per cent, so that an excellent opportunity is provided for testing the relative merits and capacity of the old and new type of locomotives.

The general data and results of the tests made on engine 1800 are given below. The figures given are the averages of 9 successive tests.

Running time	4 hrs 0 min
Time lost by stops	3 hrs. 4 min.
Total time (average)	7 hrs. 4 min.
Average speed in miles per hour	8.1



PROFILE OF ROAD FROM LEAVENWORTH TO WELLINGTON ON THE GREAT NORTHERN RY. THE GRADE IN PER CENT IS SHOWN AND ALSO THE CURVATURE OF TRACK.

From Leavenworth all trains require a pusher engine to complete the trip to the Cascade tunnel and it was for this service that the Mallet engines were secured. Before their advent the bulk of the work was handled by consolidation type of freight locomotives with 20 by 32 inch cylinders capable of handling about 500 tons on the existing grade. These gave good service but with only a single track it was almost impossible to relieve the congestion of freight. Now, however, with one of the above type assisted by a Mallet locomotive it is possible to handle a train of 1,350 tons without trouble and at the same time maintain an average speed of at least 8 miles per hour.

Grade of coal used, Gilman, Crows Nest, Coast and Sand Coulee.

Heating Value of coal used, in B. T. U	6,092.5
Pounds of coal per trip	23,100
Average tonnage of train	1,265.6 tons
Average tonnage hauled by Mallet engine	810. tons
Average number of cars per train, loads	32.1
Average number of cars hauled by Mallet engine	21.0
Maximum boiler pressure	205 lbs.
Minimum boiler pressure	195 lbs.
Average boiler pressure	200 lbs.
Temperature of atmosphere	40° F
Temperature of feed water	40° F

RESULTS.

Pounds of coal burned per sq. ft. of grate per hour	74.03
Pounds of coal per mile	717.0

Pounds of coal per 100 ton mile	89.6
Pounds of water evaporated per pound of coal	4.44
Pounds of water evaporated from and at 212°	5.38
Water consumption per horse power hour from indicator cards, pounds	21.79
Per cent of train handled by engine 1800	63.8
Per cent of total coal used by engine 1800	45.5

The results of these clearly indicate the superior performance of the Mallet compounds and the advantages gained by using them as helpers on heavy grades. The

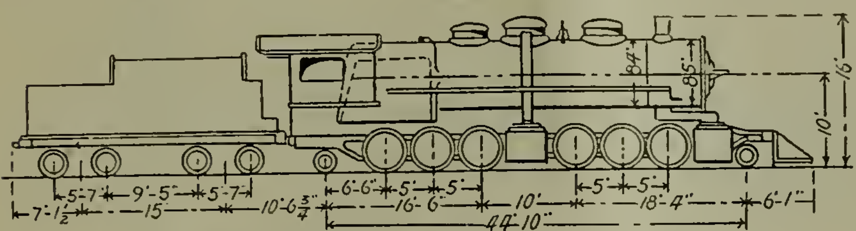


DIAGRAM OF MALLET COMPOUND LOCOMOTIVE ON GREAT NORTHERN RY.

water consumption of 21.79 pounds per indicated horse power hour is low and .24 pounds below the averages obtained from the compounds tested under similar laboratory conditions at the Pennsylvania Railroad testing plant at the St. Louis Exposition. The coal performance of the Mallet engine is equally satisfactory as the coal burned per 100 ton mile was 89.6 pounds against 189 pounds used by the consolidation locomotives. This means a saving of 99.4 pounds of coal per 100 ton mile or 25,774 pounds on one trip from Leavenworth to Cascade Tunnel when the maximum tonnage is handled. It will also be noted that engine 1800 handled 63.8 per cent of the entire train on a consumption of 45.5 per cent of the total coal used by both locomotives which represents the approximate economy and power of the Mallet engines as compared with those of the consolidation type. The tests show clearly the advantages of using this type of engine in helper service on heavy grades.

The Mallet compounds were described in detail in the September issue of the RAILWAY MASTER MECHANIC, 1906, but for convenience in reference the principal dimensions and the accompanying diagram are presented at this time.

Gauge	4 ft. 8½ ins.
Service	Freight
Fuel	Soft Coal
Tractive Force	71,600 lbs.

CYLINDERS.

Number	4
Kind	Compound
Diameter and stroke	H. P. 21½x32 in. L. P. 33x32 in.

VALVES.

Kind	Balanced slide

RATIOS.

Weight on drivers÷tractive force=4.66.
Total weight÷total heating surface=62.8.
Weight on drivers÷total heating surface=56.
Tractive force x diam. of drivers÷total heating surface=697.
Volume equivalent simple cylinders=20.82 cu. ft.
Total heating surface÷vol. equiv. simple cylinders=271.
Grate area÷vol. equiv. simple cylinders=3.75.

WEIGHTS.

On driving wheels	316,000 lbs.
On leading truck	19,000 lbs.
On trailing truck	20,000 lbs.
Total engine	355,000 lbs.
Total engine and tender	502,200 lbs.

WHEELS.

Driving, diameter over tires	55 ins.
Driving, thickness of tires	3½ ins.
Driving, journals, diameter and length	10x12 ins.
Engine truck wheels diameter	30 ins.
Engine truck, journals	6 ins. x 12 ins.

BOILER.

Style	Belpaire
Working pressure	200 lbs.
Outside diameter of first ring	84 ins.
Firebox length and width	117 ins. x 96 ins.
Firebox plates, thickness	⅜ ins.
Firebox, water space	F. 6 ins., B. 5 ins.
Tubes number and outside diameter	441, 2¼ ins.
Tubes length	21 ft.
Heating surface, tubes	5,433 sq. ft.
Heating surface, firebox	225 sq. ft.
Heating surface, total	5,658 sq. ft.
Grate area	78 sq. ft.

TENDER.

Wheels diameter	36 ins.
Journals, diameter and length	5½ ins. x 10 ins.
Water capacity	8,000 gals.
Coal capacity	13 tons.

All Steel Sleeping Car.

An all steel sleeping car has been recently completed by the Pullman Company and is now being exhibited at a number of the large terminals throughout the country. The car is a standard twelve-section sleeper, constructed throughout of steel, brass, aluminum and fire-proof composition board. The interior finish consists of pressed steel seat frames, upper and lower berths, wood being almost entirely dispensed with.

The underframing consists of two 15-inch continuous I beam center sills and four cross bearers, with a number of 4-inch channel floor supports. The side sills are of plate girder construction built up of ¼-inch plates and 6x6-inch angles. The side posts are 4-inch I beams, and are continuous from side sills to deck sills, the upper part forming the carline for the side deck.

The side sheathing is ¼ in. steel plate, with all rivets countersunk and filed smooth. The roof is galvanized iron with copper flashing. The floor construction is double, the upper floor of cement being laid on corrugated iron. Two thicknesses of asbestos board are placed in the sides and ends of the car between the sheathing. The interior is finished in a light gray shade and suitable striping. The car is of pleasing appearance and is claimed to be quiet and easy riding.

The economy of the gas engine is attracting more and more attention from power users as it has been brought down to about one-half that of the steam stationary practice. A prominent gas engine manufacturer states that with producer gas, made from coal at $3.00 a ton, a horse power can be produced in a gas engine of ordinary size for $4.00 a year. The engine to be operated 10 hours a day. The economy of operation over a steam plant of equal power will pay for the entire equipment in about eight months.

Locomotive Shops at Trenton.

Pennsylvania Railroad.

(First Installment.)

THE shop plant which has been in operation since September 1905 at Trenton, was installed by the Pennsylvania Railroad, for locomotive repairs of the United Railroads of New Jersey, constituting a division of the Pennsylvania system. The plant was built by contract from designs furnished by the road, and is completely isolated from the city on a tract of land filled to the level of the adjacent main line tracks for a distance of about seven-eigths of a mile.

The general layout of the shop buildings is such that the least possible transportation of material from storage points to the base of operations is necessary. The smith shop and casting house are situated near the erecting and machine shop, and the boiler and tank shop lies immediately in line with the latter. A continuous standard gauge track passes through the center of both buildings. The wood-working shop is contiguous to the lumber yard. The power house at one side of the plant and the office building at the other, complete the grouping of the structures which are arranged around the erecting and machine shop as a base. There is a distance of at least 80 ft. between any of the buildings.

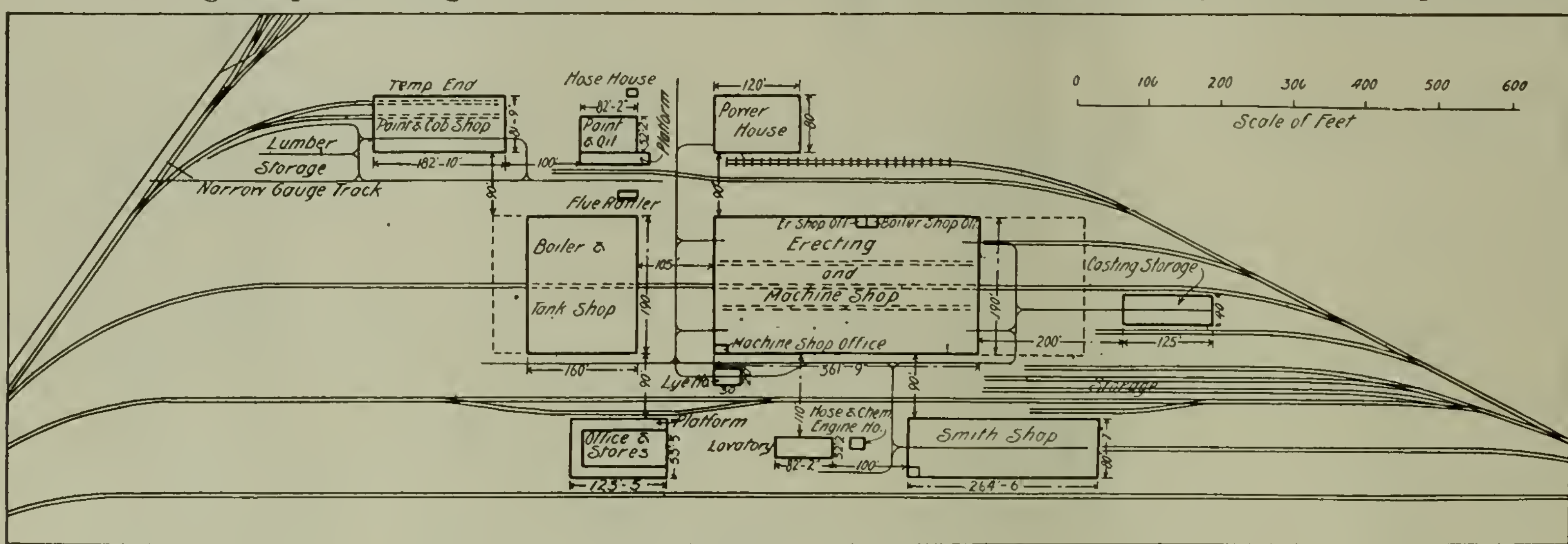
The buildings are of brick and the roofs are supported by steel frames except in the blacksmith shop, in which the roof trusses are of wood. To provide for future extensions of the erecting and boiler shops, there is a temporary wall in one end of each of these buildings and the paint shop is provided with one temporary side for the same purpose.

The erecting and machine shop is 360 feet long and 190 feet wide, with three erecting tracks and pits spaced 30 feet between centers running full length through the central bay which is 90 feet wide. Between the erecting pits are brick storage pits 6 feet deep and 14 feet wide, the shop flooring being arranged in sections which are lifted by the crane so as to give easy and instant access to the storage pits which solve the problem of taking care of piping and other details that otherwise litter up a shop. There are two 65 ton Shaw electric traveling cranes of 88 feet span over the erecting pits, running the whole length of the shop.

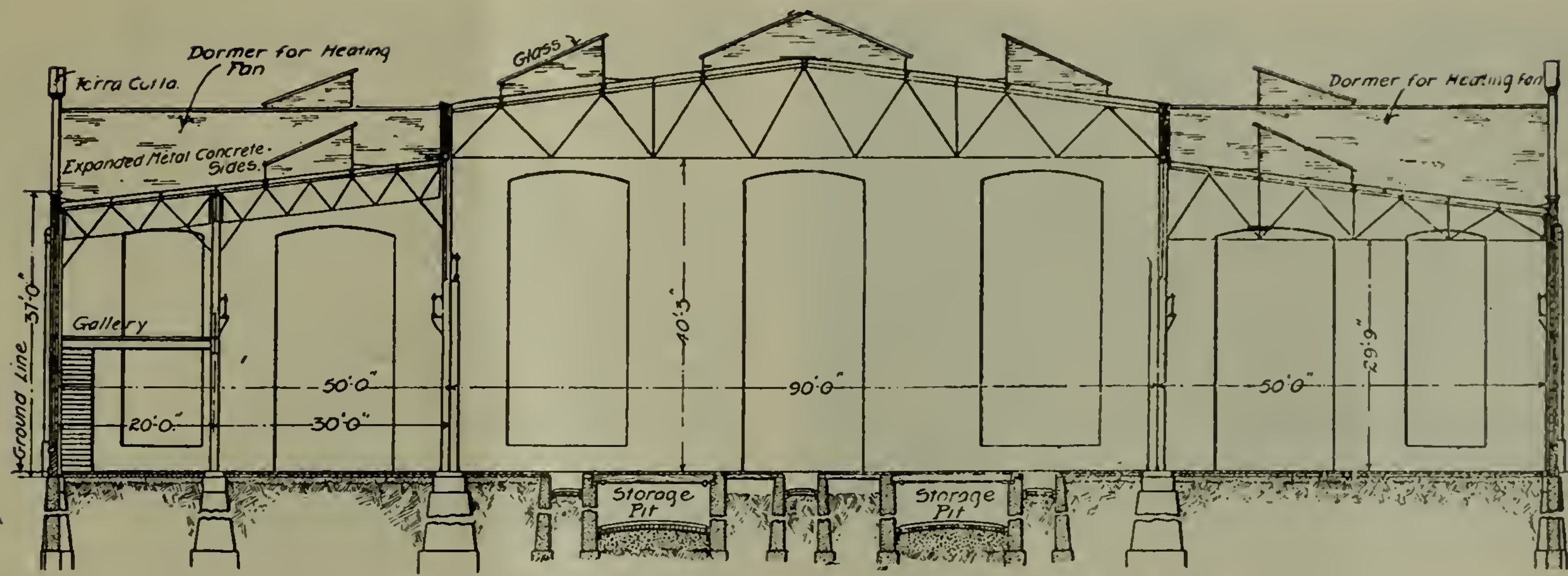
The two side bays are devoted to heavy and light machine tools respectively, in a space 50 feet wide, and over the light tool side is a gallery 20 feet wide also containing light tools used in air brake work, brass work and tool making. The copper and tin shop has 100 feet of one end of this gallery, and the pipe shop is also located there, as well as the tool repair department. The opposite end of the gallery is occupied by the air brake department.

In the heavy tool bay at one end are grouped the large tools devoted to driving wheel work—the three ninety-inch lathes, the 400 ton wheel press, the quartering machine and the tire boring machines, and a foundation for another heavy tire boring mill going in near the latter, while further down the bay is the frame planer, and still beyond, this bay is devoted to frame and truck repairs. One ten ton Niles traveling crane serves the heavy tool side. The tools are grouped in both bays so as to be at the nearest point to the several classes of repairs they are used on. The rod job, link job, and motion work generally are grouped at a central point in the light tool bay, which is traversed by one 5 ton Niles electric crane. The tool drives are electric, those for the heavy tools being of the individual type, while the light tool drives are of the group sytem.

The boiler and tank shop is beyond the west end of the erecting and machine shop, of the same width as the latter (190 feet) and 160 feet long. Being of similar design in transverse section, there are three bays, the central one of which is traversed by two 30 ton Niles electric cranes, and at each side there is a 10 ton Niles electric traveling crane. The south side of the shop is equipped with a full complement of new tools arranged to the best advantage to do work, that is, there is no possibility of interference between the flange workers and the rolls,



LAYOUT OF LOCOMOTIVE SHOPS AT TRENTON—PENNSYLVANIA, R. R.

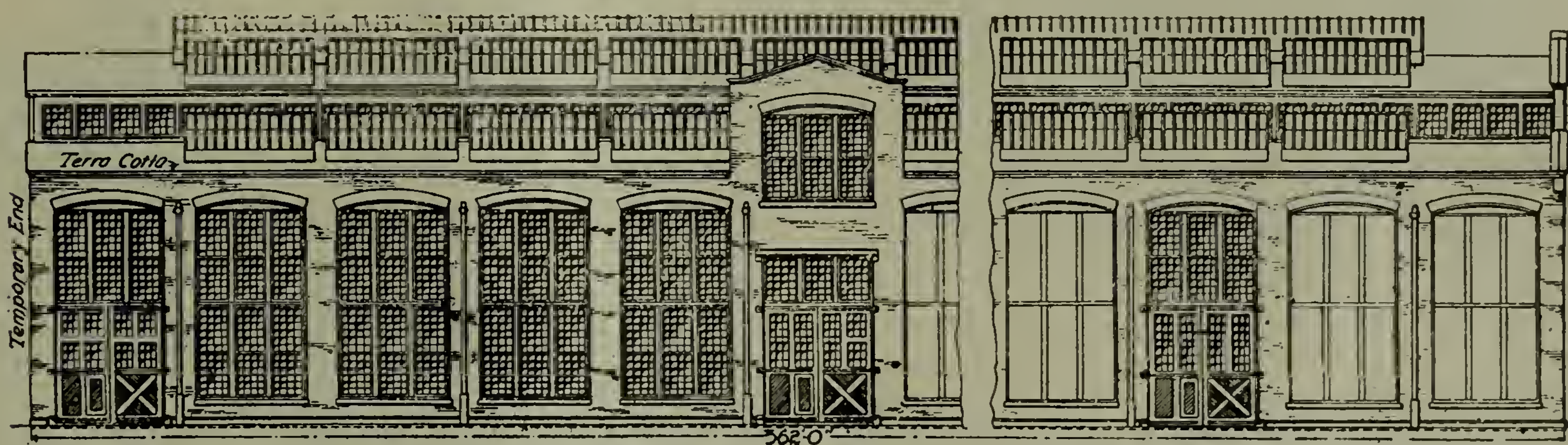


CROSS SECTION OF MACHINE AND ERECTING SHOP—LOCOMOTIVE SHOPS AT TRENTON, PENNSYLVANIA R. R.

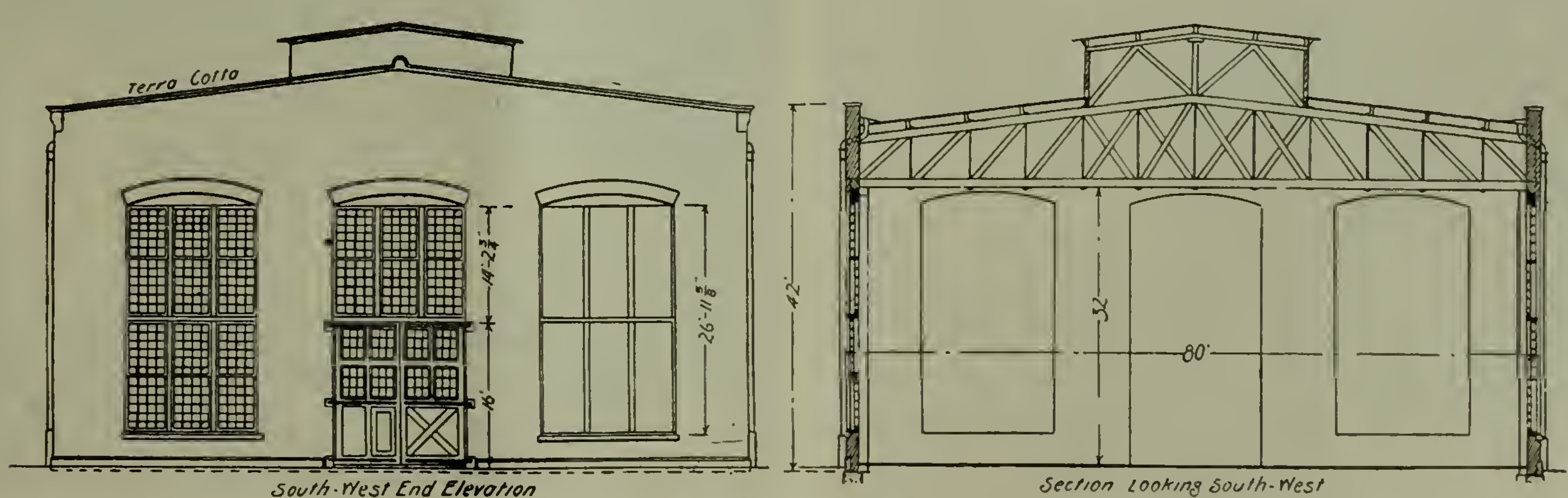
or between the latter and punches and shears. There is plenty of room well utilized, indicating that further additions to equipment may be comfortably made when necessary.

Forging is arranged for on the same liberal plan, in a smith shop 264 feet long by 80 feet wide. There are two heavy steam hammers in serivce and a foundation is being built for one of 3,200 lbs. capacity for frame forging. The spring work is provided for by the best tools of their kind, made by the road, and a hydraulic accumulator is being built for use with the machines operated by hydraulic pressure. The bolt machinery comprises a full complement of tools strictly modern, besides three oil furnaces. For the use of the oil furnaces, crude oil is stored in outside underground tanks at the west of the shop. Jib cranes of 23, 18 and 14 feet radius are at the hammers, with two 5,000 lb. air hoists besides a 6,000 lb. chain hoist.

A refinement in the removal of scale from boiler tubes is worked out in the enclosure of the flue rattler and its machinery, in a brick structure located facing the tank and truck shop, and built to harmonize with the other buildings in the plant. The flue rattler is of the cast iron stave type, revolving with its lower surface submerged in a tank of water. The motive power is a backgeared electric motor in a room by itself secure from dust. The scheme is one that impresses its good points on the observer at once, since there is no noise or dirt connected with its operation. The building containing this admirable system is shown in separate details. The



SIDE ELEVATION OF MACHINE AND ERECTING SHOPS—LOCOMOTIVE SHOPS AT TRENTON, PENNSYLVANIA, R. R.



END ELEVATION AND CROSS SECTION OF BLACKSMITH SHOP—LOCOMOTIVE SHOP AT TRENTON, PENNSYLVANIA R. R.

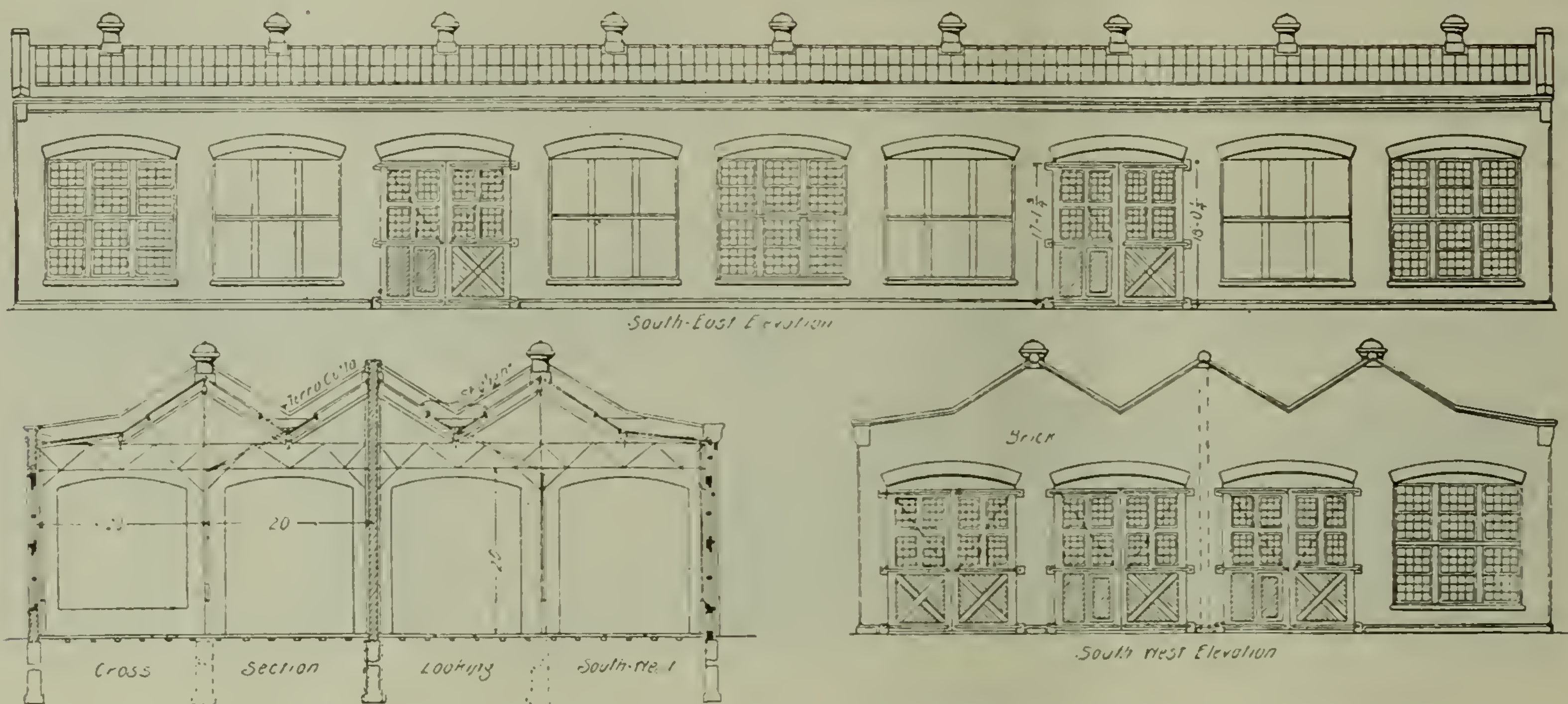
INTERIOR OF ERECTING SHOP—LOCOMOTIVE SHOPS AT TRENTON, PENNSYLVANIA, R. R.

lye cleaning vats are also shown in plan and elevation. This building is at the southwestern corner of the machine shop.

on tender frames and cab work exclusively, since no car wood work is done at these shops.

The power plant is housed in a brick building 100 feet long by 85 feet wide, the room for the generators and compressors being 35 feet wide and the boiler room 47 feet wide, both dimensions inside. The boiler installation consists of four Sterling boilers, hand fired class N type, of 1,600 total horse power, the stacks for which is steel, 225 feet high and 14 feet diameter inside at bottom. The removal of ashes is by gravity from the ash pit into steel cars in the basement, and lifted by hoist to an ash car outside. Until the projected conveyor and bunker system is completed, fuel is delivered to the boilers from cars on a trestle 9 feet 6 inches above floor.

Electric power is generated by a Westinghouse alternating turbo-generator, 500 Kilowatts, three phase, 7,200 alternations at 3,600 revolutions per minute. This unit furnishes electric power and lighting at this time for



SIDE AND END ELEVATIONS AND CROSS SECTION OF CAB AND PAINT SHOP—LOCOMOTIVE SHOPS AT TRENTON, PENNSYLVANIA, R R.

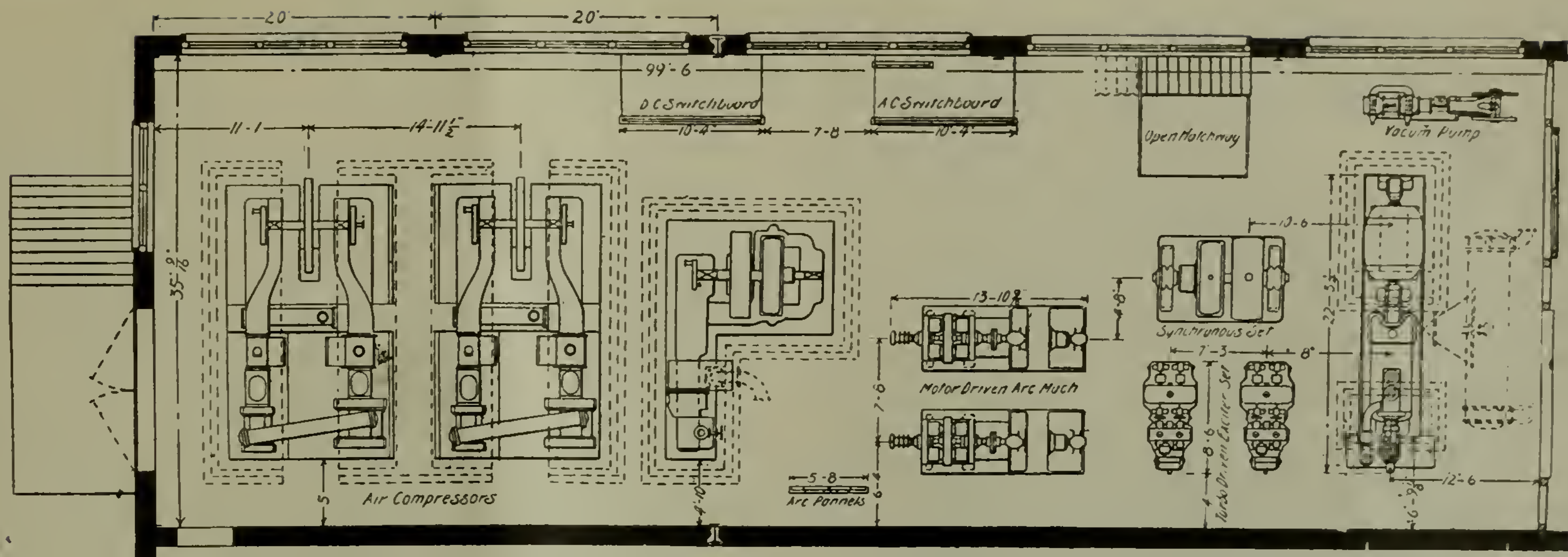
Some other features that exercise a certain influence to the good, and not common to all roads, are noted in the structure devoted to the storage of castings. This building is located immediately east of the erecting and machine shop and but a little distance away so as to further the scheme of the short haul for material. So with the storage of wrought iron. These structures, however, are of wood, but of stability and neat appearance.

The paint and oil storage building is located at a point fairly remote from the larger buildings and is as near to being fire-proof as is possible to make it with brick, steel and reinforced concrete. The building is 82 feet long and 32 feet wide, with a fire wall above and below extending the full width. The oils capable of lift by compressed air are forced up from the tanks in the basement. The heavier oil and varnishes are handled in the old way direct from the tank.

The wood-working shop and paint shop are under the same roof, divided longitudinally in half, the building being of brick 183 feet long and 82 feet wide. The tools in the wood-working shop are of light capacity for use

the whole plant. A synchron motor set, transforms the part of alternating current to direct at 230 volts for tools driven by the latter system. Air power is furnished by two 1,500 foot Laidlaw-Dunn-Gordon compound compressors, 14x22x24 by 15x24 inches. Above these heavy

INTERIOR MACHINE SHOP—LOCOMOTIVE SHOPS AT TRENTON, PENNSYLVANIA R. R.



FLOOR PLAN OF ENGINE ROOM OF POWER HOUSE—LOCOMOTIVE SHOPS AT TRENTON, PENNSYLVANIA, R. R.

power units is a ten ton Niles electric traveling crane. The water service is most complete, there being a 100,000 gallon elevated tank giving a gravity pressure equal to all ordinary requirements.

The water supply for the shops is taken from a point north of the shop property and pumped into elevated tanks. The centrifugal pumps for the condenser feed from this supply and the return is carried back to the pond. The sewerage piping leads to a septic tank located some distance north of the shops.

INTERIOR OF BLACKSMITH SHOP—LOCOMOTIVE SHOPS AT TRENTON, PENNSYLVANIA R. R.

Drinking water is pumped from a well on the south side of the shop and put into the same overhead tank as the general supply to the shop; and connections are made in the piping leading to this tank, so that the drinking water supply may be drawn in the various buildings.

The office building which is located at the southwest corner of the plant is in line with the smith shop east and west and at the south corner of the erecting and machine shop. The building is a two story and basement brick structure, 123 feet long and 53 feet wide, containing the storerooms in basement and on first floor. The second floor contains the offices of the master mechanic and clerks and the drafting room. The safeguard here thrown around the loss of tracings and office records by fire cannot be surpassed; the space devoted to the safety vault which is in the middle section of the building and extends from the basement to roof, is 29 feet long by 7 feet wide inside, with doors at each floor. The walls are 21 inches thick.

Notwithstanding the electric light equipment is more than ample to light each shop, there will be little use for it under ordinary daylight conditions, for the ratio of glass area to roof and walls of these shops is rarely found in railway shops, there being nearly three-fourths of the walls covered with ribbed glass and nearly one-half of the roof covered with skylights, also of heavy ribbed glass with wire netting below. The same care in this direction is shown in all the shops—and also in results.

Heating and ventilation has received like attention as lighting, the erecting and machine shop being heated by the Sturtevant air system of indirect radiation, using exhaust steam with vacuum return.

The nominal capacity of these shops as built is to cover the repairs of 400 locomotives per year, but this capacity has not yet been reached, since the full force of operatives necessary for the stated output has not been required. As in their other plants, it will take but a short time to bring this one to full swing on the lines laid down by the management concerning the perfection of system for which the road is proverbial. Piece work has been inaugurated and worked out so that about 25 per cent of the work is done by the day, which as it stands is a ratio that compares favorably with many shops claiming to be operated exclusively on a piece work basis.

INTERIOR OF WOOD WORKING SHOP—LOCOMOTIVE SHOPS AT TRENTON, PENNSYLVANIA R. R.

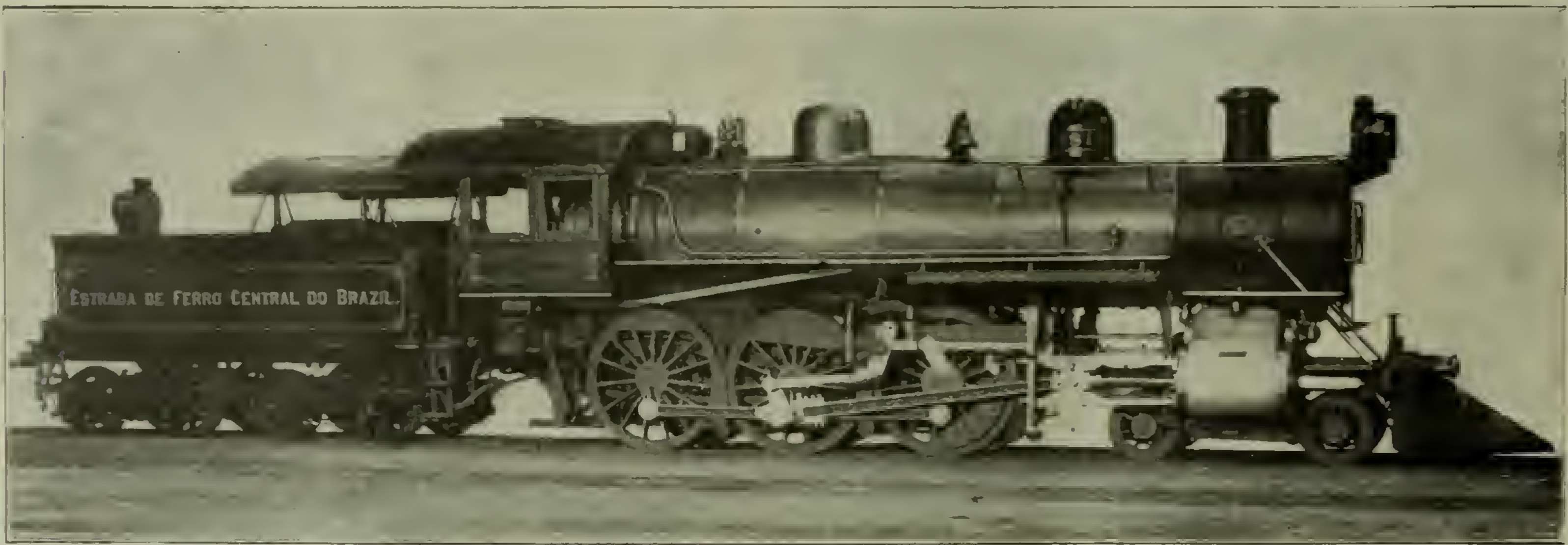
An Interesting Order of Locomotives.

Central Railroad of Brazil.

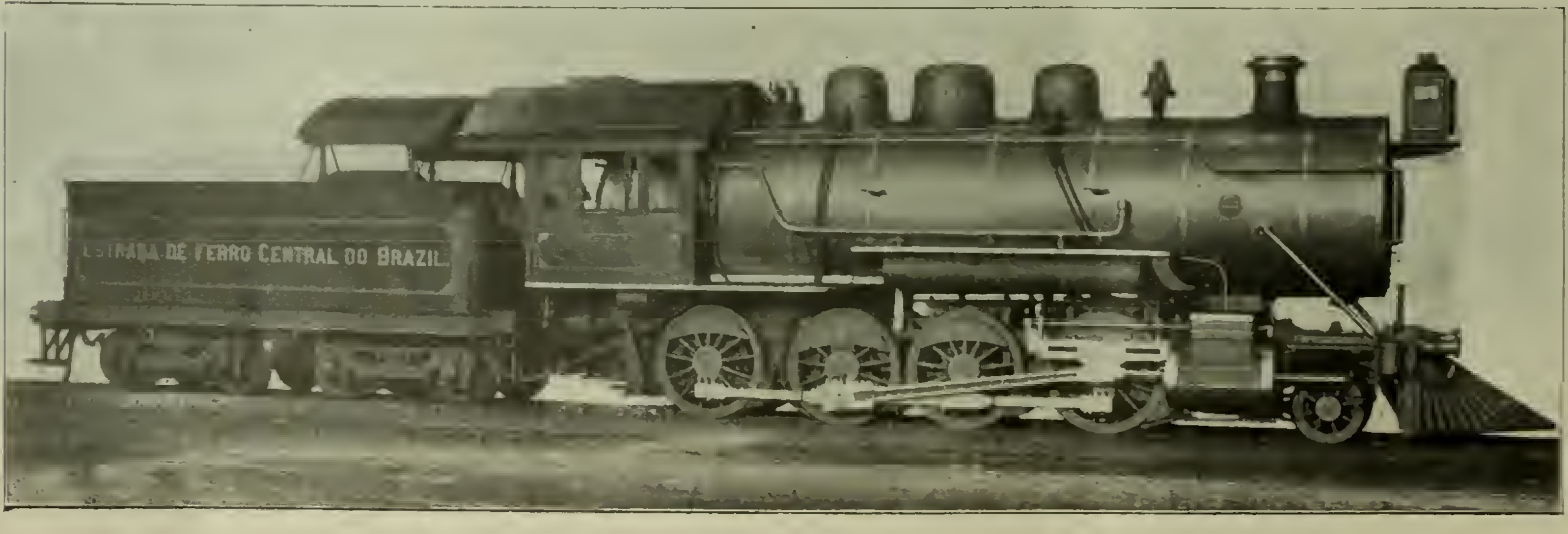
AN ORDER of ten locomotives has been recently completed by the Baldwin Locomotive Works for the Central Railroad of Brazil which include a number of interesting types and features of design. Six of the ten locomotives are of the consolidation type, two of which are equipped with Baldwin superheaters; the next two are single expansion ten wheel locomotives fitted with Vaughan superheaters, while the remaining two are of the ten wheel type with balanced compound cylinders. The various modifications in design with changes in specifications and equipment will furnish a good opportunity for testing the relative value of the different types.

The consolidation locomotives apart from the superheaters are practically alike. The have 21½ by 26 inch cylinders, balanced slide valves and 53 inch drivers. With 175 pounds steam pressure the engines will develop a tractive force of 33,700 pounds. The boilers are of the straight top, radial stayed type with diameter at front ring of 74 inches. There are 287 2¼-inch flues, 14 feet 3½ inches long. The fire boxes are over the frames, and owing to the broad gauge, which is 5 feet 3 inches, the width of the firebox is 48¼ inches, with a length of 106 inches. The total heating surface is 2550 square feet, of which 152 square feet is in the firebox and 2398 square feet in the flues. The total weight of the

SIMPLE TEN WHEEL LOCOMOTIVE EQUIPPED WITH VAUGHAN SUPERHEATERS—CENTRAL RAILROAD OF BRAZIL.



BALDWIN BALANCED COMPOUND LOCOMOTIVE—CENTRAL RAILROAD OF BRAZIL.



CONSOLIDATION TYPE LOCOMOTIVE EQUIPPED WITH BALDWIN SUPERHEATER—CENTRAL RAILROAD OF BRAZIL.

engine is 163,890 pounds, with 144,090 pounds on the drivers. The Stevenson link motion is employed, with eccentrics on the main axle. A few of the principal ratios are as follows:

Weight on drivers ÷ tractive force = 4.3.

Tractive force × diameter drivers ÷ heating surface = 700.

Total heating surface ÷ firebox heating surface = 16.7.

Total heating surface ÷ grate area = 71.8.

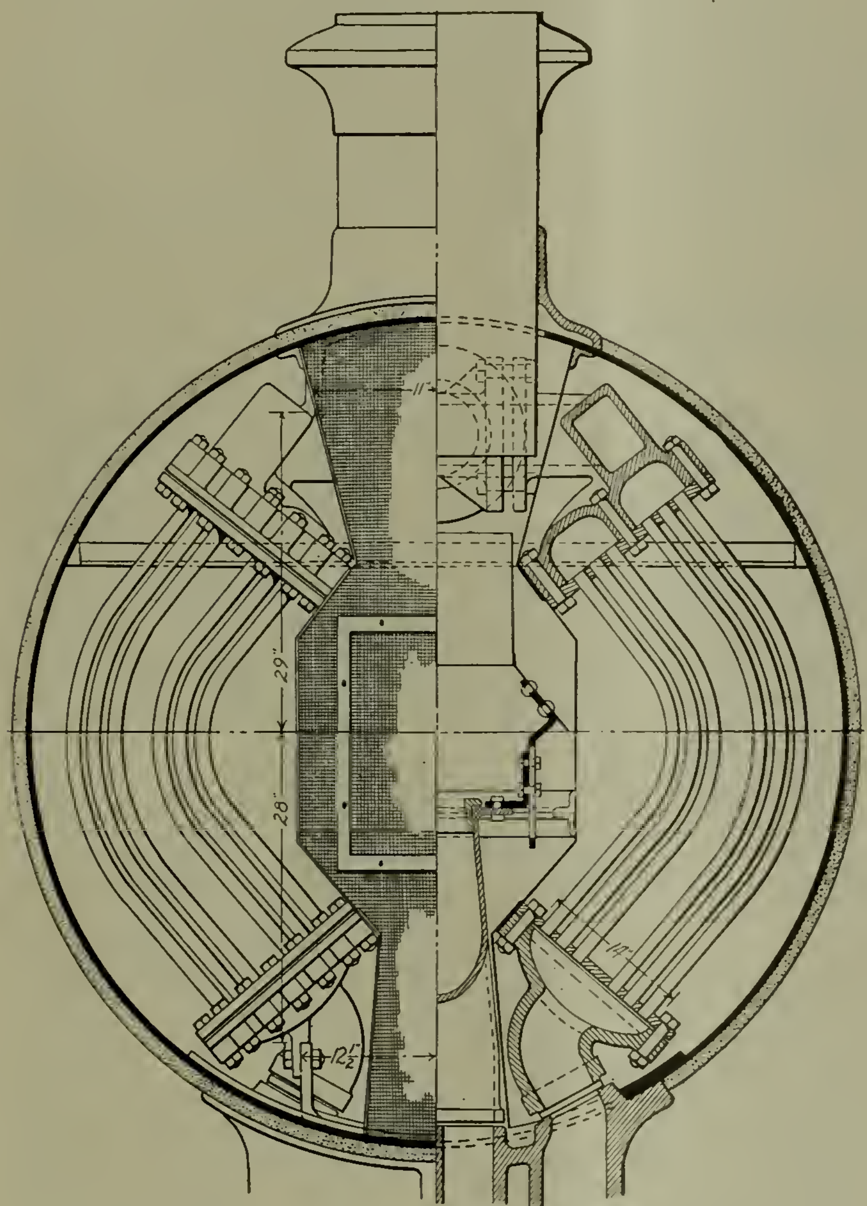
Weight on drivers ÷ total heating surface = 56.5.

Volume of cylinders = 10.8 cubic feet.

Total heating surface ÷ volume of cylinders = 236.

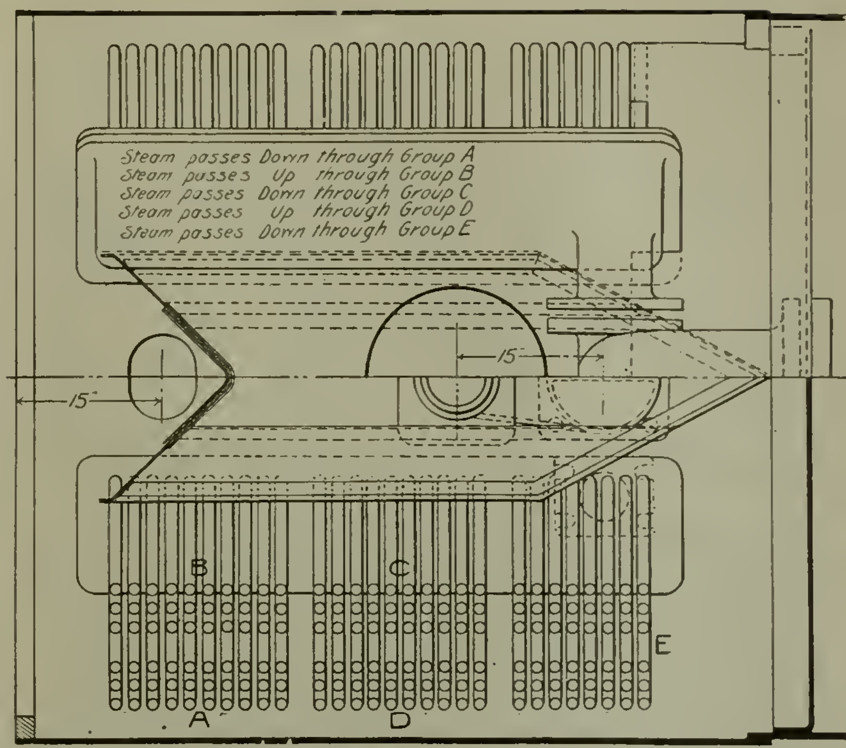
Grate area ÷ volume of cylinders = 3.29.

The Baldwin superheaters applied to two of the locomotives are similar to the one fitted to the Pittsburgh,



FRONT END VIEW OF LATEST DEVELOPMENT IN THE BALDWIN SUPERHEATER, SHOWING CHANGE MADE IN TOP DRUM AS APPLIED TO CONSOLIDATION LOCOMOTIVES—CENTRAL RAILROAD OF BRAZIL.

Shawmut and Northern Santa Fe type locomotive, as described in the March issue of the Railway Master Mechanic but an improvement has been introduced in the design which should result in obtaining a higher degree of superheat. The changes made in the superheater will be seen by referring to the accompanying illustration. In the new design the steam is first passed through the forward group of tubes and is then conducted through the intermediate and rear group of tubes, so that it passes through the hottest part of the superheater immediately before reaching the cylinders.

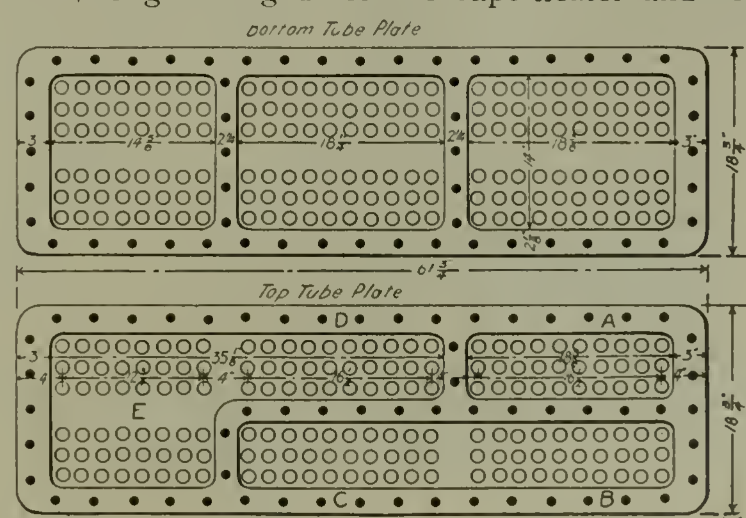


PLAN OF LATEST DEVELOPMENT IN THE BALDWIN SUPERHEATER, AS APPLIED TO CONSOLIDATION LOCOMOTIVES—CENTRAL RAILROAD OF BRAZIL.

In the previous designs referred to, the steam flowed in the opposite direction and passed to the cylinders from the forward group of tubes.

The construction of the new design of superheater follows after the same general plan as the previous one, the principal changes being made in the tube plates and the upper drum. A passageway has been cast along the top face of the upper drum for conducting the steam from the dry pipe to the forward group of tubes, as shown by the illustration. The superheater contains 336—$1\frac{1}{4}$ inch tubes there being 168 on each side. The total heating surface of drums and tubes is 378 square feet. It is evident that the new design of superheater will be the most efficient of the two and result in obtaining a higher degree of superheat.

The simple ten-wheel locomotives have $21\frac{1}{2}$ by 28 inch cylinders, piston valves actuated by Walschaert valve gear and driving wheels 68 inches diameter over tires. The boilers are of the wagon top type, 66 inches in diameter at front ring and carry 175 pounds pressure. The fire-boxes are set over the frames and are $48\frac{3}{8}$ inches wide by 89 15/16 inches long which gives a grate area of 30 square feet. There are 24 5-inch tubes 14 ft. 6 in., long arranged for the superheater and 204 2-



PLAN OF TOP AND BOTTOM TUBE PLATES, BALDWIN SUPERHEATER FOR CONSOLIDATION LOCOMOTIVES—CENTRAL RAILROAD OF BRAZIL.

inch regular tubes of the same length. The boiler has a total heating surface of 2,431 sq. ft., of which 1992 square feet is in the tubes and 149 in the fire-box. The total weight of the engines are 160,000 pounds with 120,000 pounds on the drivers. The maximum tractive force is 28,400 pounds. A few of the principal ratios are as follows:—

Weight on drivers ÷ tractive force = 4.3.

Tractive force × diameter of drivers ÷ heating surface = 795.

Total heating surface ÷ firebox heating surface = 16.3.

Total heating surface ÷ grate area = 81.0.

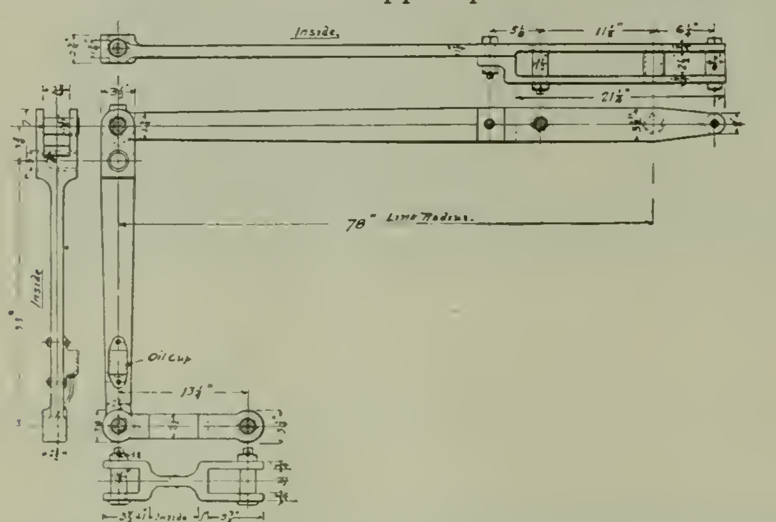
Weight on drivers ÷ total heating surface = 49.5.

Volume of Cylinders = 11.7 cu. ft.

Total heating surface ÷ volume of cylinders = 208.

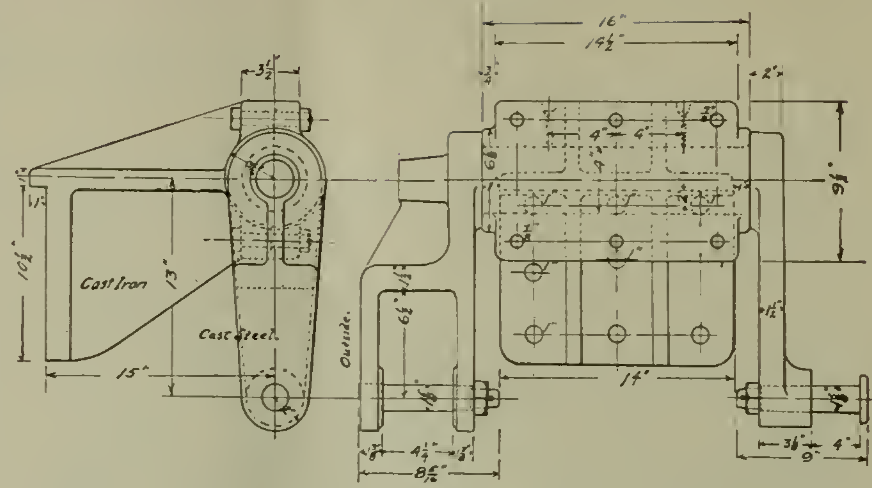
Grate area ÷ volume of cylinders = 2.56.

The Vaughan superheater as applied to the simple ten-wheel locomotives is a design which has been used largely on the Canadian Pacific Railway with satisfactory results. The general arrangement of this superheater is shown by the illustration and consists of 24 5-inch tubes located in the upper part of the boiler in



DETAILS OF CONSTRUCTION OF RADIUS ROD AND COMBINATION LEVER FOR WALSCHAERT VALVE GEAR—SIMPLE TEN WHEEL LOCOMOTIVES, CENTRAL RAILROAD OF BRAZIL.

which are placed U-shaped superheating tubes connected to headers in the smoke box. Two headers are provided, one in the upper part of the smoke box for the saturated steam and the other below the center of the smoke box for superheated steam. The super-heating tubes are arranged in groups of four and are connected to the headers by special fittings. These tubes are 1½

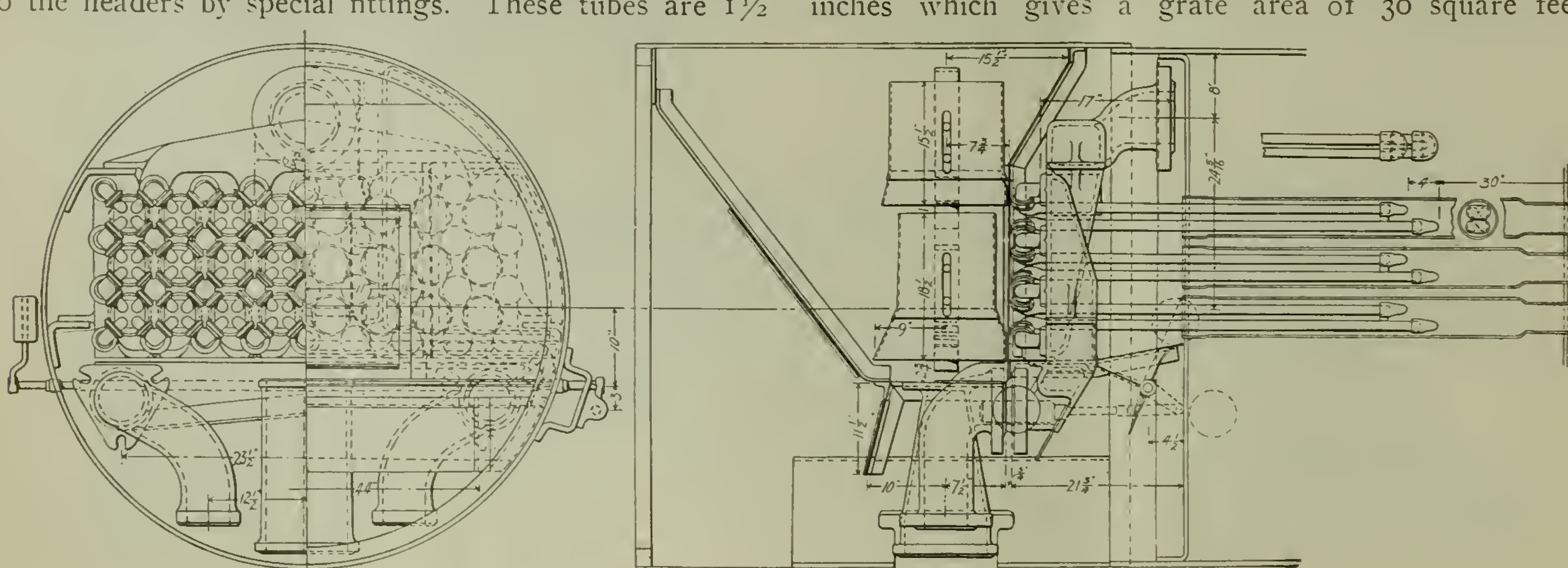


DETAILS OF CONSTRUCTION OF ROCK SHAFT FOR WALSCHAERT VALVE GEAR—SIMPLE TEN WHEEL LOCOMOTIVES, CENTRAL RAILROAD OF BRAZIL.

in diameter and extend to within 30 inches of the firebox tube sheet. It is expected that the satisfactory performance of this superheater will be repeated and that the locomotives in question show a decided gain in efficiency by the use of this device.

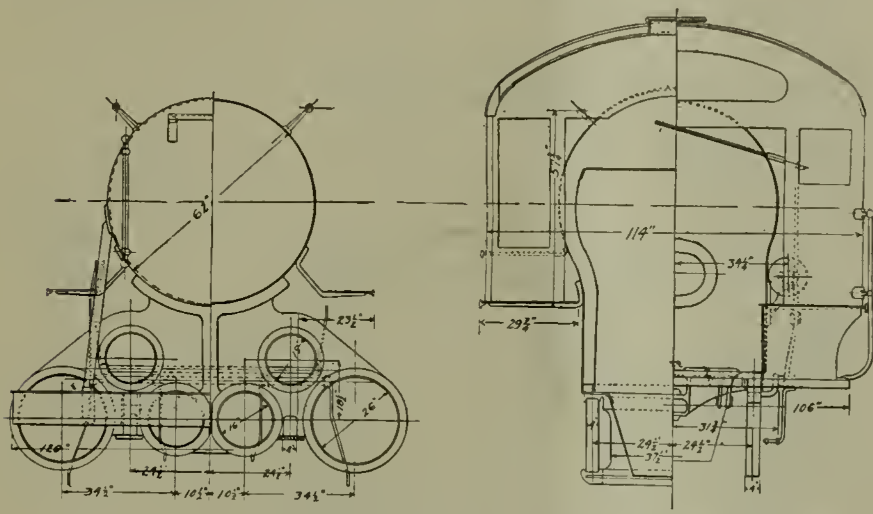
The design of the Walschaert valve gear of the simple locomotives is modified somewhat, as the piston valves are located 18 inches inside the cylinder center lines, which is an unusual location for valves arranged in connection with the Walschaert gear. In order to transmit the motion of the gear from outside the running gear to the valves, rock shafts are employed which are bolted to the guide yoke. As the valves have inside admission the crank arms are set to follow the crank pins and the radius rods are connected to the extreme ends of the combination levers. The outer arm of the rock shaft has a jaw cast on the end in order to accommodate this arrangement. These details of construction are shown by the illustrations.

The two balanced compound locomotives complete this interesting order and the results of their performance on the Brazilian railroads will be watched with interest. The locomotives have 16 by 26 inch high pressure and 26 by 28 low pressure cylinders, piston valves operated by the Walschaert valve gear, and 68-inch driving wheels. The boilers are of the wagon top type, 62 inches in diameter at the front ring and carry 200 pounds pressure. The fire-box is set over the frames and has a width of 48⅜ inches and a length of 89 15/16 inches which gives a grate area of 30 square feet.



SIDE AND FRONT ELEVATIONS OF VAUGHAN SUPERHEATER AS APPLIED TO SIMPLE TEN WHEEL LOCOMOTIVES—CENTRAL RAILROAD OF BRAZIL.

There are 272 2-inch tubes 16 ft., 1 in. long. The boiler has a total heating surface of 2415 sq. ft., of which 2279 sq. ft. are in the tubes and 136 sq. ft. in the firebox. The total weight of the engines are 159,000



SECTIONS OF BALDWIN BALANCED COMPOUND LOCOMOTIVE—CENTRAL RAILROAD OF BRAZIL.

pounds with 112,000 pounds on the drivers. The tractive force is 26,800 pounds. A few of the principal ratios are as follows:

Weight on drivers ÷ tractive force = 4.2.

Tractive force × diameter of drivers ÷ heating surface = 754.

Total heating surface ÷ fire-box heating surface = 17.7.

Total heating surface ÷ grate area = 80.5.

Weight on drivers ÷ total heating surface = 46.0.

Volume of cylinders = 8.6 cu. ft.

Total heating surface ÷ volume of cylinders = 269.

Grate area ÷ volume of cylinders = 3.4.

By referring to the ratios of the several locomotives it will be observed that the designs follow one standard of proportions closely and although some of the figures differ from what is considered typical American practice, the designs are consistent with conditions on Brazilian railroads. The advantages of the 5 foot 3-inch gauge in locomotive construction are shown in a number of ways but chiefly in the design of boiler where a fire-box having a width of 48¼ inches can be set over the frames and between the wheels. Taken altogether the locomotives represent an intelligent selection for the purpose of obtaining data on the comparative economy of various designs.

Communications.

Editor Railway Master Mechanic:

I have read with much interest the short article concerning piece work in the April issue of your valuable paper and I think you have taken a broad minded view of the situation by looking candidly at both sides of it. The piece work or bonus system of paying for shop and other labor is gaining great headway on railroads at the present time. An important consideration in connection with the installation of this practice is to prove to the men from the beginning that they will be dealt with fairly and honestly. To follow this plan it is essential to give close attention to details frequently occurring which, if properly influenced, may be directed into channels leading to improvement.

An interesting incident in this connection occurred in a certain western shop with regard to the work of a blacksmith. Before the inauguration of the bonus system, this man was looked upon as an agitator and was finally dismissed from the service for drunkenness. Incidentally he had been a prize fighter and traveled around the country for several years, finally returning to the original shop and requesting employment. He was refused by the foreman smith and finally appealed to the shop superintendent. This official reviewed his career and agreed to give him employment under consideration that he should cease his work of agitation and direct his best efforts for the promotion of the interest of the company, as well as his own.

Soon after returning to work, this man was making $6.00 per day and accomplished this by careful thought and preparation for his work as he advanced. For instance as one job was being done, the other was being prepared. On one occasion he asked for a day off on which he desired to provide certain devices to facilitate his work. He was allowed this privilege and by using the device which he had prepared, he so increased his output as to earn $8.00 per day.

This incident goes to show that where a man increases his output and thereby his own earning capacity, he increases his value to the company by which he is employed and by doing a greater amount of work in a given time, he increases the efficiency and output of the shop in which he is employed.

When men absorb the idea that as soon as they begin increasing their own earning capacity, the price of a given piece of work will be so cut down as to place them on the same earning plane as they were before piece work was instituted, they will not take hold of the work gracefully or heartily and the system is begun at a disadvantage.

For instance, take the case of a man turning out six pairs of driving wheels per day. If he understands that he is being watched by a clerk, or other checker, for the purpose of determining a piece work price, he will not endeavor to increase that number. If, however, the piece work price is determined and thereafter he increases his number of wheels to eight per day and the price is cut so that he earns no more than formerly although increasing the output of his machine, the system is doomed.

On the other hand, however, if a man is allowed to make a maximum amount by increasing his output without fear of his price being cut, he will have greater confidence in his officials and will provide his hearty cooperation.

I have taken occasion to mention these few instances to you trusting that they might have some influence in showing both shop managers and workmen that the piece work system has many advantages where both sides play fair. Yours truly,

S. S.

Boiler Design.

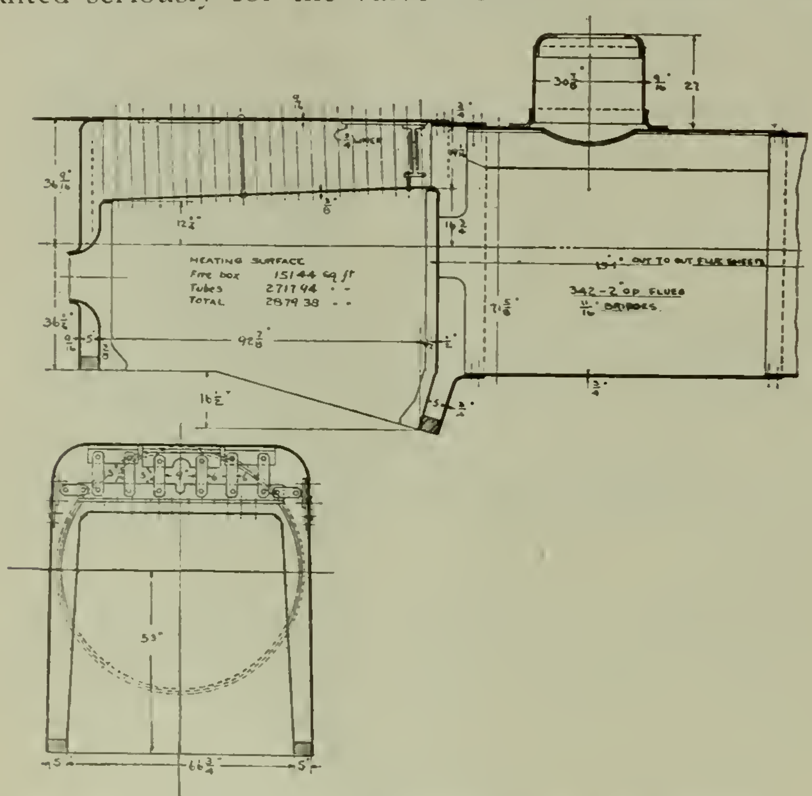
Editor Railway Master Mechanic:

Your editorial in the March issue on the advantage of the wagon top boiler over the straight top boiler suggests another feature in boiler design which is sometimes not given as much consideration as it should. The feature referred to is the provision of an ample passageway between the crown and roof sheets at the front end of the crown sheet so that the steam generated by the firebox heating surface will not be retarded on its passage forward to the dome.

Herewith is a sketch of a boiler in which this feature has been sadly neglected, and the actual service results of an engine with this boiler would appear to bear out this criticism.

This engine, a ten wheeler with 19x26 inch cylinders and 143,000 pounds on drivers, was placed on a rather hard passenger run which called for high speed up grades as on account of poor track a limit was placed on the down grade speeds and hence to make schedule time it was necessary to make speed up the hills.

Working the boiler to the limit on the up grades resulted seriously for the valve motion on account of the



SECTIONS OF BOILER WITH RESTRICTED SPACE FOR PASSAGE OF STEAM BETWEEN CROWN AND ROOF SHEETS.

water carried over to the cylinders and valves, and it was necessary to go over and doctor up the valves after almost every round trip.

The obvious remedy for such a difficulty would be to cut out the tee irons at the forward end of the crown sheet and use eye bolt sling stays and thus gain as much space as possible for the passage of steam.

On new work the advantage of the wagon top boiler in increasing the distance between the crown and roof sheets is obvious Yours truly,

O. W. OTT.

What is a Locomotive?

Editor Railway Master Mechanic:

The literal definition of a locomotive is asked for, and though the question has often been asked and as often been answered with somewhat varying definitions, the following is given as a definition and is offered subject to criticism. Up to 1829 the locomotive was unknown, and all engines in existence were known only as steam engines. With the advent of the locomotive, a

Grey Iron Castings 43

Pattern No.	Description	Engine Nos.
4242	Cylinder—Locomotive, 20"x28"	541-598.
4243	Cylinder—Locomotive, 20"x28"	651-785, 1000, 1002-1026.
4246	Cylinder—Locomotive, 17"x24"	1169-1176, 1199.
676A	Cylinder—Locomotive, 18"x24", Saddle 13" High	251-262.
676B	Cylinder—Locomotive, 18"x24", Saddle 15" High	281-290.
676C	Cylinder—Locomotive, 18"x24", Saddle 19½" High	271-280.
3398	Cylinder—Locomotive, 18"x24"	1901-1904.
4085	Cylinder—Locomotive, 20"x28"	1-63 Class.
4152	Cylinder—Locomotive, 18"x24"	1905-1929, 1940-1947.
4526A	Cylinder—Locomotive, 17" dia	1300 Class.
4526E	Cylinder—Locomotive, 17" dia	1158-1159-1160.
4526C	Cylinder—Locomotive, 16" dia	1300 Class.
4526D	Cylinder—Locomotive, 16" dia	1300 Class.
4153	Cylinder—Locomotive, 18"x24"	1424-1433.
	Cyl. Bushing (See Bushing)	
	Cyl. Casing (See Casing)	
	Cyl. Heads (See Heads)	
188	Cylinder—Large	Stone Fire Door Opener.
189	Cylinder—Small	Stone Fire Door Opener.
4316	Cylinder—For Bell Ringer	651-785.
430	Cylinder—5" Driver Brake	1501-1529, 1401-1421.
1517	Cylinder—Driver Brake	1879-1884.
1695	Cylinder—8" Driver Brake	
1699	Cylinder—10" Driver Brake	
3543	Cylinder—8" Driver Brake	1401-1421.
3700	Cylinder—8" Driver Brake	1323-1324, 1180-1181.
3701	Cylinder—10" Driver Brake	341-345.
4607	Cylinder—10"x14" Driver Brake	Driver Brake.
4608	Cylinder— 8"x10" Driver Brake	Driver Brake.
4609	Cylinder—10"x10" Driver Brake	Driver Brake.
2494	Cylinder—9" Air Brake, with Fulcrum	124-126.
2699	Cylinder—12" Driver Brake	Westinghouse.
2386	Cylinder—8" Steam Brake	
	Cyl. Cock Lever Bracket (See Bracket)	

SAMPLE PAGE, SHOWING METHOD OF LISTING GREY IRON CASTINGS FOR LOCOMOTIVES—NEW PATTERN CATALOGUE. ILLINOIS CENTRAL R. R.

distinguishing title had to be applied to designate it according to the nature of the machine and to do this as is always the case, the classics were resorted to for a name for each of the two classes of steam engines. The names given were in accord with the nature of the working of each engine. Stationary was the name applied to the first from the Latin sto-(to stand) and signifies a steam engine which stands and works indefinitely.

The term locomotive was applied to the latter and as roots locus-(a place) and move-(I move) signify, a steam engine which when it works or operates, moves its place. Therefore to deduce, we shall say that:—"A locomotive is a steam engine which when put in operation, changes its position or location relative to its surroundings."

Later we hear of the electric locomotive but the term or word by priority belongs to the steam engine, because electricity as a motive power was unknown at the time of the introduction of the locomotive, the word then, if propriety of ownership governs, distinctly belongs to the steam engine and where the motive agent is electricity or gas or any other than steam, the word motor is the proper name with which to designate the machine.

Yours truly,

JOSEPH BOURKE.

Chicago, Ill.

New Pattern and Casting Catalogue.

Illinois Central Railroad.

A NEW pattern catalogue has been recently compiled by the Illinois Central Railroad in which all locomotives and car castings are arranged in alphabetical order. The catalogue supercedes the old numerical pattern list and is a more convenient and satisfactory method for locating and ordering castings than the previous system employed.

The new catalogue is made on the loose leaf plan, in order to allow the insertion of new pages, the covers being of heavy cardboard with a leather covering and held in place by a threaded screw post which brings the binder post caps flush with the cover. The pages are 6 ins. x9⅜ ins. with 37 lines printed to the page and columns arranged as shown by the sample pages reproduced in the accompanying illustrations. In all, about 9608 patterns are catalogued, which with the cross-indexing makes 329 pages of printed matter. In cases where a pattern is known by more than one name, the article is first listed under the builders' name and then all local appellations are indexed, with a note indicating where to look for the casting. At each alphabetical division blank leader lines are left or an extra page inserted, upon which new patterns are to be entered.

The first step made in the preparation of this catalogue, was to number all patterns in a certain series, and to eliminate as far as possible all obsolete patterns. This work was put in the hands of a committee consisting of a stock clerk, a machinist and a draftsman, and took about three months to complete on account of the complex system in vogue for numbering patterns at the time the work of improvement was begun. Careful record was made of the patterns at this time and the results were then assembled in the form of an alphabetical record.

Sample page 43 shows the arrangement of the list of engine patterns used for grey iron castings. This

Grey Iron Castings 171

Pattern No.	Description	What For.
5753	Thimble—Transom, for Plain Side Bearings..	61'-0" Standard Coach and Chair Car.
5759	Thimble—Transom, at Intermediate Sills....	61'-0" Postal Car.
5235	Thimble—Transom	
5336	Thimble—Transom, 3⅜" long..............	Rogers Ballast Car.
5337	Thimble—Transom, 1⅜" long..............	Rogers Ballast Car.
5411	Thimble—Transom, End	Drovers and Caboose Truck.
5522	Thimble—Transom, Wooll Side Bearing....	30 ton Box.
5554	Thimble—Transom	
5810	Thimble—Transom	1117 Class Cars.
5811	Thimble—Transom	1117 Class Cars.
5670	Thimble—Transom, Outer End............	30 ton Coal Cars.
5673	Thimble—Transom, Inner..................	Officer's Car No. 16.
5674	Thimble—Transom, Intermediate	Officer's Car No. 16.
5555	Thimble—Transom, 3 23-32" long..........	61'-0" Baggage, Horse Car, and Combination Postal and Baggage.
5556	Thimble—Transom, 1 29-32" long..........	Same as 5555.
5557	Thimble—Transom, 1 3-32" long............	Same as 5555.
5230	Thimble—Truss, 4" long..................	61 ft. Baggage, 60 ft. Mail, 61 ft Combination Baggage and Smoker, Horse Car and Combination Postal and Baggage.
5231	Thimble—Truss, 6" long..................	Same as No. 5230.
5117	Threshold—Center, End	Fruit Cars.
5118	Threshold—Corner	Fruit Cars.
5119	Threshold—Side	Fruit Cars.
5120	Threshold—End	Fruit Cars.
5121	Threshold—End, Replaces 5118 on New Cars.	Fruit Cars.
5199	Threshold	Baggage Cars.
5249	Threshold—Corner Side Openings..........	25 ton Fruit Cars.
5250	Threshold—End Side Openings............	25 ton Fruit Cars.
5251	Threshold—Lower Center Openings........	25 ton Fruit Cars.
5252	Threshold—End Openings	25 ton Fruit Cars.
5800	Threshold—4' Outside	Baggage Cars.
5802	Threshold—3' 10"	Baggage Cars.
5803	Threshold	

SAMPLE PAGE, SHOWING METHOD OF LISTING GREY IRON CASTINGS FOR CARS—NEW PATTERN CATALOGUE, ILLINOIS CENTRAL R. R.

Malleable Iron Castings 223

Pattern No.	Description	What For
M-226	Panel—Side Door	Baggage Car.
M-227	Panel—Side Door	Mail Cars.
M-573	Pawl—Ratchet Wheel	Steel Frame Suburban Cars.
M-574	Pawl—Ratchet Wheel	Steel Frame Suburban Cars.
M-607	Pawl—Drop Door Operating Rod..........	100001-100250.
M-24	Pawl—Brake	Standard.
M-373	Pawl—Brake	30'-8", 30 ton Refr. Cars.
M-454	Pawl—Brake	40'-0", 50 ton Dump Cars.
M-550	Pawl—Brake	Gondolas 101001-101250.
M-3	Pin	Side and End Door Lock.
M-7	Pin	Side and End Door Lock.
M-32	Pin	Refrigerator Car Hatch Lock.
M-503	Pin, ⅝" Diameter..................	Uncoupling Clevis.
M-214	Pile Driver Hinge—Top Half, L. H.........	On the Leads.
M-215	Pile Driver Hinge—Top Half, R. H.........	On the Leads.
M-216	Pile Driver Hinge—Bottom Half, L. H......	On the Leads.
M-217	Pile Driver Hinge—Bottom Half, R. H......	On the Leads.
M-69	Pipe Stand, 7"..................	1¼" Pipe Stand.
M-70	Pipe Stand Cap..................	1¼" Pipe Stand.
M-313	Plug	Side Rod Grease Cup.
M-298	Pocket—Corner Post and Brace, R..........	40'-0", 40 ton Box.
M-403	Pocket—Corner Post and Brace, L..........	40'-0", 40 ton Box.
M-404	Pocket—Corner Post and End Brace, R. H...	36'-0"-30 ton Fruit Cars.
M-405	Pocket—Corner Post and End Brace, L. H...	36'-0"-30 ton Fruit Cars.
M-406	Pocket—Corner Post and Side Brace, R. H...	36'-0"-30 ton Fruit Cars.
M-320	Pocket—Corner Post and Side Brace, L. H...	36'-0"-30 ton Fruit Cars.
M-321	Pocket—Corner Post, Lower, R. H.........	36'-0", 30 ton Stock Cars.
M-322	Pocket—Corner Post, Lower, L. H.........	36'-0", 30 ton Stock Cars.
M-323	Pocket—Corner Past, Upper, R. H.........	36'-0", 30 ton Stock Cars.
M-263	Pocket—Corner Post, Upper, L. H.........	36'-0", 30 ton Stock Cars.
M-264	Pocket—Corner Post and Brace, Top, R. H...	41'-0"-30 ton Furniture.
M-277	Pocket—Corner Post and Brace, Top, L. H...	41'-0"-30 ton Furniture.
M-278	Pocket—Corner Post and Brace, R. H......	51'-0"-30 ton Furniture Cars.
M-342	Pocket—Corner Post and Brace, L. H......	51'-0"-30 ton Furniture Cars.
M-343	Pocket—Corner Post, Bottom..............	36'-0"-40 ton Box Car.
M-344	Pocket—Corner Post, Top, R. H...........	36'-0"-40 ton Box Car.
M-300	Pocket—Corner Post, Top, L. H...........	36'-0"-40 ton Box Car.

SAMPLE PAGE, SHOWING METHOD OF LISTING MALLEABLE IRON CASTINGS—NEW PATTERN CATALOGUE, ILINOIS CENTRAL R. R.

list is very simple and contains the pattern number, description of casting and engine numbers to which the patterns apply. These patterns are numbered in the series from 1 - 4,999.

Sample page 171 shows the grey iron patterns which are used for car equipment. These follow the engine patterns and are numbered from 5,000 up. The steel castings have the prefix "S" added to the pattern number as shown by sample page 178. The malleable iron patterns are distinguished by the prefix "M" which is added to the pattern number as shown by sample page 223. The brass castings are listed under pattern numbers to which the prefix "O" is added as shown by sample page 252.

The catalogue will save enough in the time of the store department alone in a short time to pay for the cost of assembling and printing. One of these catalogues will be placed in the hands of all who have to order material. The foreman whose order previously read, for, instance, "one steam chest for 900 class engine" will now be able to give the number of the casting, thereby reducing the labors of the store keeper and also eliminating a certain element of uncertainty sometimes found in such orders.

It will be easy to ascertain if a casting which is needed can be procured, and if not, immediate steps can be taken to get a casting, either by checking up similar castings, with a view of substitution, or if necessary by making a new pattern.

Brass Castings 252

Pattern No.	Description	What For.
03748	Brass—Driving Box	65-84.
0438	Brass—Driving Box	85-99, 166-198, 201-244, 401-519, 601-638, 1422-1433.
0922	Brass—Driving Box	101-151, 158-161, 1801-1820.
0435	Brass—Driving Box	152-157, 341-345, 1822-1854, 1869-1878, 1879-1884.
0869	Brass—Driving Box	251-290, 1184-1193, 346-351, 1798-1799.
03717	Brass—Driving Box, for Old Boxes	251-290, 346-351, 297-298.
03313	Brass—Driving Box, Main	201-244, 601-638, 401-519, 1422-1433.
0437	Brass—Driving Box	301-333, 338-340.
0433	Brass—Driving Box	399.
03268	Brass—Driving Box	541-598, Main 640, 651-785, 1000-1035, 1031 Class F. & B.
03258	Brass—Driving Box, Front, Back and Intermediate	640.
0578	Brass—Driving Box	600, 1701-1761.
03258	Brass—Driving Box	639.
03805	Brass—Driving Box	641-644.
03747	Brass—Driving Box, Front, Back and Intermediate	801-840.
03748	Brass—Driving Box, Main	801-840, 1031-1035.
02254	Brass—Driving Box	1101-1127.
0436	Brass—Driving Box	1134, 1879-1884.
0537	Brass—Driving Box	1144.
01502	Brass—Driving Box	1156.
03416	Brass—Driving Box	1205-1209, 1213-1214, 1217-1225, 1235-1238.
02254	Brass—Driving Box	1301-1307, 1309-1310.
0351	Brass—Driving Box	1401-1421, 1501-1529.
03097	Brass—Driving Box	1467.
0866	Brass—Driving Box	1561-1574.
0450	Brass—Driving Box	1905-1929.
01318	Brass—Driving Box	1930-1939.
01770	Brass—Driving Box, With C. I. Box	1940-1947.
01730	Brass—Driving Box, with Steel Box	1940-1947.

SAMPLE PAGE, SHOWING METHOD OF LISTING BRASS CASTINGS—NEW PATTERN CATALOGUE, ILLINOIS CENTRAL R. R.

Steel Castings 178

Pattern No.	Description	What For.
S-416	Box—Driving Wheel, Main	801-905,
S-417	Box—Driving Wheel, Front, Int., and Back	801-905
S-452	Box—Driving Wheel	641-644.
S-453	Box—Driving Wheel	641-644.
S-467	Box—Driving Wheel, Back and Intermediate	640.
S-468	Box—Driving Wheel, Front	640.
S-514	Box—Driving	1801-1820 Front back and Main.
S-454	Box—Driving	1869-1878 Front and Back.
		271-280.
S-529	Box—Engine Truck	541-598.
S-308	Box—Engine Truck, Trailer	1031-1035.
S-34	Brace—Frame Cross, Front of Fire-Box	541-598.
S-134	Brace—Frame Cross	1002-1026.
S-16[illegible]	Brace—Frame Cross	651-785.
S-24[illegible]	Brace—Furnace Cross	651-785.
S-286	Brace—Frame Cross	65-84.
S-287	Brace—Frame Cross and Waist Bearer	65-84.
S-348	Brace—Frame Cross	651-785.
S-423	Brace—Frame Cross	801-840.
S-424	Brace—Frame Cross	801-840.
S-425	Brace—Frame Cross	801-840.
S-337	Brace—Frame and Cylinder	1002-1026.
S-458	Brace—Smoke Box	801-840.
S-459	Brace—Smoke Box	801-840.
S-460	Brace—Smoke Box	801-840.
S-7	Brace—Frame Crosstie	1031-1035.
S-325	Bracket—Brake Hanger	541-598-63" drivers.
S-326	Bracket—Brake Hanger	541-598-63" drivers.
S-346	Bracket—Brake Hanger	65-84.
S-347	Bracket—Brake Hanger	65-84.
S-254	Bracket—Bumper Beam and Center Guide	651-785.
S-330	Bracket—Bumper Beam and Center Guide	541-598-63" drivers.
S-421	Bracket—Bumper Beam and Center Guide	801-840.
S-294	Bracket—Bumper Beam	1031-1035.
S-29	Bracket—Furnace Crosstie, R.	1001, 1002-1026.
S-30	Bracket—Furnace Crosstie, L.	1001, 1002-1026.
S-247	Bracket—Furnace Crosstie	651-785.

SAMPLE PAGE, SHOWING METHOD OF LISTING STEEL CASTINGS—NEW PATTERN CATALOGUE, ILLINOIS CENTRAL R. R.

The advantages of the new catalogue over the old numerical pattern list will be readily apparent to those who are familiar with the difficulty experienced in locating patterns according to the old system.

Frank Thomson Scholarships.

At a meeting of the Board of Directors of the Pennsylvania Railroad Company recently, the offer of Anne Thomson, Frank Graham Thomson and Clark Thomson, of a fund of $120,000 to establish what are to be known as the "Frank Thomson Scholarship" was accepted and approved. The fund has been deposited with the Fidelity Trust Company, as trustee.

The grantors of the trust declare their desire to afford to "sons of living or deceased employees of all the lines of the railroad an opportunity for a technical education, so as better to enable them to qualify themselves for employment by the company." Competitive examinations are to be held, open only to sons of Pennsylvania employees, "corresponding in general to the entrance requirements of the scientific departments of the higher class universities, colleges, and technical schools." The company, in selecting candidates for the Frank Thomson scholarships, is allowed to take into consideration not only the examination "marks" candidate makes, but also the physical and moral qualifications requisite for railroad employees.

After passing the examinations held by the company, the winner of a scholarship must qualify for admission to one of the technical schools or departments approved by the company before he receives his certificate entitling him to draw upon the scholarship fund.

Beginning this year two scholarships, each of which amounts to $600 a year, are to be filled, and every year two will be added. After four years two will be graduated annually, keeping a total of eight men in college all the time.

New Steel Underframe Tank Car.

German-American Car Lines.

THE steel tank cars now under construction by the German-American Car Company embody a number of features which have not heretofore entered into designs of this type. By a careful design and arrangement of parts the weight has been reduced about 6,000 pounds below that of existing cars of this type and at the same time great strength has been secured.

The construction of this car is shown by the accompanying illustration. The car which has a length over couplers of 37 feet has a capacity of 80,000 pounds or 8,000 gallons. The tank is supported on two 15-inch channels which form continuous center sills of strong and rigid construction. Steel brackets riveted to the body bolsters and upper flange of the center sills, in addition to four intermediate brackets, form the outer supports for the tank which rests on wooden slabbing bolted to the brackets. The shocks transmitted to the coupler when the car is in service and the longitudinal thrust of the tank are taken care of by a specially designed cast steel head block buffer riveted to the center sills. These head block buffer castings are of strong ribbed construction as shown by the illustration and is one of the novel features of this car. Wooden filler blocks are placed between the head block buffer and the tank and by means of a wedge arrangement, the distance between the head block buffer at each end of the car can be varied to accommodate the expansion of the tank. Vertical movement of the tank is prevented by five strap bands, which secure it firmly to the frame.

One of the most important features of the car is that every part is exposed, making it easy to inspect and repair. The side bearings are set as far out as possible. The upper bearing is formed by a continuation of the body bolster and is braced by the steel bracket already referred to. A running board supported by steel brackets riveted to the tank completely encircles the car, and both end and side hand rails are provided.

The trucks are of the usual arch bar type with inside hung brakes. Corner sockets are bolted to the truck for polling purposes. Of the equipment furnished the car may be mentioned Major couplers, Caldwell friction draft gear, Monarch brake beams and McCord journal boxes.

The car combines a number of well designed features and as one of the latest developments in cars of this type, is a good example of light and strong construction obtained by a careful distribution of material.

NEW STEEL UNDER FRAME TANK CAR—GERMAN AMERICAN CAR LINES.

Boltless Sectional Piston Head.

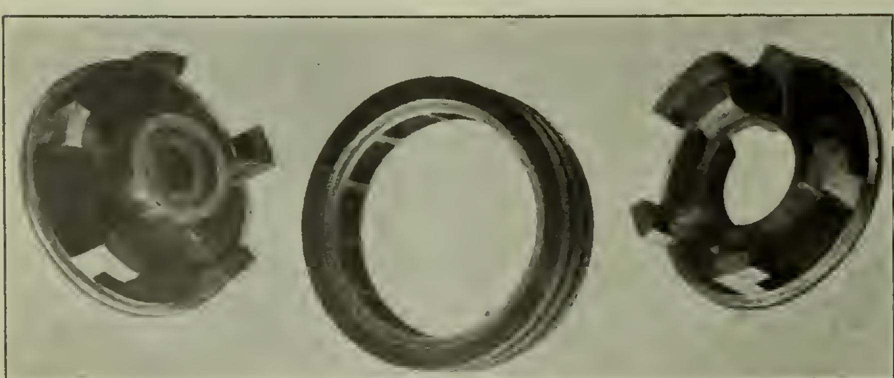
THE proper construction of piston heads is one of the most important things to consider in locomotive design. It is a part which is not readily accessible for either inspection or repairs, yet it is subject to severe service and for these reasons it must be carefully designed and built. The failure of a piston head means a disabled engine, broken cylinder head and many times a broken cylinder casting.

At the present time the solid and ordinary forms of built up piston heads, are the two styles in general use.

THE WHITE BOLTLESS PISTON HEAD WITH SPIDER AND FOLLOWER IN POSITION. BULLRING DETACHED.

There are advantages to each type and also disadvantages which greatly outnumber the first. The solid piston can be made strong and reasonably light but the piston rod must be disconnected from the cross-head every time the head is examined or packing rings renewed, which is a slow and costly method of making repairs. Also if the casting is not perfectly sound, (the flaws in most cases are not visible) it is liable to give way at any time without any warning whatever.

The built up piston head, with bull ring and follower plate held in place with follower studs is composed of more parts than the solid piston but packing can be renewed and repairs made much quicker than with the other style as it is not necessary to disconnect the rod from the cross-head. It is more expensive to fit up and trouble is experienced from the follower studs working loose and backing out with the consequent result that cylinder heads are broken.



THE WHITE BOLTLESS PISTON HEAD TAKEN APART, SHOWING CONSTRUCTION OF SPIDER, FOLLOWER AND BULLRING.

It is obvious that there is much room for improvement in the construction of piston heads and that a style is needed which combines the advantages of both the types referred to, without including the bad features of each.

In this connection it is interesting to note the new design of piston head which a number of railroads are applying to some of their engines. The accompanying illustrations give a clear idea of this design, which is manufactured and patented by the National Patent Holding Co., of Chicago, under the name of the "White Boltless Piston Head." In this design the built up feature is obtained without the use of the unsatisfactory follower bolts, which will be readily apparent from the illustrations. The spider and follower are arranged with lugs having a tapered recess in each, into which the corresponding lug on the other part fits closely. In this manner the two parts can be locked tightly together and by means of the screw and nut shown in the slot, the parts are closed until they fit against the bull ring, the same also preventing them from coming unlocked. By this method, the advantages of the built up piston are secured without the use of follower bolts, in addition to obtaining lightness and strength. The construction of this piston head is simple and it can be readily machined, fitted up and taken apart for repairs at the same time avoiding the expense of maintaining the usual built up head and the excessive cost of renewals of the solid head. The performance of this design of piston head will be watched with interest.

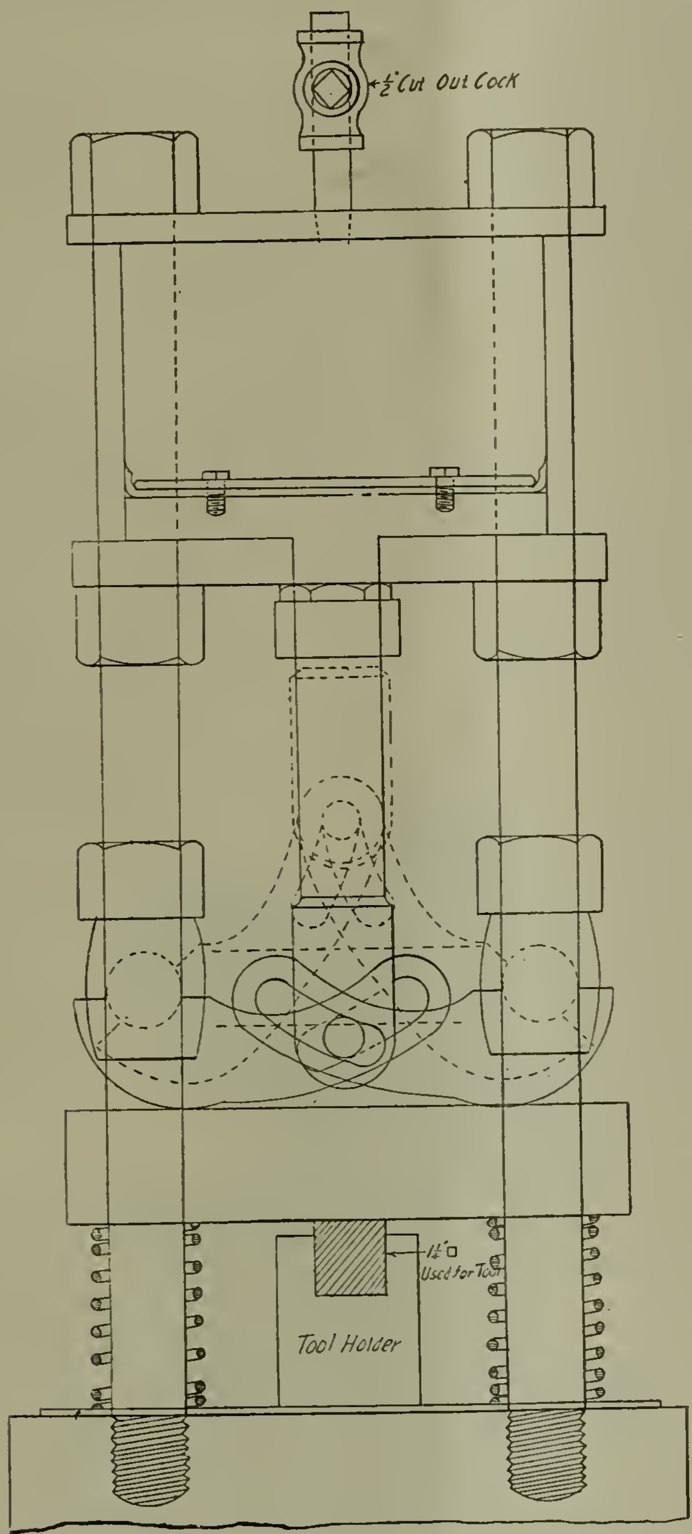
Pneumatic Tool Clamp for Wheel Lathe.

THE average wheel lathe man consumes from five to six minutes each time he changes tools and as it is not unusual to change five times for a pair of wheels, thirty minutes is used in the operation, which is practically lost time. In order to reduce this time as much as possible, Mr. F. C. Pickard, machine foreman of the Pere Marquette shops, at Grand Rapids, has devised a pneumatic appliance for raising and lowering the tool holder plate on a driving wheel lathe, to take the place of the usual four studs and nuts which are tightened with a wrench.

The device as shown by the illustration consists of a 7½ by 5¼ inch air cylinder, anchored by two stud bolts to the tool column, the piston operating two slotted cams which raise or lower the tool holder plate, according to the position of the piston. When the piston is down, the plate is forced against the tool, holding it firmly in position by air pressure, and when raised to the position as shown by the dotted lines the tool is released and can be freely removed. The coiled springs under the tool plate force it upward when pressure is released. The piston moves the tool holder plate ½ inch.

For a tool rest or holder, a piece of steel 2¼ by 3 inch is used and is slotted lengthwise along the top for receiving a piece of self-hardening steel 1¼ inch square. This not only saves steel but gives a greater bearing on the tool rest.

By using this appliance, lathe tools can be changed easily in one minute without the exertion required in the usual method, and the trouble resulting from the wrench slipping and studs breaking is entirely avoided. We are indebted to Mr. W. J. Haynan, superintendent of shops for the illustration presented.



PNEUMATIC TOOL CLAMP FOR WHEEL LATHE—GRAND RAPIDS SHOPS. PERE MARQUETTE R. R.

General Foremen's Association.

The International Railway General Foremen's Association will hold its annual convention at the Lexington Hotel, Chicago, on May 14-16. A number of interesting subjects will come up for discussion, and it is expected that the convention will be the most interesting and largely attended of any yet held by the Association.

Although electric traction has solved the city and suburban transportation problem where dense traffic must be handled, safely and quickly, it has not yet proved itself to be the ideal method for conducting long distance trunk line service on account of the high first cost and lack of proper method and facilities for conducting the service under all conditions.

Personal Mention.

Mr. J. D. Crawley has been appointed master mechanic of the Georgia, Florida & Alabama, with office at Bainbridge, Ga.

Mr. A. C. Adams has been appointed master mechanic of the Lehigh Valley at Sayre, Pa., to succeed Mr. John McMullen, resigned.

Mr. I. W. Smith has been appointed master mechanic of the Great Northern at Crookston, Minn., in place of Mr. R. H. Smith, transferred.

Mr. W. Kennedy has resigned as master mechanic of the Grand Trunk at Toronto, Ont., to accept a position with the Great Northern.

Mr. John N. Davis has been appointed master carpenter of the Pennsylvania Railroad at Tyrone, Pa., in place of H. S. Wyman, deceased.

Mr. G. W. Mudd, formerly master mechanic on the Wabash, has been appointed master mechanic of the Denver & Rio Grande at Alamosa, Colo.

Mr. Bert Myers has been appointed acting road foreman of engines of the Erie at Huntington, Ind., in place of Mr. J. A. Cooper, transferred.

Mr. J. B. Diven, heretofore master mechanic of the Cumberland Valley, has been appointed assistant engineer of motive power of the United Railroads of New Jersey division of the Pennsylvania Railroad, at Jersey City, N. J.

Mr. Taber Hamilton has been appointed master mechanic of the Cumberland Valley, with office at Chambersburg, Pa., in place of Mr. J. B. Diven, resigned.

Mr. R. M. Boldridge has resigned as master mechanic of the Mississippi Central, and has been succeeded by Mr. W. J. Haynen, with office at Hattiesburg, Miss.

Mr. Walter Errett Hooton has been appointed chief clerk to the superintendent of motive power and rolling stock of the Santa Fe Central, with office at Estancia, N. M.

Mr. George Siemantle has been appointed general master mechanic of the Fort Worth & Denver City at Childress, Tex., succeeding Mr. D. D. Robertson, resigned.

Mr. W. H. Sitterly has been appointed general car inspector of the Buffalo & Allegheny Valley division of the Pennsylvania Railroad at Buffalo, N. Y., in place of Mr. S. M. Hindman, promoted.

Mr. R. W. Burnett, formerly master car builder of the Erie, has been appointed assistant master car builder of the Canadian Pacific lines east of Port Arthur, with office at Montreal, Quebec, succeeding Mr. S. King, resigned.

Mr. L. J. Miller, heretofore division foreman of the Missouri Pacific at Atchison, Kan., has been appointed master mechanic of the northern Kansas and Omaha divisions, except the Kansas City Northwestern Railroad, with office at Atchison, Kas.

Mr. George Donahue division master mechanic of the New York, New Haven & Hartford at Providence, R. I., has been appointed master car builder of that road at Readville, Mass., to succeed Mr. T. D. Simpson, resigned. Mr. P. Z. Zang has been appointed master mechanic of the Worcester division at Providence, R. I., to succeed Mr. Donahue.

Mr. W. R. Davis, general foreman of shops of the Toledo & Ohio Central at West Columbus, O., has been appointed road foreman of engines at Columbus in place of Mr. E. Hartenstein, resigned. Mr. M. F. Burke succeeds Mr. Davis as general foreman of shops, and Mr. Joseph Warren, general foreman at Whitmore, O., has been transferred to Corning, O., as general foreman to succeed Mr. Burke.

Mr. W. G. Wallace, formerly superintendent of motive power and cars of the Duluth, Missabe & Northern, has been appointed superintendent of motive power of the Ann Arbor and the Detroit, Toledo & Ironton, with headquarters at Toledo, O. He succeeds Mr Robert Tawse, master mechanic of the Ann Arbor, and Mr. A. J. Ball, master mechanic of the Detroit, Toledo & Ironton, and those positions have been abolished.

Mr. David M. Perine, heretofore superintendent of motive power of the Philadelphia & Erie division, has been appointed superintendent of motive power of the new Grand Western Pennsylvania division of the Pennsylvania Railroad. Mr. J. T. Wallis, master mechanic at West Philadelphia, Pa., has been appointed superintendent of motive power of the Philadelphia & Erie division and the Northern Central Railway, with headquarters at Williamsport, Pa., succeeding Mr. Perine.

Mr. J. Schumacher has been appointed master mechanic of the Missouri Pacific at Ferriday, La., in place of R. W. Ruffner. Mr. B. Donahue has been appointed master mechanic at Van Buren, Ark., to succeed Mr. F. K. Tutt, who has been transferred to Osawatomie, Kan., succeeding Mr. W. B. Gaskins, resigned.

On the Chicago, Rock Island & Pacific the following appointments and assignment of territory in the mechanical department, effective on April 1 have been made: Mr. W J. Tollerton, assistant general superintendent of motive power, with office at Chicago, Ill.; Mr. J. B. Kilpatrick, superintendent of motive power, central district, with headquarters at Chicago; Mr W. L. Harrison, superintendent of motive power, northern district, with office at Cedar Rapids, Ia.; Mr. S. W. Mullinix, superintendent of motive power, southwestern district, with office at Topeka, Kan.; Mr C. M. Taylor, superintendent of motive power, Choctaw district, with headquarters at Shawnee, Okla. Mr. F. W. Williams, superintendent of motive power, southern district, with office at Ft. Worth, Tex. Superintendents of motive power will report to assistant general superintendent of motive power and make such reports and perform such duties as are required by the general superintendent of motive power, and will be subject to his directions in matters of shop practice, standard plans, etc. Assistant general superintendent of motive power will report to the general manager.

Mr. W. F. Girten has been appointed General Storekeeper of the Central Railroad of New Jersey, with headquarters at Elizabethport, N. J., vice Mr. H. S. Hoskinson, resigned, to engage in other business.

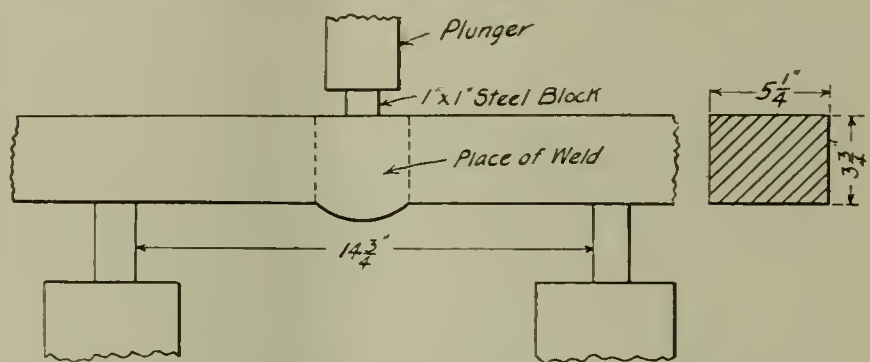
Test of Thermit Weld.

At the St. Louis & San Francisco railroad shops, Springfield, Mo., on March 30, the following test of a Thermit weld was made.

A section of a cast steel frame 4"x5½", was welded by the Thermit process. In making the weld, 75 lbs. of Thermit, 12 lbs. of punchings and 1½ lbs. of Manganese were used. For molds, fire brick was used, cut to shape.

After the weld was cold the collar on the bottom and one side was planed off one-fourth of an inch below the original surface of the castings, in order to show the place where the two metals had joined. The riser also was cut off, leaving the collar, however. The weld was absolutely solid, not a single blow-hole appearing anywhere—not even in the riser.

The welded section (now 3¾x5¼") with collar 1" thick on



METHOD OF TESTING THE STRENGTH OF A THERMIT WELD.

top and one side, was then placed in wheel press on supports 14¾" apart and a piece of hardened steel one inch square placed on the center of the piece to receive the plunger of the press, as shown in the illustration.

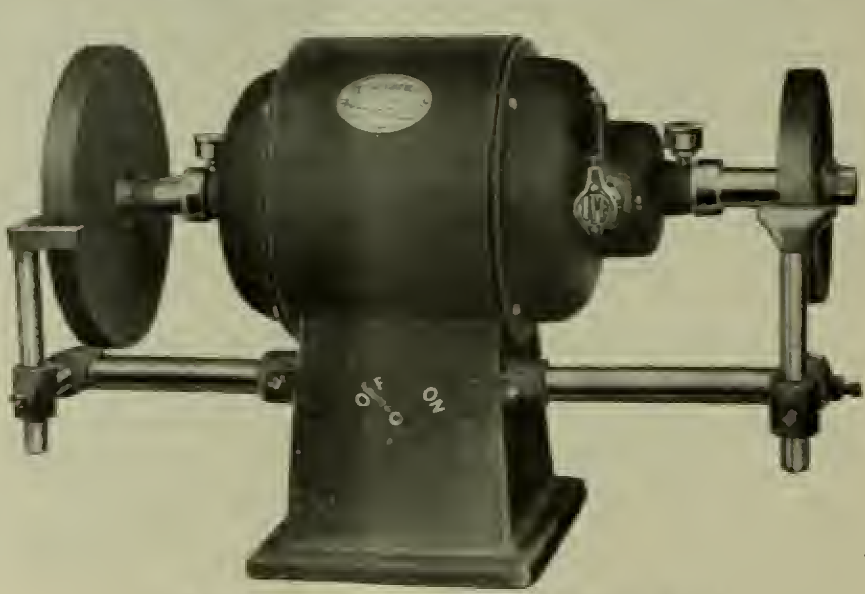
A pressure of 170 tons was applied before breaking. The fracture started at the bottom outside welded section, extending into the center of the weld at the top. The fracture showed that perfect amalgamation of the metals had taken place.

In comparing the strength of this weld with original stock, assuming a maximum stress in the outer fibre for cast steel of 60,000 lbs. to the square inch, a section 3¼"x5¼" tested in the same way would break at 100 tons.

Direct Current Grinding and Buffing Motor.

A portable grinding and buffing motor which is adapted to many different kinds of work and can be used in any position or location, is manufactured by the Lamb Electric Co., Grand Rapids, Mich. The illustration gives a clear idea of the construction of this motor and the convenient arrangement of operating parts.

While the grinding wheels are mounted on the ends of the central shaft for straight work and arranged with tool rests, a flexible shaft can be substituted which will enable the grinder to be used in remote parts of locomotives, where it would be impossible to get with any kind of a tool. This is a feature which



DIRECT CURRENT GRINDING AND BUFFING MOTOR.

could be used to advantage on many locomotive repair jobs. It is also possible to fit pulleys to the shaft and run light machinery and owing to the portable nature of the motor it can be moved to the machine and connected up to it with very little expense.

The motors are made in sizes ranging from 1/4 to 5 horse power and adapted to either 110 or 220 volt direct current. The bearings are extra large and dust proof. The armature is of the "slotted" type and inclosed in an iron casing which offers an absolute protection from injury. The brushes are carbon. Smooth running is obtained through perfect balancing and economy of operation is secured through the adaption of modern designs which have proved to be efficient. There is a wide field for these motors in railroad work.

A High Duty Drill.

A well designed high duty drill, which will handle drills up to 2 1/4 inches in diameter of high speed steel, without danger of splitting the drill, is one of the latest products of the Foote-Burt Co., Cleveland, Ohio. The feature which is particularly noticeable is the heavy construction of the table and the provisions made for holding it rigid at all times. This construction is of special advantage when using high speed drills, as there is no deflection between the point of the drill and the table with the consequent freedom from breakage caused by the drill catching.

Three changes of feed are provided, any one of which is available by simply shifting a lever conveniently located at the front of the machine. The other operating levers, such as the power feed, hand worm feed, automatic stop and quick return, are placed within easy reach of the operator. The sleeve is made of the heaviest construction possible, and is provided with ball bearing thrust collars. The spindle is of high carbon steel 2 1/4 inches in diameter in the sleeve and 2 1/8 inches above. The table is fitted to column by square locked slide and clamped by straps. A 2-inch square threaded screw acts as a supporting jack and at the same time is used to elevate the table. The ratio of back gearing is 3 1/2 to 1. The machine is of heavy construction throughout and is designed to withstand the heaviest duty under all conditions.

FOOTE, BURT & CO., HIGH DUTY DRILL

Notes of the Month.

S. F. Bowser & Co., Inc., Fort Wayne, Ind., manufacturers of oil storage systems for shops, factories, railway signal towers, etc., have opened up an office at No. 210 Fisher building, Chicago, which will be in charge of Mr. James W. Runyan, assistant general manager.

The H. B. Smith Machine Company, Smithville, N. J., will remove its Chicago office from 110 North Canal street to No. 105-109 South Clinton street. The company manufactures a complete line of wood working machinery.

Mr. W. L. Garland has been appointed general agent of the Safety Car Heating and Lighting Company at Philadelphia, Pa., to succeed Mr. B. V. H. Johnson, resigned.

The Ralston Steel Car Company, Columbus, O., is preparing plans for a new office building to be erected at its works in East Columbus. With the completion of this building the present offices in the First National Bank building will be abandoned. Several additional buildings to its plant will be erected, which will greatly increase its present capacity.

The Goldschmidt Thermit Company, New York, on April 1 removed its offices from 43-49 Exchange place to the new West street building, 90 West street. At the same time a San Francisco office was opened at 432 Folsom street, under the management of Mr. Heynemann, for handling the business in the territory of California, Oregon, Washington and Nevada.

The Quincy, Manchester, Sargent Company, of Chicago, has removed its machinery sales department from Plainfield, N. J., to the new West street building, No. 90 West street, New York.

The Philip Carey Manufacturing Company, Lockland, O., are just starting excavation work in preparation for the construction of two magnificent brick and concrete factory buildings 80 feet wide by 400 feet long. which they hope to have ready for operation by September 1. All orders for building and equipment have been placed. These two immense additions to their plant are occasioned by the phenomenal increase in their business.

The American Locomotive Company's exhibit at the coming Jamestown exhibition will occupy a plot 100x250 feet in the southern portion of the grounds on the south-easterly side of Lee's parade grounds. The exhibit will be housed in a building especially constructed for the purpose 177 feet long and 20 feet wide with the entrance facing the parade. The exhibit will consist of one Consolidation type locomotive built for the Southern railway with 22x30 inch cylinders and slide valves operated by the Walschaert valve gear; a Pacific type passenger locomotive built for the Chesapeake & Ohio railway with 22x28 inch cylinders and piston valves; a 10x16 inch saddle tank contractor's locomotive and a class 44-16-2 1/2 Atlantic steam shovel. The steam shovel will be placed outside of the building and will be in operation under its own steam.

J. L. Pilling, formerly of the Pilling Air Engine works of Detroit, Mich., has closed a ten-year contract with the Weir & Craig Mfg. Co., of Chicago, Ill., for the manufacture of his electric and compressed air applications.

Locomotives recently ordered from the American Locomotive Company for foreign countries: Two 8-wheel passenger locomotives for the Canton Hankow railway, China; three Prairie type tank locomotives for the Yueh Han railway, China; five Prairie type tank locomotives for the Yokohama railway of Japan; two 4-wheel type saddle tank locomotives, Government railway of Guatemala; three Mallet type locomotives, Central railway of Brazil.

The Armstrong Bros.' Tool Company, Chicago, were awarded a medal at the Liege, Belgium, international exhibition for their exhibit of lathe and planer tool holders.

Mr. William C. McMillan, late president of the Detroit seamless Tube Company, Detroit, Mich., died on February 21.

The Crocker-Wheeler Company, whose main office and works are at Ampere, N. J., has found it impossible to handle its rapidly increasing business in electric motors and generators in Birmingham, Ala., from its New Orleans and Baltimore offices, and has been obliged to establish headquarters at Birmingham. The new office, which is in the Woodward building, Birmingham, is in charge of Mr. B. A. Schroder, who hitherto has taken care of the New Orleans territory of the company.

The "Allen Record" from John F. Allen, New York, shows a number of quick jobs done with the Allen riveter, among them, one from the superintendent of the Chicago Bridge and Iron Works. One operator with one machine drove 1,240 ¾-inch rivets in 38 minutes; 10,809 ¾-inch rivets in 8 hours, and 13,589 ¾-inch rivets in 10 hours. The question is asked if this record has ever been equaled.

"Spring Painting" is the title of the latest publication of the Joseph Dixon Crucible Company, Jersey City, N. J. It is handsomely trimmed and illustrated in green, the appropriate spring color, and contains a great deal of information in regard to paint and the action of climatic conditions on wood, iron, etc. A copy may be had upon request.

The Cleveland Twist Drill Company, Cleveland, O., is sending out what it terms "Ready Reference," which is a lot of information in regard to twist drills, screw threads, decimals, table of cutting speeds, etc., printed on five sheets of cardboard and fastened together by means of a brass ring, for convenience in hanging up in the shop. This will prove of value to the shop man, as it contains a great deal of necessary information in a form which is easily got at.

The Manhattan Electrical Supply Company, New York, has just issued catalogue No. 22, covering "Something electrical for everybody." It contains 144 pages and over 750 illustrations of goods manufactured and handled by them, and is the most comprehensive catalogue for its size ever published, including as it does electrical products in all branches, viz.: Electricians' supplies, telegraph instruments and supplies, automobile and motorboat sundries, telephones and telephone supplies, electrical novelties, burglar and fire alarms, automatic gas lighting specialties, linemens' equipment, medical apparatus and laboratory supplies—in fact anything and everything pertaining to electricity.

The Goldschmidt Thermit Company, 90 West street, New York, is sending out a book, "The Thermit Welding Process and What it Offers to Transportation Companies," which shows very conclusively the value of Thermit in repairing broken locomotive frames, marine engine shafts, etc.

The Railway Steel Spring Company, 71 Broadway, New York, has issued a catalogue of the steel tired wheels it manufactures. The catalogue is full of excellent half-tone illustrations, showing sections and side views of the various types of wheels, and the composition and make up is of a high order.

The Niles-Bement-Pond Company, New York, has issued list No. 13 of second-hand metal working machinery, which lists 294 miscellaneous machines of all sizes, styles and makes.

The Armstrong Bros.' Tool Company, Chicago, has recently issued catalogue and price list No. 14, showing the many styles of tool holders and specialties which it manufactures.

The Railway Steel Spring Company, New York, has issued its latest catalogue showing a few of the various types of its springs used throughout the United States. A number of high grade illustrations show the different styles of locomotive driving, tender springs, etc.

The H. B. Smith Machine Company, Smithville, N. J., is sending out bulletins descriptive of the wood working machinery manufactured by the company. Several illustrations of each machine with detailed descriptive matter give a very clear idea of the construction and operation of the machines in question.

A pamphlet recently issued by the American Locomotive Company illustrates and describes the rotary snow plow built by that company. The first part of the pamphlet contains a brief account of the work done by the rotary in fighting the snow on various railroads, with illustrations of the rotary in operation. Then follows a description of the plow giving the particular features of the design. The last part of the pamphlet contains a set of rules for the guidance of those operating the rotary, based on experience gained during the past years in handling the plow.

The Mason Regulator Company, Boston, Mass., has issued its 1907 catalogue of the Mason automatic regulating devices for steam, electric and power pumps. The devices are fully illustrated by elevations, sectional views and line drawings. The catalogue is a handsome example of the printers' art and fullfils its mission exactly.

The Foundry Supply Association, organized to co-operate with the American Foundryman's Association, is preparing for the exhibition to be held in connection with the Foundrymen's Association convention in Philadelphia, May 20 to 24, at the Second regiment armory. Mr. H. M. Lane is the secretary of the association with offices at 1137 Schofield building, Cleveland, O.

Technical Publications.

"Coke," By John Fulton, Published by the International Textbook Co., Scranton, Pa. 498 pages, and 20 two-page inserts of working drawings. Price $5.00.

The first edition of "Coke," which was published just ten years ago, has been the standard and most exhaustive book on the subject in English. In the Second Edition Mr. Fulton has completely revised his original manuscript, taking out processes and apparatus which are no longer in use, and replacing this material by a large amount of new material. A slight rearrangement of the order of the chapters has also been made, and the book is now divided under the following heads:

Chapter 1. The Coal Fields of North America, and Chapter 2, the Formation and Chemical Properties of Coal. Chapters follow treating of the subject matter noted. The Preparation of Coal for the Manufacture of Coke; History and Development of the Coke Industry; Manufacture of Coke; The Retort and By-Product Saving of Coke Ovens; Physical Properties of Charcoal, Anthracite and Coke; Laboratory Methods of Obtaining Relative Calorific Values of Metallurgical Fuels; Locating of Plants for the Manufacture of Coke; General Conclusions on the Work, Cost and Products of Several Types of Coke Ovens; The Fuel Briqueting Industry.

Typographically the book is very pleasing, and the large number of illustrations and working drawings add greatly to the value of the statistical and descriptive matter contained in the text. In a subject such as coking, where each plant is more or less individual, it is difficult for an author to know just where to stop in choosing his illustrations. Mr. Fulton has been successful in selecting types of plants with very little duplication of the details in different plants, and has covered the subject of coking as it has never been done before.

"Modern Steam Engineering," By Gardner D. Hiscox, M. E. Published by Norman W. Henley Pub. Co., New York. 487 pages. 400 illustrations. Price $3.

A new, complete and practical work for steam users, electricians, firemen and engineers. It contains the latest practical information on boilers and their adjuncts; economy of steam making and its use from the fuel to the condenser, with illustrated details of steam engine parts; superheated steam, its use and economy; details of slide valve and high speed engines; corliss, compound, and triple effect engines; the steam turbine and its work; the cost of steam power, its application and operation in power plants for electric generation, pumping, refrigeration and elevators. There are forty-two tables for ready reference to the properties of steam and its application to the production of power, ratios, engine parts and proportions, most useful in the service now devolved upon the duties of a successful engineer. There are also several chapters on electrical engineering by Newton Harrison, E. E. Over 200 questions with their answers, likely to be asked by the examining board are also included.

Railroad Paint Shop

Edited by
J. H. PITARD
M. C. Painter, M. & O. R. R.

Devoted to the Interests of
Master Car and
Locomotive Painters

Official Organ of the Master Car and Locomotive Painters' Association

Has the Present Limit in the Methods of Coach Painting Been Reduced Below the Point of Reasonable Durability?

When it is considered that the cost of coach and locomotive painting has in recent years been reduced more than 50 per cent through the operations of the Master Car and Locomotive Painters' Association, it naturally follows that there was a quickening in the various processes and stages of painting which meant a quickening or forcing of the drying of both paints and varnishes much beyond their natural limit. There are various considerations that operate to make this forced drying necessary that should not be overlooked in the consideration of this subject, the first and most essential of which is expediency, and the next utility.

It has long been the opinion of the painting fraternity that paints, as made at present by chemicals and other rapid methods, are inferior to the hand-made paints of former periods. This belief seems to have been verified in at least one important instance at the national capitol. In the rotunda of the capitol building are to be seen mural paintings by Brumidi, the Italian artist, who made his own paints by hand. On the same walls are other paintings by other artists who used the prepared paints of the present day; the contrast in the durability of the two are very apparent, and the guides in the building never fail to call attention to this, and to the superiority of the hand-made paints. It is not to be inferred from this fact, however, that paint-making is a lost art. The paint manufacturers make what the people demand, so far as the price and drying is concerned. But this is a digression. The demands of the railroad companies for expeditious handling of equipment passing through the shop, has necessarily created a demand on the paint and varnish maker for quick-drying material, seemingly regardless of durability. If the equipment retains a passably fair appearance until the next regular shopping, no questions are asked. If this class of painting meets the approval of the superior officials, apparently all concerned should be satisfied, for the reason that the whole mechanical fabric, so far as it in anyway pertains to the painting, or the painting to it, has become adjusted to this method of painting. It is possible that the present method of coach painting has to some extent reduced the durability below a reasonable limit, but only in response to the demands of the powers that be. It is not possible to have the cake and penny, too; there must be a sacrifice somewhere. The retention of a passenger car in the shop undergoing repairs beyond a reasonable period means a distinct financial loss to the company. It means also that needed repairs and painting of other equipment is deferred on this account until its perished condition, when it arrives, is such as to entail additional work that could have been avoided by having earlier attention. Thus it is that one condition of things implies or determines another. There is an unexampled wave of prosperity sweeping the country, and all things affected thereby are becoming adjusted to the new conditions. The days of fancy coach painting, or even durable coach painting, as compared to the painting of long ago, seem to have forever passed, much to the regret of the old school painter, who owing to previous training does not view with complacency the changed conditions of things. He sees in them nothing to excite or to call forth his artistic talents. There is plainness becoming plainer still as wealth increases, when we might naturally expect that the reverse would be the case. But it is said the times change and men change with them. We have had very striking illustration of this during recent years, especially in railroading. So rapid has the pace become, so great is the demand for cars, that the question of durability and embellishment have become secondary considerations, and although all the various facilities for repairing rolling stock, has been greatly improved, it is yet unequal to the demand. The extent of commerce is circumscribed by the transporting facilities of the railroads. Adverse railroad legislation is seriously complicating the situation by curtailing the net earnings of roads, and by other demands regarded as unreasonable. With these very important matters hanging in the balance, the question of more time for better painting must bide its time, and the question of better painting in the present allotted time becomes the paramount issue so far as painting is concerned. It is very probable that in many instances, durability in painting is sacrificed in response to the demands of the hour, and the question of reasonable durability is not to be considered under the circumstances. On the other hand, the situation has evolved an added duty or responsibility which confronts the master painter, that of devising a means of meeting the exigency of the hour without reducing the durability of painting below a reasonable limit. How can this be done? As a suggestion, there must be less volatile liquids used in the under, or surfacing coats, which, on account of shrinkage, caused by evaporation of the volatile liquids, causes cracking and defacement of the surface. There must be less driers used to cause brittleness. There must be fewer coats applied to complete the work, and throughout the entire work, the finest grades of paints and varnishes must be used, and the painters' judgment in selecting such materials should be permitted to supercede that of the purchasing agent or of the higher officials.

Cleaning Engines.

"Does it pay to wipe engines?" asks the Railway and Engineering Review (New York, December 29). "In the good old days they were kept clean, as a matter of course. Then came pooling, and with its advent a disposition to cut out the expense of wiping altogether, on freight locomotives at least. Despite the increased use of power it is observable that most lines are again taking up wiping as a legitimate item of both freight- and passenger-locomotive maintenance. We believe this is in recognition of the fact that there is considerable more to the wiping proposition than the mere matter of the general appearance of the locomotives. It has been a well-observed fact that abandonment of wiping on any particular division always caused an equivalent 'let-down' in the esprit de corps of the engine crews, which resulted in a marked increase of engine failures, in which the round-house men as well as the engine crews were to blame. . . . It is gratifying to note recognition of the fact that one of the essentials in securing good locomotive performance lies in providing the engine crews with clean engines to run and the shop men with clean engines to work on and clean surroundings to work in."

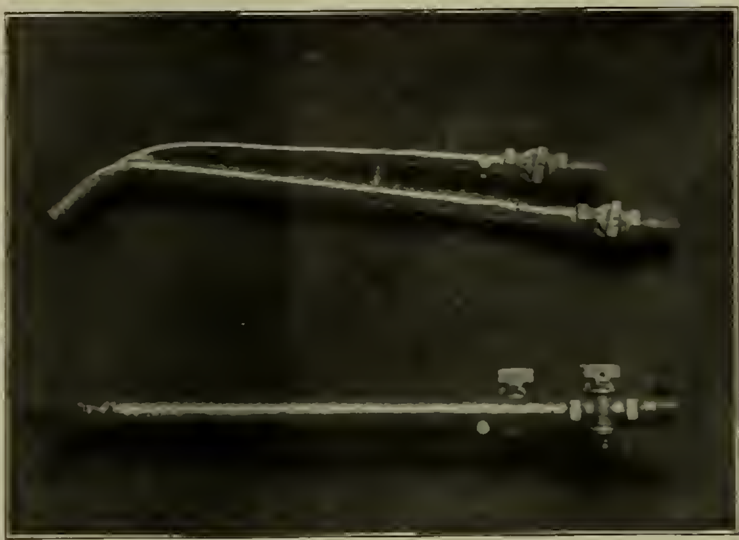
Concerning the above clipping on engine cleaning, it is perhaps timely to remark that where the careful painting of engines is supplemented by good terminal cleaning, much better results are obtained from the painting.

On the Mobile & Ohio, with which road the writer is domiciled, the passenger engines are painted Pullman body color, to conform to the color of the cars, and are cleaned at terminals with the same emulsion cleaner that is used for cleaning the coaches, and as a result of this attention given the engines, they require much less painting and varnishing than formerly.

It pays to keep things clean and neat; it exercises a beneficial influence generally, and indirectly it pays in dollars and cents.

Air-Gas Burner for Burning off Cars.

The accompanying illustrations show the air-gas burner for burning off cars which has been developed by Mr. Geo. A. Grabell, foreman painter Grand Rapids Railway Company, Grand Rapids, Mich., with whom he has been for the last fifteen years. It consists essentially of an elongated nozzle in which the gas



PLAN AND SIDE VIEW OF GRABELLS NOZZLE FOR BURNING OFF CARS

and air under pressure are combined, with stop cocks for regulating the supply of each at the nozzle.

Mr. Grabell uses 50 ft. of twin hose so the painter can get to all parts of the car to do the burning off. He states either natural or artificial gas can be used, and he has found the gas burner a distinct improvement over any form of hand blow-torch using liquid fuel which is dangerous.

Comments on the Advisory Committee Program.

Subject No. 1.

The Painting of Steel Passenger Equipment.

(A) How Should the Interior be painted?

(B) How Should the Exterior be Painted?

Recent events in railroad circles, portend the inevitable passing of the modern passenger coach, to be superceded by the stronger and fire proof steel car, and although the innovation is yet practically in its incipiency, it is well for the painting fraternity to begin to devote some thought to a matter of such importance, although subsequent developments may suggest the necessity of many changes from time to time, until a more perfect system is devised for the care of this class of equipment. When the use of this class of equipment becomes general, it will cause somewhat of a revolution in the art of coach painting, and much of the work of systematizing heretofore done by the association will necessarily have to be revised.

"Essay—"Plainness, Problems, Perplexities, and Prophecies, pertaining to the present day railway paint shop." These subjects cover a very wide range of the master painter's domain, and also affords a very wide latitude for the talents of any one who by practical explanation, or by process of reasoning may be able to bring the master painter and his superiors to a common plane of reasoning in all matters pertaining to the paint department, and thus minimise many of the obstacles that confronts the painter, but which he has not always the authority to deal with as his best judgment may dictate. The committee showed excellent judgment in selecting a man of Mr. Copp's ability to handle such a complex subject.

No. 2.

Disinfecting passenger cars. "What is the most improved method of disinfecting passenger equipment at terminals to comply with state laws?"

This is a matter in which the interstate commerce commission has precedence, and so far as the sanitary condition of passenger cars are concerned, the U. S. Marine Hospital service have, by making a comparative analysis of the sweepings of passenger cars, and the sweepings of dwellings in various cities, decided that the sanitary condition of passenger cars in service are not inferior to that of other places of residence, permanent or temporary.

No. 3.

"The cleaning, coloring and lacquering of metal trimmings, lamps, etc., for passenger equipment cars."

This is a subject which should have due consideration, looking to the reduction of the expense of this particular department of passenger equipment maintenance. Considering the various stages through which the brass trimmings must pass before attaining the high burnished effect desired, and also the fact that the operation must needs be repeated at each annual shopping of a car, renders it highly necessary that this particular branch of the work should be reduced in cost to conform to the various departments of passenger equipment maintenance.

The natural tendency of brass is to oxidize or darken, and rather than undergo the tedious and expensive and oft repeated operation of resisting this tendency, some roads and leading car works have abandoned the natural brass finish, and have adopted the oxidized or Statuary bronze finish, the process for which was recently published in these columns. This class of metal trimmings is fast becoming popular, and it is safe to predict that it will soon entirely supercede the natural brass finish for metal car trimmings.

No. 4.

"Painting Locomotives and Tenders."

(a) "What parts should be varnished? What parts should be treated to enamels with advantage?

(b) "Is it advisable to use asphaltum or oil paint?"

To make the proper distinction in the painting of those parts of a locomotive that are subjected to different conditions, is the proper thing for simplifying the work, and obtaining the best results. It does seem that the tender, filled with cold water and kept at a comparatively low temperature continually, should receive different treatment from that of the heated parts of the engine that are kept at almost a constant high temperature, and

METHOD OF USING GRABELLS APPARATUS FOR BURNING OFF CARS.

subject to varied and rapid extremes of temperature.

In general practice, it is customary to use the same system throughout on an engine, but as a result of this we usually see the heated parts give way first, this fact appeals to one's judgment that different treatment for separate parts are necessary.

No. 5.

To what extent may the various linseed oil substitutes and drying oils be used in painting cars and locomotives?

The list of oils of this character now on the market, are so numerous and so varying in degrees of merit that one needs must have an extensive experience with them in order to make the proper distinction as to their qualities and fitness for different classes of painting. It is difficult to cover them all with one blanket so to speak. There is no paint oil superior to unadulterated linseed oil, its only objection is its slow drying, too slow in fact for this lightning age. It is possible to get chemical compounds that will dry much quicker, but none that will excel it in durability. It is in order to draw the line of distinction between these two classes of oils, and let them each be set forth clearly on their merits.

QUERIES.

No. 1.

Have you found any material or coating that will resist the action of rust?

This is a subject that is continually bobbing up, which fact makes it significant that the advances thus far made in metal coatings are not entirely satisfactory, or if in particular instances such a material has been found it has not become generally known owing to a lack of being properly advertised. The durability of all metal paints hinges as much on the proper cleaning of the metal, as on the durability of the paint.

No. 2.

"Denatured alcohol, is it a satisfactory substitute for pure grain alcohol for railroad painters use?"

An affirmative answer to this question depends upon the material used for denaturing purposes. A small per cent of wood alcohol added to grain alcohol would probably not make any appreciable difference, but the various napthas, etc., would not be of sufficient strength to dissolve the gum, as shellac is not soluble in petroleum spirits. Methylated spirits has long been used in some countries for cutting shellac. We might say more on this subject, but feel that it would be trespassing. It is a good subject for discussion.

No. 3.

"Is it advisable to apply three coats of body color to a car if two coats will cover."

In consideration of this subject, affinity plays an important part. In order to reduce the number of body coats to the minimum, on any class of work, the ground coats must possess a strong affinity for the coats to follow, or in other words it should approach as near as possible in color to the body coats. In some instances, colors of certain kinds can be made perfectly opaque with one coat, by observing this method. There can not be any iron clad rule made to govern this point in coach painting owing to the fact that porosity and other conditions alter circumstances.

No. 4.

"Can the lasting qualities of light colored freight car stenciling paint be improved?"

This is an excellent theme for a subject. Owing to the rapid fading away of white lead, generally used for this purpose, it is something that has long agitated the minds of the painting fraternity, and if brother Bailey will solve the matter, it will indeed be a benefaction.

No. 5.

"From a painter's standpoint, is pressed fibre as durable as a three-ply wood veneer head lining for passenger equipment?"

Heretofore there has been general objection to carvings and other uneven surfaces in passenger cars for the reason that it furnishes a most inviting place for dust and disease germs, and is also more difficult to clean and to keep clean. But possibly something may develop in the discussion of the subject that may overcome these objections.

No. 6.

"What should be the nature of a detergent for railway paint shop use?"

The inflammable nature of the generality of detergents has possibly lead up to this question. Detergents of the alkali class have been abandoned, and chemicals of a highly inflammable nature, and in some instances dangerous to health have superceded them. Many disastrous fires have resulted from their use due possibly lead up to this question. Detergents of the alkali class for handling them in a manner to profit by their rapid solvent qualities, without at the same time incurring risk of damage from their dangerous properties. Gunpowder and dynamite are also useful but dangerous, and at first many accidents resulted from their use, but they have gradually compelled respect for their characteristics on the part of their consumers until accidents from this source are now comparatively rare. This will be the course possibly that chemical solvents will finally take. Possibly much useful information will be threshed from this subject.

On the whole, the program comprises an excellent list of subjects, from which may be deduced much valuable information. It is gratifying to see among the list of names assigned to the various subjects, some of the new members. This is, perhaps, gratifying to many of the older members who have borne the brunt of battle, too, these many years.

Steel Passenger Cars.

It is reported that the Pennsylvania Railroad Company is requesting bids for the construction of 500 steel passenger coaches to cost from $12,000 to $15,000 each, and the New York Central lines are having fifty-five all steel passenger cars built by the St. Louis Car Company, twenty-two of them being already completed. The Pullman Company, according to a report from Chicago, has built its first all steel sleeping car, and it is said the company proposes now to build all of its cars out of steel, so as to make them practically indestructible. Several months ago the Southern Railway Company received from the builders an all steel passenger car which was a decided novelty, and the Pennsylvania railroad soon also had a car built of steel. These more extended orders encourage the belief that the railroad companies thus interested are directing their efforts toward providing a passenger car that will greatly lessen the peril to life and limb in railroad accidents. Freight cars of steel which have had their endurance severely tested in collisions have shown such remarkable strength that it is hoped that steel passenger cars will prove to be not only fire proof in wrecks, but also death proof. The Southern railway is fast becoming one of the leading railway systems of the country. It has ever been liberal in the care of its passenger equipment, and is today one of the few roads of the country that still hold to the gold stripes on its cars.

Editor Paint Shop:

As will have well become known ere this may be placed in print, the 38th Annual Convention of the Master Car and Locomotive Painters' Association will be held at the Ryan hotel, St. Paul, Minn., Sept. 10 to 13. I wish to urge the necessity of all who intend to be present at this convention, of engaging room or rooms as early as possible so that committee may be prepared to care for the overflowing gathering. This I feel quite certain, will be a necessity judging from the number of rooms already engaged and from information at hand of members who have not attended in several years, and some few others as beginners. The resident member of the hotel committee will endeavor to have all attending well cared for, and is endeavoring even now to make special arrangement with the weather man so as to secure exceptionally good results in all conditions, trusting that it may not be found necessary to carry an overcoat and umbrella, duster or fan. It is said that everything possible and over which control can be had, advantage will be taken and effort made so that all who shall attend this convention will enjoy the visit to this Northwest section, admire our New Capitol building, Auditorium and other attractions, but more than all else that the sessions of the association, the presentation and discussion of subjects and the benefit and interest therein inculcated shall prove one of the best, if not absolutely the best convention held in recent years.

A. J. Bishop, Master Painter,
Northern Pacific, St. Paul, Minn.

Paint Shop Fires.

The recent destruction by fire of the paint department of the Baldwin Locomotive Works is only another chapter added to a subject, which owing to its importance, justifies careful consideration.

Although such fires are not frequent, they are usually disastrous when they occur, and, owing to the nature of the chemicals that contribute to such disasters, they are the most difficult fires to control.

Paint shop fires like railroad wrecks are indirectly traceable to the demands of the hour, and to changed conditions. The traveling public demand a high rate of speed, and wrecks are a natural sequence. There is a demand for labor saving appliances and materials, and in the paint shop, science has met this demand (even tho it be in some instances with highly inflamable materials), as it has in all other departments of railroad work.

Some of the materials of this class, such for instance as varnish removers, have advantages that largely over-balance their hazardous nature. Of all paint shop fires that have their origin from this source it is safe to say that it was due to negligence that would have resulted the same had naphtha or gasoline been used instead of varnish removers, and there is no highly inflamable chemical more generally used about a railroad shop than gasoline, or its counterpart, benzine, and yet fires from this source are rare, possibly because those who use them have become by long association to know their dangerous qualities, and therefore observe proper precautions for their own personal safety if for no other reason. In some instances, however, some people after a while become oblivious to danger and relax their precautions, and an accident is the result. But the only danger from fire arising from the use of inflamable chemicals is not by direct application of fire to such liquids, but the gases which they generate, and for which if there is not proper provision made for their escape, are liable at any time to ignite, when it becomes sufficiently dense, and when fire is brought in contact with it. It is this feature of such chemicals that is really the most dangerous quality they possess, and which renders such fires so difficult to combat. Such fires have no base on which to direct a stream of water, and as the gases are in the entire building, the whole building is aflame at once, and water is almost useless in combating such fires.

It is not wise in every instance to abandon or abolish a thing simply because it has some dangerous qualities; if this rule obtained, the public would be denied the advantages to be gained from the use of gun powder, dynamite, etc. The proper thing to do is to acquaint those who have to deal with such chemicals with their natures, and to make proper provisions for their use, in order that danger of fire may be reduced to the minimum. How can this be done? By setting apart a building in which such chemicals are to be used exclusively, a building lighted if it must be, by electric lights only, and entirely encased in glass bulbs. There should also be ample provision made for the free escape of gases as rapidly as they accumulate; there should also be some means of ascertaining the density of such gases. As regards the heating of such a building it should only be done by introducing it from the outside, such as steam heat or hot air.

No fire should ever be permitted in such a building, and when a car has passed this stage of the work, it should be removed to another building for the successive stages of work.

The writer recently had an experience along this line which while it was a most palpable illustration of negligence and the degree of precaution that is usually observed by the average workman about shop, it also demonstrated the necessity of isolating this class of work. A car was in process of cleaning with varnish remover on the interior, a portion of the car had just been coated, and a carpenter for some reason entered the car with a torch which when it came within a few inches of the cleaner, quickly ignited, and the coated portion of the car was instantly in a flame, but fortunately was extinguished with a Babcock extinguisher before any considerable damage was done.

It is not surprising that most shop fires possibly originate in the paint department, when it is considered that all the paint materials with which a painter has to deal are inflamable in a greater or less degree. Owing to this fact, it is a business that calls for constant exercise of precautionary measures in order to guard against such contingencies. One of the most innocent appearing, and yet the most treacherous sources of such fires, is the bunch of oily waste which ignites by spontaneous combustion. Many disastrous fires have originated from this source. For such waste, and in fact all refuse waste, there should be provided an iron box containing a few inches of water, into which all employes should be required to deposit such waste instead of throwing it about the shop or leaving it in overalls or lockers. The lockers should be of metal with wire netting fronts in order that a fire may be quickly discovered should it originate in a locker, as it occasionally does.

Next in importance to precautionary measures, is the necessity of having fire fighting apparatuses convenient, and in the use of which all the employes should be thoroughly informed, and possibly drilled.

With the above precautions strictly enforced, there is no reason why paint shop fires should not become as infrequent as fires in any other departments of railroad shops.

Necrological.

Through the kindness of Secretary-Treasurer Dane, we learn of the death, on February 14, of Mr. John A. Putz, at Endeavor, Wis., at the ripe age of 75 years. He was born at Elberfield, Prussia, April 5, 1832, and came to this country at the age of 14, making his home in Milwaukee, Wis., where he was married to Miss Matilda Esslinger in 1853. Mr. Putz was a painter by trade, and was for many years master painter of the Wisconsin Central. In 1864 he abandoned painting to engage in the Presbyterian ministry, at which he continued until incapitated by an injury. He is survived by seven sons and two daughters. He was a member of the order of Masons and Odd Fellows. The writer was personally acquainted with Mr. Putz, having made his acquaintance at the Boston Convention, and we regarded him as a most excellent Christian gentleman, and to his surviving relatives we extend our condolence.

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Contents

Railway Storekeepers' Association

As we go to press the fourth annual meeting of the Railway Storekeepers' Association is in progress, and from all indications the session will be the most important and largely attended of any held thus far. The ten subjects under discussion are live topics which are of vital interest to the storekeepers of all large railroads, and those presenting the papers are among the best known supply department officials in the country. A report of this convention will be given in a later issue.

He Supposed So!

ACCURACY is one of the watchwords of the railroads, as upon it depend the safety of life and property. It is a fundamental part of the organization and is held ever before the minds of those who are responsible for the movement of trains, as the one all-important law. Not only is accuracy an essential as a safeguard to human life, but it necessarily enters into the minutest details of railroad organization. It is the foundation upon which successful railroad operation rests. This has been very clearly brought out by Mr. J. H. Waterman in a paper entitled, "He Supposed So!" as published on another page of this issue. The paper is especially valuable, as it gives the views of a practical organizer who does not suppose and who has been successful in demonstrating that men can be taught to be accurate in all things.

The Effect of Long Divisions on Engine Failures

IN the last few years the operating divisions on a number of the large railroads have been materially lengthened, in some cases over one hundred per cent. This change has undoubtedly resulted in a reduction of operating expenses and a greater road efficiency of both locomotives and cars. Although the long division has been a success from an operating standpoint, the questionable features introduced in regard to locomotive operation and maintenance, render the change from the shorter division of more or less uncertain value.

Since the advent of the long division, the reports indicate that engine failures have increased and that greater difficulty has been experienced in keeping locomotives in proper shape. Investigation would seem to show that these conditions are caused directly by the long division. A locomotive in good shape will take a full tonnage train over a long division without difficulty provided everything is favorable. Too often, however, the conditions are not favorable for a continuous trip and delays occur which increase the hours on the road to such an extent that the engine crew is physically unable to do its work in the best manner. The fire gets dirty and in such shape as to start the flues leaking, and the long waits on side tracks aggravate this trouble. Hot driving boxes are not properly attended to and many things are left undone which would be looked after under ordinary conditions. Practically all of the trouble comes on the last few miles of the division, showing that good results are not obtained from locomotives when the men in charge of them are worked beyond the limit of ordinary endurance.

A delay on the road represents dead time as the locomotive is out of service for that period, so the greater the delay, the greater the demand for the locomotive to turn back from the terminal. This often results in turning back locomotives which are not in shape to go, with the consequent result that the trouble is aggravated on the return trip and a series of engine failures results. The long division is not an unqualified success when it causes locomotives to spend too much time on sidetracks and not enough time in the roundhouse.

The General Foremen's Association

THE International Railway General Foremen's Association held its third annual convention in Chicago during the past month. While the attendance at the meeting was not as large as might have been expected, the association has a large membership for one that has been organized for such a short time, and a number of new members were added during the convention.

There is a very fertile field for an association whose members are selected from among general foremen, shop superintendents and foremen of railway shops and roundhouses. There is much to be gained by such men assembling each year for the discussion of subjects pertaining to shop operation and management and for the consideration of methods by which output may be increased wh 'e operating expenses are reduced.

Both the railroad companies and the individual members stand to gain by the successful development of this association, and it would seem to the advantage of higher mechanical officials as well as of officials eligible to membership to lend their support in every way possible.

Encouragement from higher officials can be offered by sending their subordinates to the conventions of the association and by providing means and facilities by which their subordinates may gather the necessary data to assist in the formulation of their reports.

To the member of the association an opportunity is offered which it would seem unfortunate to overlook. The history of other associations of a like nature would signify that those who take an active part in the progress of this association will advance to positions of greater responsibility and remuneration than those which they occupy. For instance, every living past president of the Traveling Engineers' Association has been advanced to positions of greater responsibility than that of road foreman.

The life of the association depends upon the class of reports presented and discussed each year. The subjects so far selected would indicate that the organization is working in the right direction. By analyzing and discussing thoroughly the subjects of the various reports taken up at conventions and by making practical recommendations based on the wide experience of the various members, the association should make for itself an enviable reputation.

The value of such association work to the individual member is inestimable. By preparing to take an active part in all discussions and by gathering information and data for committee reports and individual papers he is led to make investigations and study various subjects more closely than he would be likely to do in the ordinary routine of daily life. By meeting in convention with men in his own line of work, by developing discussion and so exchanging ideas, he is given an opportunity of enlarging his mental calibre by gaining from the experience of others.

The advantages of committee work to an association and its members was discussed in an interesting and instructive paper presented before the last convention of the Traveling Engineers' Association by Mr. C. B. Conger. This paper might be read to advantage by those interested in the development of the newer organizations for the principles involved are identical and the advantages to the members are well described.

Passenger Locomotive Design

WHILE the locomotive designer in Europe has been perfecting the compound locomotive for passenger service, the designer in this country has been developing the simple engine for the same work. In view of the results obtained from the respective types of passenger locomotives at home and abroad, the question of the proper type to select for future development is worthy of the consideration of motive power men.

The Pacific type locomotive represents the extreme development of the simple engine as applied to passenger service. In several cases, it has almost reached the limit of height, width and weight permissible with the present track arrangement. A powerful locomotive capable of starting a heavy train has been developed, but at high speed the excessive friction of the heavy machinery and the energy absorbed by the machine itself, reduces the tractive force available at the tender drawbar, to an amount out of proportion to the work developed in the cylinders. The enormous boiler and cylinder capacity of the locomotive is not available as motive power at high speeds, on account of the percentage of power required to maintain the heavy locomotive at the desired speed.

Considering the performance of the heavy simple locomotive in high-speed passenger service, should not greater attention be given to perfecting a more efficient type of locomotive which will deliver a larger percentage of the developed tractive force, at the drawbar, than the simple type of locomotive under consideration? Investigation of the performance of the four-cylinder balanced compound will show that with this type of locomotive it is possible to obtain a maximum amount of power with the least weight and friction losses. With equivalent cylinders of relatively small size, a high tractive force can be maintained. The economical distribution of steam gives the boiler a large reserve power. There are a greater number of parts and the cost of maintenance is perhaps a little higher than the simple locomotive, but the saving of the balanced compound in fuel, more than compensates for the extra cost of maintenance.

He Supposed So!

By J. H. Waterman, Storekeeper, C. B. & Q. Ry.

AT the annual meeting of the association of Operating Offices of the Chicago, Burlington and Quincy Railway, held in Chicago during the month of May, a paper of unusual interest entitled "He Supposed So" was presented by Mr. J. H. Waterman, Storekeeper at Lincoln. Through the courtesy of Mr. Waterman and the association we are permitted to present this paper in full. The paper is as follows:—

In presenting this subject to you, there is no doubt but what some of you smile, and others wonder what I hope to get out of it by which an intelligent body of men like the gentlemen I am now addressing, can profit. For surely we must admit it would be a waste of time to spend fifteen or twenty minutes on this, or any other subject, unless we could leave an impression on some that are here to-day that would be of benefit to the Burlington railroad.

It might be well for me to state what reason I have for proposing this subject. Some time ago I was requested by the engineering department of this road to take a trip over one of the operating divisions, and look up some special work (it is not necessary for me to say the kind of work), for that department. It was a trip which necessitated my having a gasoline motor car.

I went personally to the superintendent of the division over which I was to make the trip and requested him to arrange for the car. He very kindly consented to do so. He wired to have the car put on the second section of Blank Train Number. The message was received by the right party, but the agent put the car on the first section, instead of the second section.

The baggage agent was instructed to unload the car at Blank Station, and to be sure that it was put off the train at that point. He in turn put off the car at the first station east of the point where he was instructed to unload it.

I arrived at the point where I expected the car, and found there was no car there. I immediately started tracer by wire, and found the car one station east of the point where I stopped. I took a freight train from the point where I was at, and went one station east. When I arrived at the point where the car was unloaded, I did not find it there, but I found that the claim agent had taken the car and gone out into the country some four or five miles.

I immediately wired the superintendent, that notwithstanding the fact regarding the instructions he had given, I had failed, so far, to reach the car. He immediately sent a letter trying to locate the blame or the party that was at fault, and what did he find? This is what I found in the correspondence when it was returned to me.

First, the agent, instead of putting the car on the second section of Blank Train, put it on the first section, because he supposed that the second section would have no baggage car. The baggage agent of the first section put the car off at the first station east, because he supposed the train would not stop at the point where the car was billed. The claim agent used the car because he supposed that no one else would show up that would want the car before he could get back.

That put me to thinking, and I wondered what I would have done if I were the superintendent of that division. I'll tell you what I think I would have done. I would have called in every man that had anything to do with the car, and I would have told them that I wanted them to cut out the word "Suppose," and in future, if they expected to railroad on the division which I was operating, I wanted them forever after to understand that "Suppose" was an obsolete word.

I want to state frankly here to you, gentlemen, that we should educate the young men who are now operating, or learning to operate, on the Burlington, that there is no such word as "Suppose," that they must know, and not suppose anything.

It seems to me that some one may smile and say: "Oh, I don't know as there is very much to that." Let us take another case, but before I state the other case, I want to say this, that I am here to state positively, and I believe investigations which you operating officers have made will bear out the statement, that seventy-five per cent of the wrecks which we have, would not occur if the parties operating our trains would not use the word "Suppose." If he who supposes were dead, and only he who knows were alive, I repeat at least seventy-five per cent of our wrecks would not occur.

I give you another case. Some time ago on one of our great western lines, the private car of one of the general officers of the road was attached to the rear end of one of the passenger trains on that line. The train took a siding to let a fast mail train pass. When the train pulled into the siding, the passing track was not clear, but it pulled in far enough so that the switch could be thrown. The operator sitting in the bay window saw the switch turned and the light showed white. He released the block for the fast mail train one siding east, before the conductor reported the train into clear. The flagman on the passenger train to which was attached the private car, failed to go back to protect his train. Only one man on that train knew that the train was not safe, and that was the general official whose car was attached to the train. What did he do? He ordered the flagman back to protect the train. He ordered him to go as fast as he could go. The flagman succeeded in stopping the fast mail.

Let us see where "He Supposed So" came in. The operator in the bay window supposed the train was in to clear when the switch light showed white. The flagman supposed the train was protected by the block the first siding east. The conductor supposed that the flagman was doing his duty and that the operator would not release the block until the train was into clear. The fact that there was one man on the train, and that a general officer, and that his car was in danger, and that he knew that there was danger, was the only thing that saved probably one of the worst wrecks that has been recorded in the past year, and there have been a good many.

There is no question in my mind but that the wreck in which Mr. Samuel Spencer, President of the Southern Railway, was killed in his private car, was caused because some one supposed the train was properly protected when it was not.

Some time ago there was a serious wreck on another one of the great trunk lines of the west. Why? Because the dispatcher supposed that a passenger train had cleared the block, and it had not. He let a freight train out. What was the result? The result was that by a hair's breadth the superintendent of the division saved his wife and babies and himself, but his car was a total wreck.

Is the operating department the only department that supposed things? Is that the only department in which we find that fellow whom I have termed; "He supposed so!" Not by any means.

I was at a storehouse some time ago, and the storekeeper said to me:

"Waterman, I want to show you something," and he took me out in the yard and he showed me a frog made by the mechanical department. He said: "I ordered a one to six frog. There is a frog branded one to six, you measure it." I measured it; it measured one to seven. I asked him to tell me about it. He said that when the frog was received he measured it and called the master mechanic's attention to it, who sent the blacksmith out to look at it, and the result was this: They received an order for a one to six frog; the blacksmith gave the order to one of the men; the man made a one to seven and branded it one to six; the foreman of the blacksmith shop supposed it was a one to six frog. It was shipped for a one to six and received by the storekeeper to whom I was talking, as a one to six, but he refused to accept even the branded figures on the frog. He measured it, and he found it was a one to seven. One man knew what he was doing, the other men supposed what they were doing.

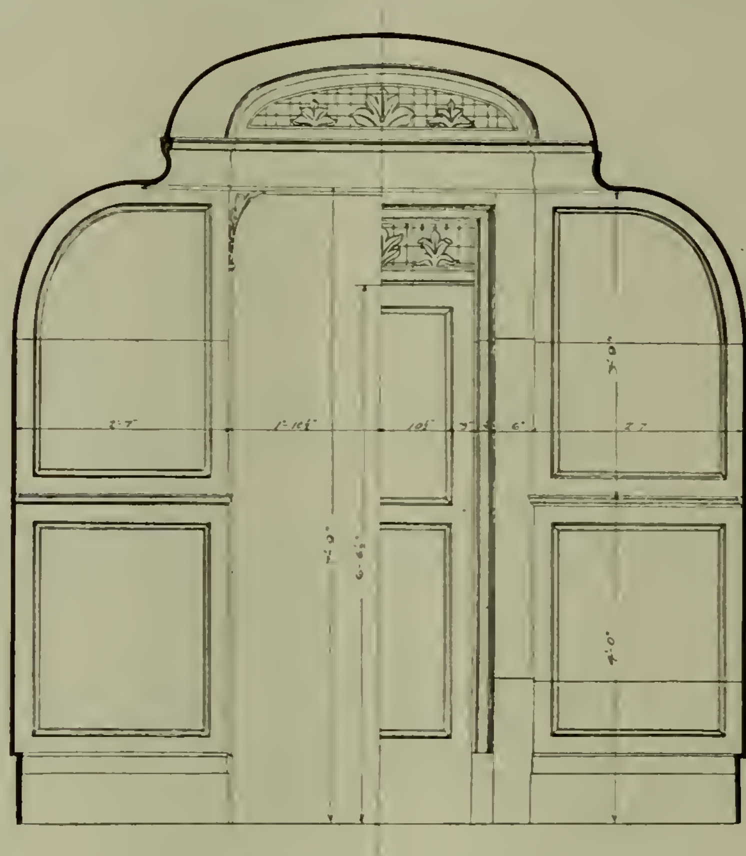
Some one I hear say: "How about the store department? Do they ever suppose anything?" If it had not been for suppositions of some of the men in the store department, I do not hesitate to say that I would have a good many more black hairs in my whiskers than I have today.

In all the lines we find men not only using the word "Suppose," but acting upon it. One of the most difficult propositions that we are up against today is to educate young men to the fact that if they do not know, it is no crime, but never suppose anything.

Some time ago I was called to account by what is now known as the transportation department, for having one hundred and fifty cars of material on track at Lincoln. The party calling me to account is not now in the employ of the company. If he was you may think I would hesitate to name the place. I would for I do not want anything in this paper to be construed as personal. But I want to state this as a fact. I stated to the party that his information was wrong, and I proved beyond a reasonable doubt that it was wrong, and that there were less than sixty cars of material on track.

What was the trouble? He had a report which he supposed was correct, and it ought to have been correct, but it was not. It was full of duplications, car number after car number was duplicated, some of them two and three times.

Some times when we are crowded almost beyond endurance, we find that it is all on account of supposition, or an incorrect report made by incompetent men.



CROSS SECTION OF CAR, SHOWING DESIGN OF INTERIOR FINISH—NEW DINING CAR, CANADIAN PACIFIC RY.

Now the remedy! I would suggest: First, that every official of this system provide himself with a blue or red pencil, and every time he receives a letter or message where the writer directly or indirectly supposes anything, that he call their attention to that fact, and it will not be long before we will have men in all branches of the service educated that the word "Suppose" is obsolete.

W owe something to the men who are working under us. We owe them more than we realize. For our own benefit, and for the benefit of the road which employs us, we should educate and drill them to get the best out of them, and if we have young men, and we all have more or less of them working for us, if we can instill in their brain that what is worth doing is worth doing well, and when they do anything to know that they are right, and then to go ahead, or refuse to act, we will have built up for ourselves and around ourselves a monument which cannot be torn down.

There is no place in this world for men who do not know what they are doing. The dispatcher who operates a train must know his track is clear; the engineer must know his orders are right; the conductor must know that all trains have passed the junction point before he leaves the station; the operator or signal man must know the block is clear before he releases the block; the flagman must know his train is protected, and the only way to know it is to go back far enough to see that it is protected, for the man operating the block may suppose it is clear when it is not. All along the line we must educate men to know what they are doing.

When we have accomplished that, when there are good positions open on the Burlington Railroad, it will not be necessary to go to some other road to secure men to fill their places. There will be plenty of men all along the line who will be competent and able to take any place which may be vacant.

Not only that, but the railroads north, south, east and west will soon learn that the Burlington men do not suppose and when they want competent and efficient men to operate their lines will go to the Burlington to get tnem.

The bones of the children of Israel are scattered all over the desert, because they supposed the men of Canaan were giants, and they were not able to go up and possess the land. From one end to the other of the great trunk lines of this country are scattered the bones, figuratively speaking, of young men who might today have been holding good positions, if they had known what they were doing, instead of supposing.

Paul H. Brooks, in a paper before the New York Railroad Club, entitled "The Future Leaders," said: "The railroad man of tomorrow will be he who operates most economically." I would add to that: "The railroad man of tomorrow will be he who knows, not he who 'supposes so.' "

New Dining Cars

Canadian Pacific Ry.

THERE are many appropriate and pleasing designs of dining cars in service on the various railroads of the country but the Canadian Pacific Railway has recently built two cars at the Angus shops in which the interior construction of the dining room has been treated in an entirely original manner, with very successful results. The harmonious and beautiful interior of these cars is clearly shown by the accompanying illustrations.

The most noticeable feature of the car is the effect of roominess both laterally and vertically, which has been secured by omitting the side wall and deck sill mouldings. The radius of the side roof has been largely increased and with the veneered facing substituted for the deck moulding, the side walls, roof and deck, form a continuous profile from floor to ceiling. The addition of the art glass sash over the usual inside body sash was a part of the scheme for increasing the apparent height of the car and it succeeds in securing this effect very nicely.

The art glass window is not seen from the outside but there is sufficient light from the upper outside body window to thoroughly display the beautiful colored lights and with the free sweep of walls and roof, entirely removes the appearance usually given by the extremely wide window sash, to many dining cars. The margins around the windows are trimmed with a light architrave, inlaid on its face, the design consisting of a rustic vine of maple leaves. There are additional lines of marquetry inlaid at the proper distance around the window openings and also along the side roof head linings, which in connection with the richly figured mahogany veneering used, gives the car a very handsome appearance. The large panels at each end of dining room were selected especially for the beautiful figure in the mahogany and they con-

NEW DINING CAR—CANADIAN PAIFIC RY.

tribute materially to the appearance of the car. The clear story ceiling or head lining is of a rich green leaf or ornamentation of Lin Cresto.

The dining room is lighted artificially by a combination of acetylene gas, center and side deck lamps, one of which is placed over each dining table. The lamps are of graceful design, finished in statuary bronze tint, and are fitted with opalescent spherical bowls. They were manufactured by the Safety Car Heating and Lighting Company especially for these cars and they not only harmonize with the finish of the car but present an artistic effect at night.

The kitchen which is the key to satisfactory service, is the Canadian Pacific standard in regard to dimensions and equipment. It contains a six foot steel range, a boiler, three dish steam tables, a large refrigerator, sink and the usual cupboard arrangement for utensils and equipment. The vestibule at one end of the car is of the Pullman type, and as the space at the other end is taken up by the refrigerator extension, the car can be entered from the outside at but one end.

The cars have a total length over end sills of 72 feet 9 inches, length over platforms 79 feet 10 inches, width over side sills 9 feet 10½ inches, width over sheathing 10 feet 0 inches. The exterior of the cars is mahogany finished naturally with varnish, relieved only by black bands at the edges of the various parts, by square mosaic blocks in gold leaf. The cars are heated by the Gold duplex hot water and steam heating system, and are carried on six wheel standard trucks with 36 inch wrought centers, steel tired wheels, having 5 by 9 inch journals. Miner tandem draft rigging is used. The cars were built under the direction of Mr. W. E. Fowler, master car builder, to whom we are indebted for the illustrations presented.

INTERIOR OF NEW DINING CAR—CANADIAN PACIFIC RY.

Car Foremen's Convention

The next national convention of the Chief Joint Car Inspectors' and Car Foremen's Association of America will be held at the Palmer House, Chicago, September 4th and 5th.

This association is rapidly reaching national proportions in its influence, and harmonizes the question of uniformity in connection with interchange and every feature of the car department.

The advantages of those interested in this class of railroad activity in attending this meeting are obvious.

The officers of the association are: H. Boutet, Cincinnati, O., President; W. H. Cressey, South Omaha, Vice-President; D. T. Taylor, C., B. & Q. Ry., St. Louis, Secretary and Treasurer. Executive Board: Charles Waughop, St. Louis; Stephen Skidmore, Cincinnati; W. E. Sharp, Chicago. Bruce V. Crandall, of Chicago, is chairman of the reception committee.

Railway Records

By U. H. Clarke

(Fourth of a series of articles on Accounting and Office Records of the Motive Power Department.)

CONTINUING last article on slow process of ordering material, we have already accounted for a certain delay of at least ten to fifteen days in getting requisitions through, figuring from the time the start was made, and a more probable delay of from twenty to thirty days' time.

After the order finally reaches the manufacturer, supply house, or whoever fills the order, we would naturally expect some further delay in getting material ready for shipment, as the demand for railroad material of all classes has been heavy in recent years, and it is not always possible to get material needed, for immediate shipment; in fact, some class of material requires orders placed months in advance to obtain supply at all; then when we consider the further delays in transit that ensues from car shortage and congested condition of traffic of the country, it will be understood that the present system of ordering, receiving and distributing company material still leaves very much to be desired.

So far as the reference to manufacturers and supply houses is concerned, I think it is largely due to the promptness and enterprise of these concerns that railroads are able to get even the results they do, in regard to obtaining supply of company material, and if the railroad company's own end of the proposition was as well organized and as promptly and systematically handled as is the part of the commercial concern, the whole proposition would not be difficult.

What the situation requires, to my mind, is just this, make the store house department the same thing as a commercial enterprise, have competent man at the head with a commercial as well as technical training, with full authority to do anything necessary to get results, and not hamper him with any official interference with details, but let him work out his own salvation, judging him only by results he gets. Give him sole charge of local store houses and all material used on divisions and shops, let every division storekeeper be a diminished replica of the general storekeeper, get a man in each place that knows what to do, and don't give him any instructions except to adhere to the general policy and authorized standards and get results, let a result be considered, to have anything needed, at any time needed and in any quantity needed. If he inavertently gets too much of anything it shows up on his balance sheet and it is easy to ask him about it. He will have lots of time to think out an ingenious explanation if he does not have to put in all his time hammering at somebody trying to get material to repair equipment that is waiting. Of course, it costs some money on interest on a few thousand dollars excess stock, but to delay one or two $15,000 locomotives an hour or two apiece each day, or have a few high-priced mechanics lose a few hours each day in taking material from one engine or car to put onto another soon amounts to a far larger sum than would be the interest at six per cent upon twice the amount of stock generally carried.

No one can estimate the actual amount of money that is lost by reason of not having adequate supply of material. We know of course, when it is necessary to take a cylinder head from one engine to put on another that it costs nearly twice as much to get the two engines out as it would to have repaired the first one, but in a case like taking an angle cock off one car to put on another the case is different, for I have noticed occasions of this kind where the cock had rusted on pipe so that when the wrench was applied to it, the result would be to either strip the threads or break the pipe, and thus repair work which will cost four or five dollars is sometimes created simply by not having a cheap article at the start, for had the rusty pipe been left on the original car it would probably have continued in service for months.

Another feature still harder to estimate in this connection is the tendency that shortage of material encourages shop men to loaf. The first effect is that they are discouraged at the outset in any desire they may have to make a good showing in the matter of output of work from their labor, by the fact that the company itself apparently does not assist him sufficiently by providing every possible means of pushing his work; this is the really competent and honest workman who wants to give the company honest return for his wages; unfortunately also there are numbered in the ranks of workmen a considerable per cent of men who are not looking for a chance to get an honest day's work, but are looking rather for a good excuse to draw pay with the minimum amount of labor. For the latter class "looking for material" is a quick and easy excuse he can always hand out to his foreman if the latter catches him away from his work. Primarily he may have started out to look for something, but en route he possibly meets two or three friends who started out on same ostensible errands, and they spent a pleasant half hour or two talking at so much per hour.

To my mind the whole proposition could be controlled at the start simply by close consideration of the human element of the ground floor organization. Instead of trying to operate by long-range typewritten and telegraphic instructions, let the management get down on the ground floor of actual conditions, make a study of each individual detail, and work out the method to get the best results at the least cost, keep every man busy on the work he is assigned to, give him every assistance necessary to turn out the most work of his particular kind in the shop hours, push the material right up under him for the next job so that he doesn't have to wait for anything, but on the contrary has to hurry up with the job he is on to keep the man with the material from covering him up.

I think the local store house should have sole charge of the material from the moment the demand arises until it is delivered at the actual place where it is to be applied to engine or car; in other words, instead of having high-salaried foremen waste time in writing requisitions for material and high-priced mechanics waste time going to the store house for it, have each shop patrolled by cheap messenger boys and simply let the foreman or mechanic tell the boy what he wants, let the boy deliver it and make the requisition and have the foreman sign it when material is delivered. Or, better still, in the event that the messenger boy was not always at hand, each shop could be connected by electric bells with the store house, by which means the boys could be quickly summoned.

As far as possible facilities should be provided for unloading heavy material at points near where it is to be used, and tracks provided by which material can be taken to machines or other places where needed, with minimum amount of labor.

Locomotive Shops at Trenton

Pennsylvania Railroad

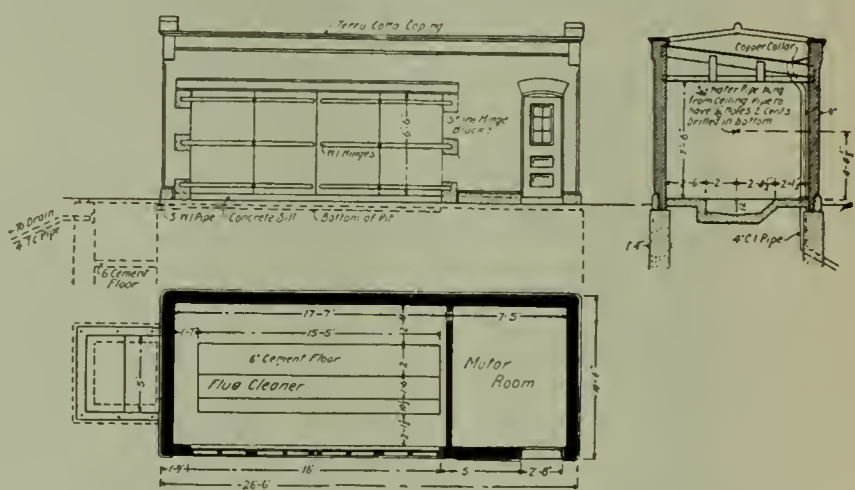
(*Second Installment.*)

IN the previous article, the layout and construction of the shops at Trenton were considered, together with the various features of interest which entered into the design and arrangement of buildings. The machine tool equipment of the different departments and the distribution and arrangement of machines in the various buildings will be next taken up.

The side bays of the locomotive shop are devoted to heavy and light machine tools, and over the light tool bay is a gallery which contains the tools in air brake work, tool making, etc. Fig. 1 shows the arrangement of the light machine tools in the west end of the south bay of the machine shop. The lathes are grouped and driven by a 25 H. P. motor. The method used in driving the other machinery is shown by the illustrations. Fig. 2 shows the light tools in the east end of the south bay of the machine shop, where the grinders and buffing wheels are located, while nearer the east wall is the pipe shop with work benches and pipe-bending machine.

The brass and air brake shop is located in west end of the gallery over the light machine bay, as shown in Fig. 3. The machine tool equipment consists of 5 lathes, 3 turret lathes, 1 boring machine, 2 drill presses, 1 milling machine and 1 shaper, all group motor driven. Air brake testing racks and work benches are also included. The tool making section is located about in the center of the gallery, as shown in Fig. 3, and has a complete assignment of machine tools, all motor driven. The east end of the gallery is arranged as a tin shop, with the usual complement of cutters, formers, shears, work benches, etc.

In the north bay of the machine shop are located the heavy machine tools. Fig. 4 shows the arrangement of machines and motors in the west end of the shop. The wheel press and wheel lathes are located adjacent to service track for handling wheels to and from the shop.

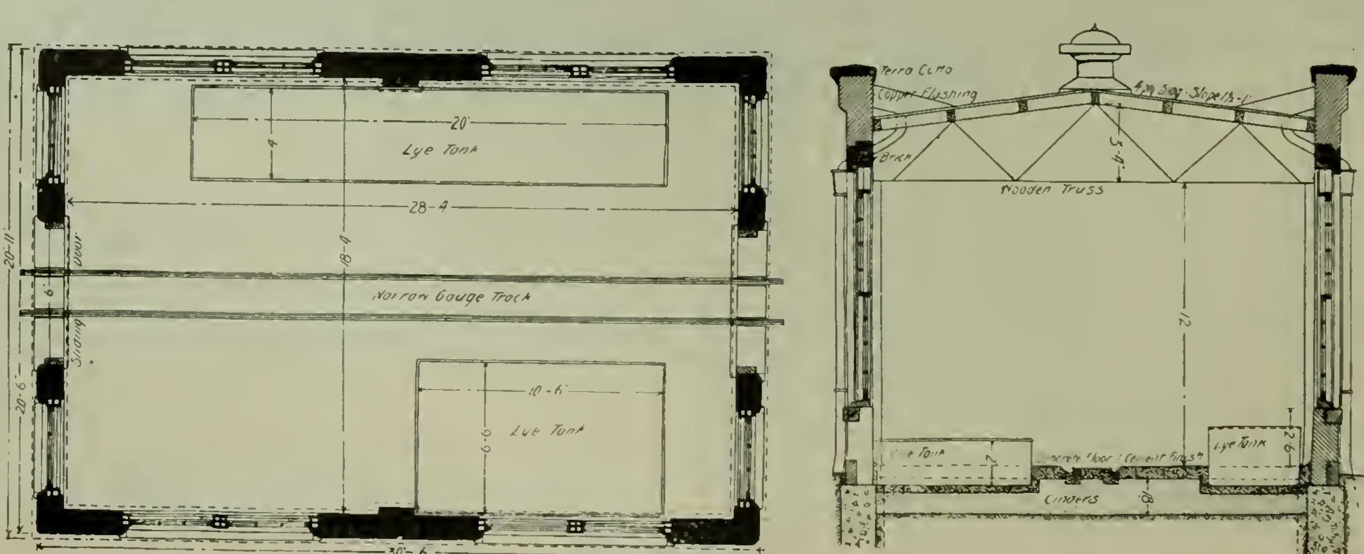


PLAN, SIDE AND END ELEVATIONS OF FLUE CLEANER HOUSE—LOCOMOTIVE SHOPS AT TRENTON, P. R. R.

The machines in this section are all driven by individual motors.

The arrangement of tools in the boiler shop is shown in Fig. 5. In the north bay are located the flue cutters, work benches, tool room, small punch, etc. The heavy tools are all placed in the south bay, as will be observed from Fig. 5. These tools have individual motor drives.

The blacksmith shop has been completely equipped



PLAN AND CROSS SECTION OF LYE HOUSE—LOCOMOTIVE SHOPS AT TRENTON, P. R. R.

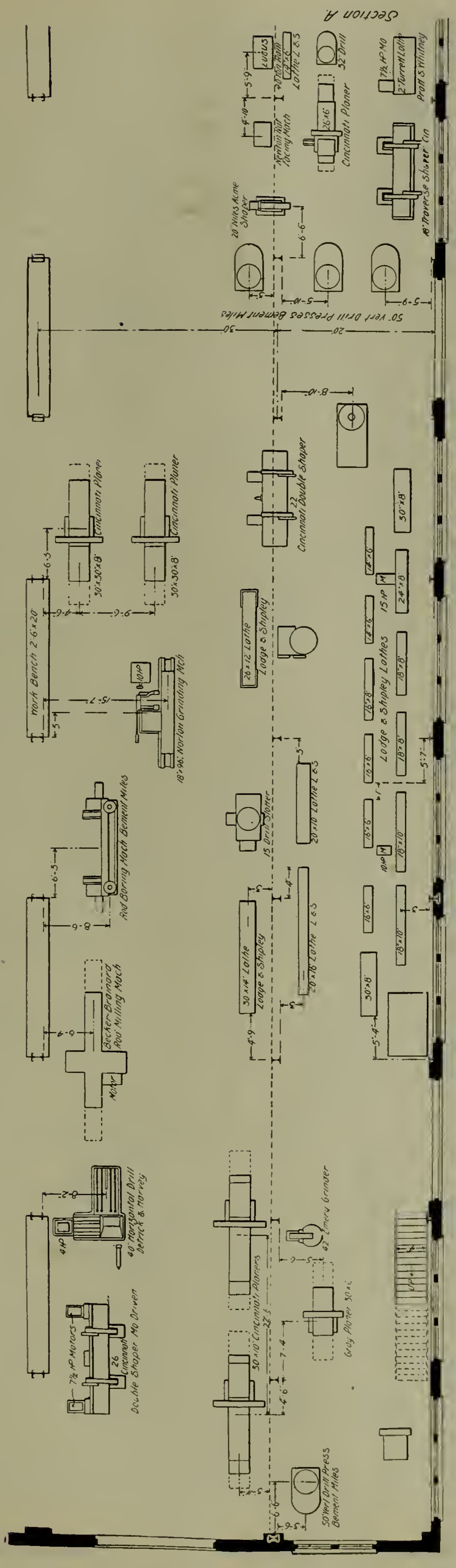


FIG 1.—PLAN OF WEST END OF SOUTH BAY OF MACHINE SHOP, SHOWING ARRANGEMENT OF LIGHT MACHINE TOOLS—LOCOMOTIVE SHOPS AT TRENTON, P. R. R.

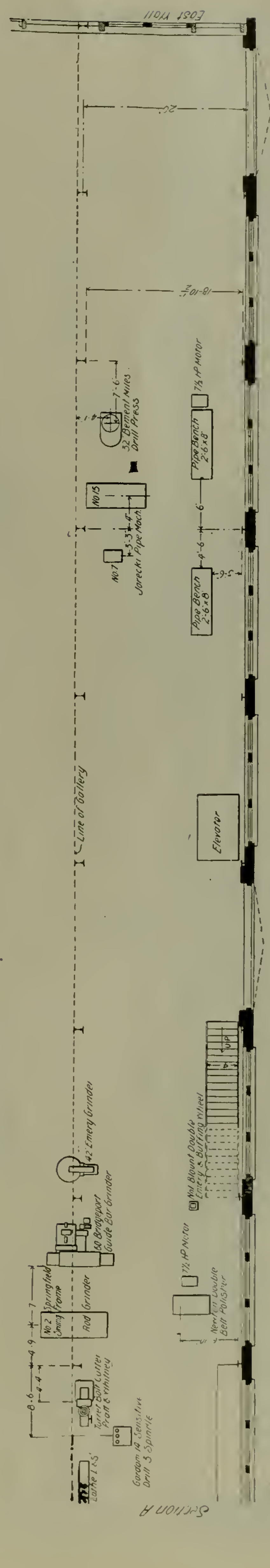
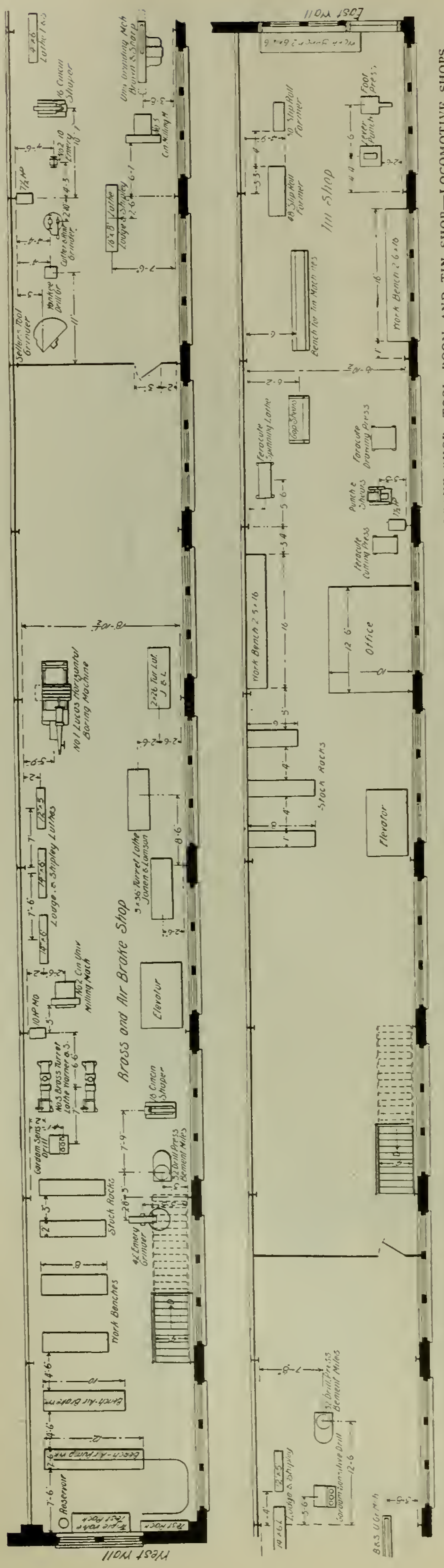


FIG 2.—PLAN OF EAST END OF SOUTH BAY OF MACHINE SHOP, SHOWING ARRANGEMENT OF LIGHT MACHINE TOOLS—LOCOMOTIVE SHOPS AT TRENTON, P. R. R.



AN OF BOTH EAST AND WEST ENDS OF GALLERY OVER MACHINE SHOP, SHOWING ARRANGEMENT OF TOOLS IN AIR BRAKE SHOP, TOOL ROOM AND TIN SHOP—LOCOMOTIVE SHOPS AT TRENTON, P. R. R.

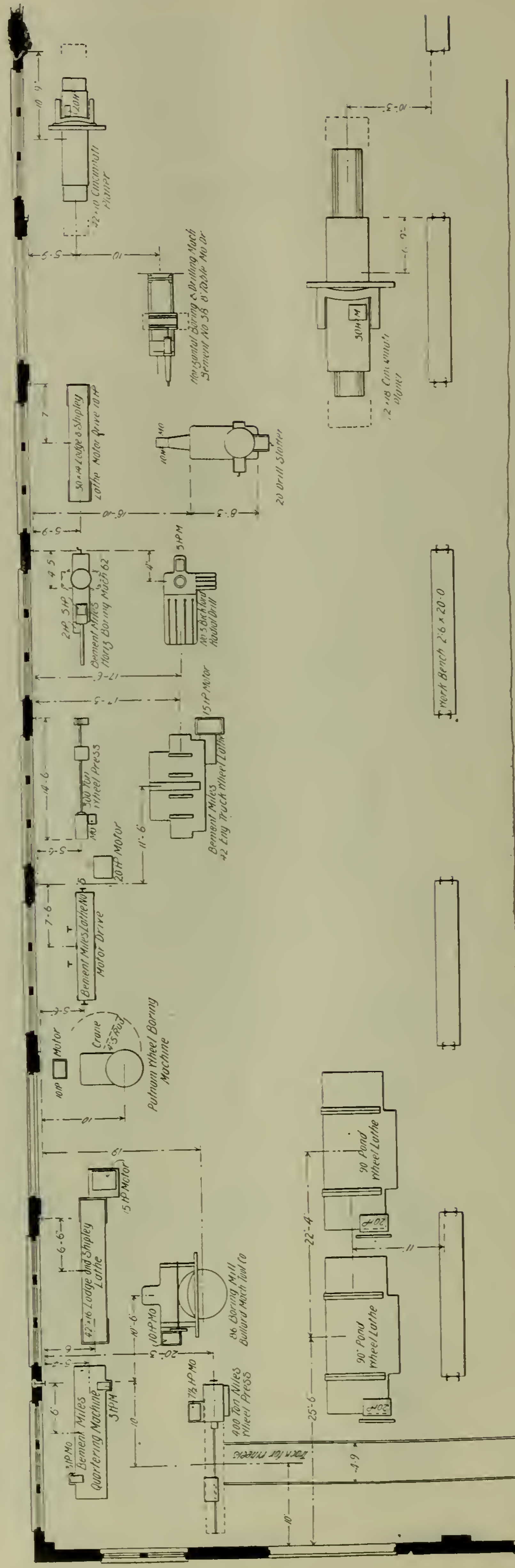


FIG. 4.—PLAN OF NORTH BAY OF MACHINE SHOP, SHOWING ARRANGEMENT OF HEAVY MACHINE TOOLS—LOCOMOTIVE SHOPS AT TRENTON, P. R. R.

with appliances for doing all classes of work rapidly. Fig. 6 shows the layout of equipment. The forges are arranged at an angle to the shop, with two anvils in connection with each forge, which are of the double type. The steam hammers are located adjacent to the anvils. The bolt headers, shears, etc., are located at the west end of the shop and are driven by a 15 H. P, motor. The oil and coal furnaces are grouped on the north side of the shop in connection with a 5,000-pound steam hammer served by a swinging jib crane. Future extension has been provided for, as shown in the illustration.

The arrangement of tools in the wood-working shop is shown in Fig. 7. The planer, cut-off saw, tenoning machine, etc., are located along the north wall of the shop adjacent to the service track for convenience in handling material. These tools have individual motor drives. On the south side of the shop the band saws, mortising machines, etc., are located and equipped with individual motor drives.

A detailed list of the machine tools assigned each shop, with the method of driving and size of motors and the equipment of the powerhouse are given as follows:

POWER HOUSE.

Four Sterling boilers—400 h. p. each.
One feed water heater.
One fuel economizer.
Two 16x8x12 inch feed pumps.
Two 18x12x12 inch vacuum pumps.
Two 18x10x12 inch Worthington fire pumps.
One De Laval steam turbine pump.
One 7½x3x10 inch steam duplex pump.
One 500 K. W. Westinghouse turbo-generator.
One 200 K. W. Westinghouse synchronous motor set.
One 200 K. W. direct current generator driven by tandem comp'd engine (not yet installed).
Two 50 K. W. exciters. Turbine driven.
One 2,000 sq. ft. surface condenser for Westinghouse turbine.
Two 125 light Brush arc machines driven by D. C. motors.
One General Electric. T. A. voltage regulator on switch board.

HEAVY TOOLS—MACHINE SHOP.

Two 90 inch driving wheel lathes—Each with 20 h. p. d. c. motors.
One 90 inch driving wheel lathe—40 h. p. d. c. motor.
One 400 ton driving wheel press—7½ h. p. motor.
One 90 inch driving wheel quartering machine—Two 3 h. p. motors.
One 80 inch boring mill—5 and 15 h. p. d. c. motors.
One 100 inch boring mill—5 and 15 h. p. d. c. motors.
One 42 inch lathe—15 h. p. d. c. motor.
One car wheel borer—10 h. p. motor.
Two double head axle lathes—20 h. p. d. c. motors each.
One 300 ton car wheel press—7½ h. p. motor.
One 42 inch tire turning lathe—15 h. p. d. c. motor.
One radial drill—5 h. p. motor.
One horizontal borer and miller—5 and 2 h. p. d. c. motors.

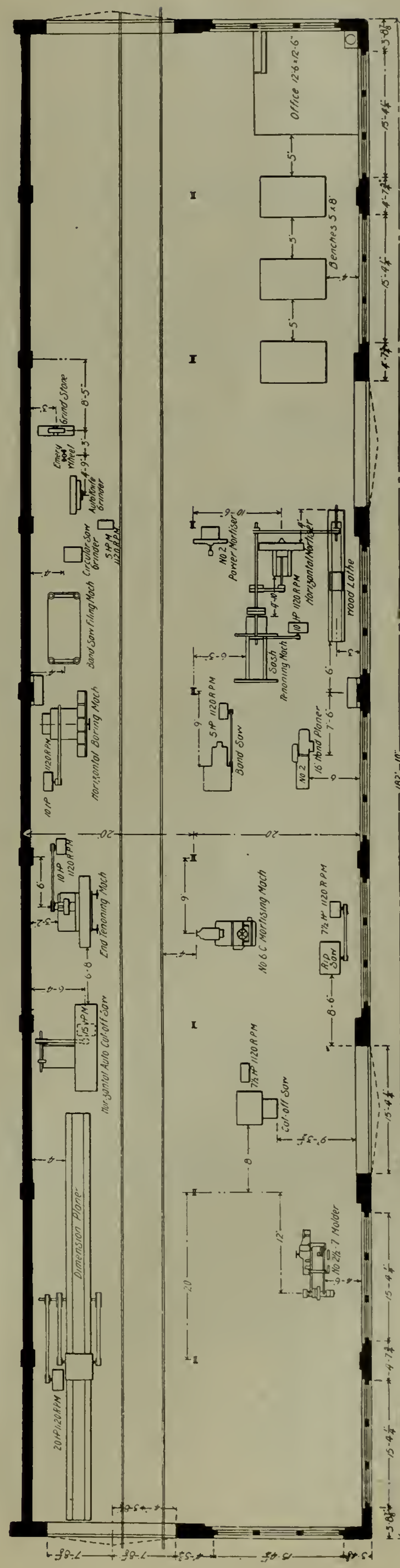


FIG. 7—PLAN OF WOOD WORKING SHOP, SHOWING ARRANGEMENT OF WOOD WORKING TOOLS—LOCOMOTIVE SHOPS AT TRENTON, P. R. R.

One 30 inch lathe—10 h. p. d. c. motor.
One 20 inch slotter—10 h. p. motor.
One 22 inch slotter—10 h. p. motor.
One 72 inch planer—30 h. p. motor.
Two 42 inch planer—20 h. p. motors each.
One 40 inch horizontal borer—3½ h. p. motor.
One 26 inch double head shaper—7½ h. p. motor.
One cut-off cold saw—5 h. p. motor.
One 26 inch double head shaper—Two 7½ h. p. motors.
One 40 inch horizontal borer and miller—4 h. p. motor.
One 32 inch slab miller—20 h. p. motor.
One double head side rod borer—Two 5 h. p. motors.
One 18 by 96 inch gap piston rod grinder—10 h. p. motor.

One turret lathe.
Two 42 inch boring mills.
One 22 inch double head shaper.
One 18 inch double head shaper.
One 15 inch slotter.
One 42 inch emery grinder.

10 HORSE POWER MOTOR.

One 24 inch turret lathe.
One vertical miller.
One 30 inch planer.
One horizontal miller.

7½ HORSE POWER MOTOR.

One 42 inch emery grinder.
One 10 inch pipe threading machine.
One 3 inch pipe threading machine.

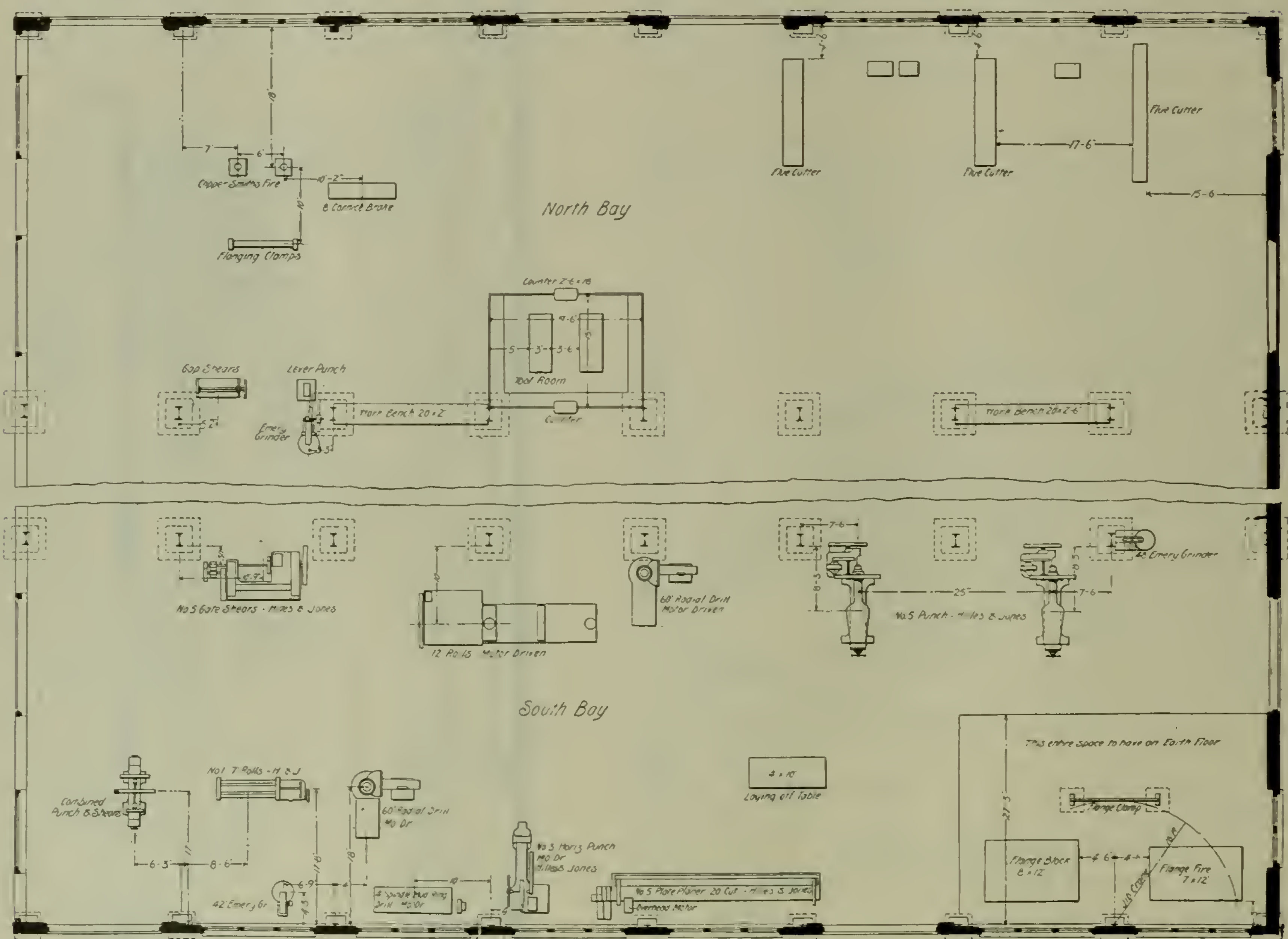


FIG. 5.—PLAN OF BOILER SHOP, SHOWING ARRANGEMENT OF TOOLS AND APPLIANCES—LOCOMOTIVE SHOPS AT TRENTON, P. R. R.

Two 30 inch planers—10 h. p. motors each.
Two 6,000 lbs. electric elevators.

MACHINE SHOP—GROUP DRIVEN TOOLS.

25 HORSE POWER MOTOR.

Five 18 inch lathes.
One 24 inch lathe.
Two 16 inch lathes.
Three 14 inch lathes.
Three 30 inch lathes.
One 24 inch lathe.
One 16 inch lathe.
One 12 inch lathe.
One turret-head bolt cutter.
One 2-spindle bolt cutter.

7½ HORSE POWER MOTOR.

Three turret lathes.
Four 50 inch drill presses.
Two 32 inch drill presses.
One 26 inch planer.
One 14 inch lathe.

MACHINE SHOP—GROUP DRIVEN TOOLS.

7½ HORSE POWER MOTOR.

One double emery wheel.
One double belt polisher.

One double disc grinder.
One 42 inch emery grinder.
One 60 inch guide bar grinder.
One swing frame grinder.
One nut facing machine.
One 24 inch turret lathe.
One 20 inch pillar shaper.

TOOLS IN WOOD WORKING SHOP.

One dimension planer—20 h. p. motor.
One 40 inch cut-off saw—15 h. p. motor.
One end tenoner—10 h. p. motor.
One three-spindle horizontal borer—10 h. p. motor.
One horizontal chisel mortiser—10 h. p. motor.
One 14 inch cut-off saw—7½ h. p. motor.

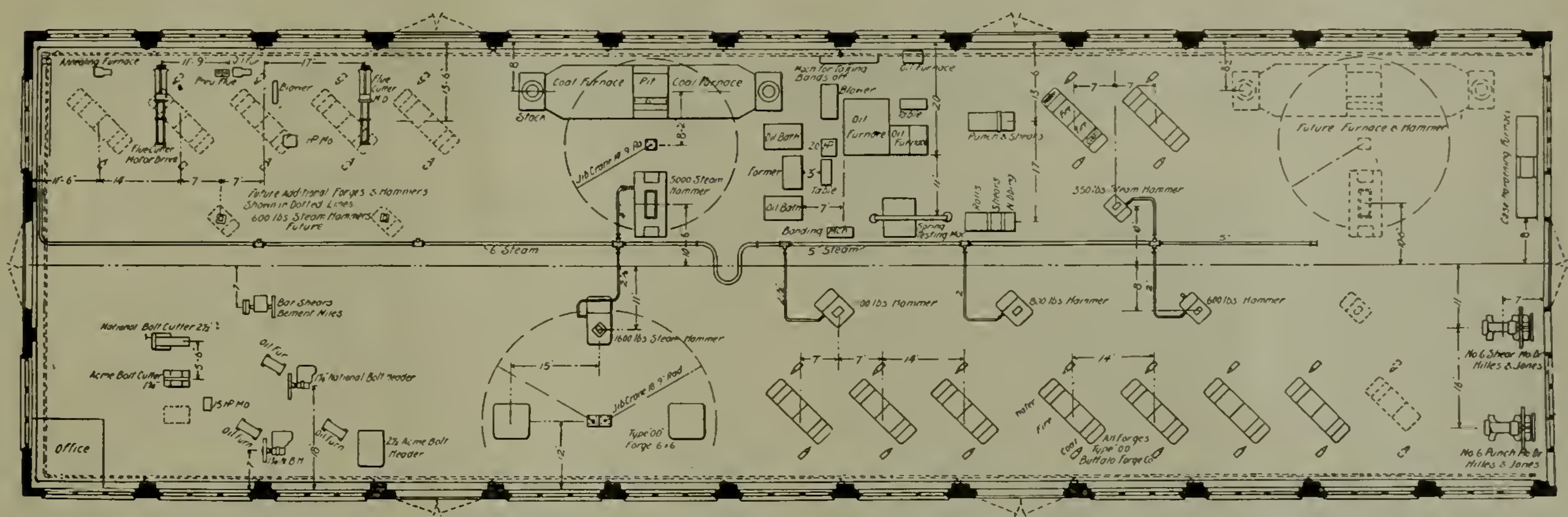


FIG. 6.—PLAN OF BLACKSMITH SHOP, SHOWING LOCATION OF FORGES, ANVILS, CRANES, STEAM HAMMERS AND TOOLS—LOCOMOTIVE SHOPS AT TRENTON, P. R. R.

One 50 ton power press.

GROUP DRIVEN TOOLS IN GALLERY—TIN AND COPPER SHOP.

7½ HORSE POWER MOTOR.

One three-spindle sensitive drill.
One 20 inch tool grinder.
One drawing press.
One power press.
One combined punch and shear.
One spinning lathe.
One power gap shear.

GROUP DRIVEN TOOLS IN GALLERY—TOOL REPAIR ROOM.

7½ HORSE POWER MOTOR.

One wet tool grinder.
One Universal tool grinder.
Two drill grinders.
Two universal grinders.
One magnetic chuck surface grinder.
One 10 inch double emery wheel.
One 24 inch lathe.
One 16 inch lathe.
One 12 inch lathe.
Two universal millers.
One 12 inch slotter.
One 16 inch shaper.
One 32 inch drill.
One power hack saw.

GROUP DRIVEN TOOLS IN GALLERY—AIR BRAKE WORK.

One 42 inch emery grinder.
One 32 inch drill press.
One horizontal borer.
One 14 inch lathe.
One 12 inch lathe.
One universal miller.
Two brass turret lathes.
One three-spindle sensitive drill.

One moulding machine—7½ h. p. motor.
One rip-saw—7½ h. p. motor.
One 38 inch band saw—5 h. p. motor.
One planer and jointer—5 h. p. motor.

GROUP DRIVEN WOOD WORKING TOOLS.

10 HORSE POWER MOTOR.

One vertical chisel mortiser and borer.
One sash tenoner.
One 20 inch wood turning lathe.
One emery grinder.

5 HORSE POWER MOTOR.

One band saw filing machine.
One 48 inch saw grinder.
One 30 inch cutter grinder.
One 30 inch grindstone.

OFFICE BUILDING.

One 6,000 lbs. electric elevator.

TOOLS IN BOILER AND TANK SHOP.

One 12 foot boiler plate rolls—30 and 7½ h. p. motors.
One 20 foot plate planer—15 h. p. motor.
One punch with 18 inch throat—15 h. p. motor
One combined punch and shear—10 h. p. motors each.
One combined punch and shear—7½ h. p. motor each.
One 60 inch radial drill—5 h. p. motor.
One 8 by 12 foot flange block.
One flange clamp.

TOOLS IN SMITH SHOP GROUP DRIVEN.

15 HORSE POWER MOTOR.

Two 1½ inch bolt headers.
One 2½ inch bolt headers.
Two 1½ inch double head bolt cutters.
One 2½ inch bolt cutter.
One 2 inch bar shear.
Three oil furnaces.

One nibbing machine.
One spring punch and shear.
One spring stripping machine.
One spring cambering machine.
One hydraulic spring binding machine.
One $5\frac{1}{2}x1\frac{3}{4}x5$ inch duplex hydraulic pump.
Two large furnaces for coal.
One annealing and case hardening furnace.
Thirty 42 inch forges.
Two 6 by 6 foot forges.
One grindstone.
One 5,000 lb. steam hammer.
One 1,600 lb. steam hammer.
One 1,100 lb. steam hammer.
One 800 lb. steam hammer.
Two pressure blowers.

International Railway General Foremen's Association

Third Annual Convention

THE third annual convention of the International Railway General Foremen's Association was held in Chicago at the Lexington hotel, May 14th, 15th, 16th, and 17th. The meetings were presided over by the president, Mr. C. A. Swan, Jr., of the Hicks Locomotive Company. After formally opening the first session, Rev. Dondthaler led in prayer, which was followed by a short address from Mr. W. E. Symons, of the Pioneer Cast Steel Truck Company, of Chicago. Following this address, Mr. E. S. Marshall, of the American Car & Foundry Co., on behalf of the Supply Men's Association, made a few remarks. Mr. D. E. Barton, chairman of the executive committee, then gave a short talk, which was followed by the address of the president, Mr. Swan.

The report of the secretary showed the present membership to be 290, a gain of 45 over the preceding year, and the report of the treasurer indicated that the finances of the association were in good condition.

SHOP BETTERMENT.

The first subject of the regular proceedings to be presented was the question of "'Shop Betterment," and as the regular committee appointed to handle this topic had not made a report, the report of the emergency committee on the subject was presented. The broad question of "Shop Betterment" was divided up into several sections, each one of which was considered separately. They are as follows: "First, "How can the output of a shop be increased by the reconstruction of old machine tools?" Under this sub-head the report called attention to the fact that, as a rule, the machine tools are not sufficiently heavy to give the maximum output of the new self-hardening steels, and that some designs of old machine tools with a few necessary changes would produce nearly as good results as the modern machines. Second, "Maintenance and proper distribution of small tools." In considering this question, the committee suggested that in the ordinary sized shop, all small tools which are the natural equipment of the machine, be kept in the tool room and checked out from there, and that the efficiency of tool room be increased until all tools are in proper shape for use at any time. Third, "The care of air tools." The necessity of proper inspection and care of pneumatic tools was emphasized and seven days recommended as the longest period for continual service of tools without regular inspection and repairs. Fourth, "Special devices, jigs, templates and the use of same." Under this sub-head the committee recommended that the use of jigs and templates be extended as much as possible, as they are so much more reliable than calipers or scales when duplication of parts is required.

In addition to the four sub-heads under shop betterment, the committee also considered two other phases of the question, the first under the title, "The necessity of having one main tool-making plant for large railway systems and distribution of tools to outlying points." The committee recommended that "it is proper, economical and better practice to standardize, manufacture and distribute all shop tools for railway systems at one central point." The question of proper toilet facilities for employes was

MR. C A. SWAN, JR., PRESIDENT OF THE INTERNATIONAL RAILWAY GENERAL FOREMEN'S ASSOCIATION

also considered and the necessity of providing good lockers, wash basins, etc., was brought out and emphasized. After an interesting discussion, the recommendations of the committee were adopted in practically the form submitted to the convention.

PIECEWORK.

The next subject considered was an individual paper, entitled, "Piecework Practically Applied to Locomotive and Car Repairs, by Mr. W. S. Cozad, Shop Specialist, Erie Railroad. The paper was read by Mr. Hunt of the Erie, in the absence of the author. The paper described in detail the method of handling piecework on the Erie Railroad, and was illustrated with a number of reproductions showing the piecework forms, index files, etc. The subject was treated in very broad way by Mr. Cozad. and as the facts given represented the experience of a piecework specialist, who has been very successful in applying the system to shop practice, the paper was followed with interest by all the members present. The discussion of the subject brought out many different expressions in regard to the merits of the piecework system, and, while it may be said that the general opinion was favorable, it was felt that the question should be gone into more thoroughly before definite action was taken, so the subject was laid over until the next meeting.

THE INDIVIDUAL EFFORT SYSTEM.

The individual effort system was the next subject taken up, and was introduced by a paper prepared by Mr. D. E. Barton of the Santa Fe. As the individual effort system has been brought up to a high degree of efficiency on the Santa Fe Railroad, the paper was very interesting and instructive, as it brought out the practical advantages of the system. Facts and not fancies were presented. Following the reading of the paper. Mr. Harrington Emerson, Standardizing Engineer of the American Locomotive Company, gave an instructive talk on the individual effort system, and pointed out his reasons for preferring it to the piecework system. His remarks showed clearly the advantages of the system, both to the men and the company, as a man is rewarded according to the effort he is willing to put out and the company is able to obtain an increased amount of work from each shop. The success of the Santa Fe in handling the individual effort system was referred to as showing the possibilities of the system, which as yet is in the early stages of its growth and development. Mr. Emerson's remarks brought out a number of questions from members which showed the interest manifested in the subject. Mr. Clyde Hastings, who succeeds Mr. Emerson on the Santa Fe, and was Mr. Emerson's assistant with that company, explained how the efficiency of the workmen was determined. On the day following, the subject was discussed by the convention, and in view of the widespread interest manifested and the comparatively little knowledge of the system, it was voted to carry over the subject until the next meeting.

THE RELATION OF THE STORE DEPARTMENT TO THE SHOPS.

The next subject considered was "The Relation of the Store Department to the Shops." The report of the committee appointed to investigate the subject was read by the chairman, Mr. G. W. Keller of the Norfolk & Western. It was clearly brought out that a closer relationship should exist between the shop organization and the storekeeper in order to obtain the best results. The shop foreman should keep the storekeeper posted as far as possible on what class of material will be needed in the future, so that it can be ordered and on hand, when the call is made for it. The subject brought out a general discussion which showed that all appreciated the importance of the shop foreman and storekeeper working in harmony. The weekly meeting of shop foremen and storekeeper was recommended, so that the two departments could work together to better advantage.

ROUNDHOUSE VENTILATION.

The next report, on "Roundhouse Ventilation," was read by Mr. J. W. Crysler of the Chicago & Northwestern Railway. The necessity of the proper smoke-jacks and ventilators was emphasized in order to keep the roundhouse free of smoke and steam. Higher roundhouse roofs and arrangements for blowing off steam and water from locomotives were also mentioned as being desirable points to consider in roundhouse construction. Appliances for keeping down the amount of steam which escapes when washing out and blowing off, were recommended, as by this means the fog, etc., will be materially reduced, and consequently the roundhouse will be a much better place to work in. The discussion brought out the fact that even in modern roundhouses more or less trouble is exprienced with fog, due to poor ventilation, which emphasizes the necessity of paying more attention to the subject when designing roundhouses.

OFFICERS.

The ballot for the election of officers resulted as follows: President, E. F. Fay, Union Pacific; First Vice-President, L. R. Laizure, Erie; Second Vice-President, J. J. Houlihan, Wabash; Fourth Vice-President, G. W. Keller, Norfolk & Western; Secretary, E. C. Cook; Treasurer, Fred Hunt, Erie; Chairman of Executive Committee, C. H. Voges, Big Four.

Railway Motor Cars

IN an effort to ascertain the usefulness of railway motor cars to be operated in connection with the regular steam service, the Pennsylvania Railroad last fall commissioned a committee of three officials to go to Europe and see what had been done there along this line. The committee was composed of the Messrs. C. M Schaeffer, Superintendent of Passenger Transportation; R. N. Durborow, Superintendent of Motive Power, and A E. Buchanan, Chief Clerk to the General Passenger Agent. Their report, just submitted to the management, says:

"Rail motors, costing from $8,000 to $10,000 each, have been introduced to a greater or less extent by all principal railways of England; also by several on the Continent.

"In some cases these rail motors have entirely displaced the steam passenger service on branch lines, but are generally being used for supplementary service in connection with other trains.

"It appears that where rail motor service has been established travel has increased to a considerable extent. Within itself, the service is not remunerative, but the expense would seem to be warranted when its value as a feeder in creating additional long-distance travel from the main line steam trains is considered.

"Operating officials of roads on which this character of service has been established were rather enthusiastic as to its possibilities. The mechanical officials, however, were not favorable to it. It was admitted that there is a slight saving in fuel, but it is claimed that this is more than offset by the increased cost of maintenance and the loss of service while undergoing repairs.

"With the benefit of this experience the committee is of opinion that the installation of self-contained motor cars for passenger service on certain branch lines largely depends upon the gradients, the possibilities for increased travel and the possible saving from a reduction in the train crews. A small tank locomotive and car, equipped for operation in either direction without turning, commends itself as the most elastic adaptation of the rail motor which came under our observation and appears to be in the line of future development abroad."

Pacific Type Locomotive

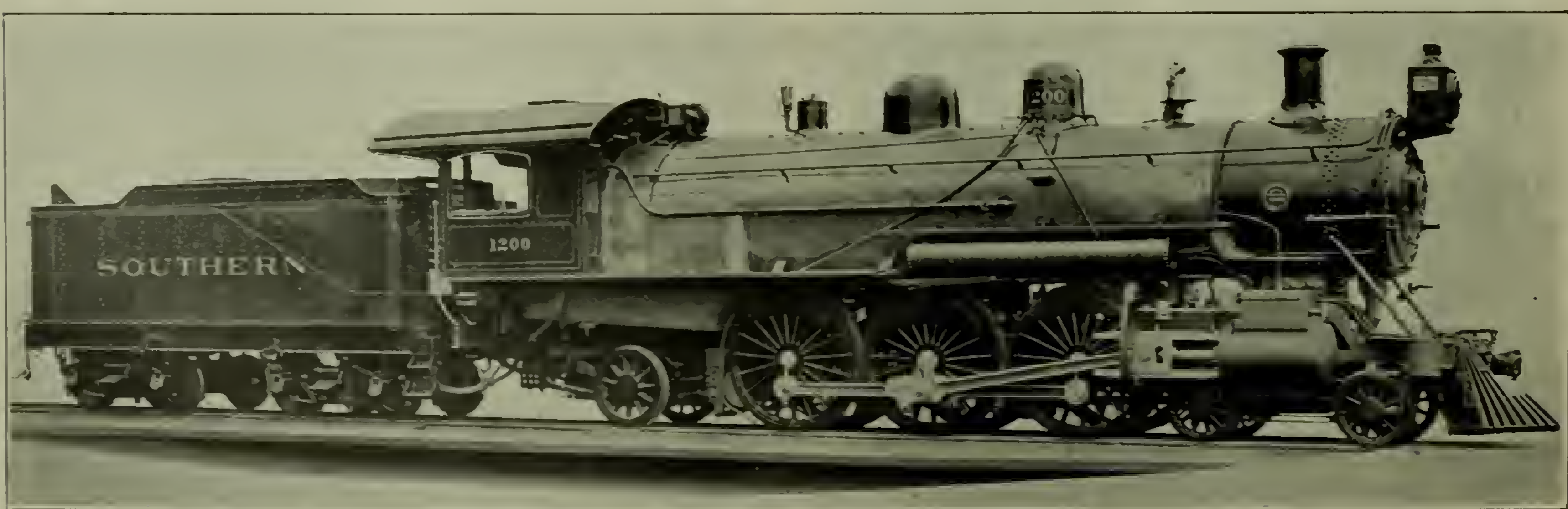
Southern Railway

THE Baldwin Locomotive Works are exhibiting at the Jamestown Exposition, a large Pacific type locomotive recently built for the Southern Railway. This engine represents a class which since 1903 has been in heavy express passenger service on this road.

The cylinders are single-expansion, equipped with slide valves which are driven by the Stephenson link motion. The rockshafts are placed in front of the leading pair of driving wheels, and are connected to the link blocks by transmission bars which span the first driving axle. The eccentrics are placed on the second, which is also the main axle.

The frames are of cast steel, with double front rails and separate rear sections. The trailing truck is of the Rushton type with inside journals, and is equalized with the driving wheels. The fulcrum of the connecting equalizer is placed under the frame splice. The frame is supported at the rear end by an inverted leaf spring.

The boiler has a straight top, with wide firebox. The mud ring slopes toward the front, and is supported on expansion plates at each end. The throat and back head are also sloping. The throat sheet completely encircles the barrel, which is built up of four rings. The dome is placed on the third ring, which has a welded seam on the top centre line with a heavy liner inside. Sextuple riveted butt seams at each end, are used on the other rings. The boiler shell is strengthened by inside liners at the points where it is riveted to the guide bearer and waist sheet T-irons.



PACIFIC TYPE LOCOMOTIVE, EXHIBITED AT JAMESTOWN EXPOSITION—SOUTHERN RY.

The tender frame is built of steel channels. The tank has a water bottom with sloping fuel space, and carries 7500 gallons of water and 12½ tons of coal.

The principal dimensions and specifications are as follows:

Type of engine	Pacific
Service	Passenger
Fuel	Bituminous Coal
Tractive force	31680 lbs.
Gauge	4 ft. 8½ ins.
Cylinders	22 in. x 28 in.
Valve Gear, type	Stevenson link
Valves, kind	Balanced Slide
RATIOS.	
Weight on drivers ÷ tractive force	4.3
Tractive force x diameter drivers ÷ heating surface	592.
Total heating surface ÷ firebox heating surface	19.8
Total heating surface ÷ grate area	71.5
Weight on drivers ÷ total heating surface	35.7
Volume of cylinders	12.3
Total heating surface ÷ volume of cylinders	31.2
Grate area ÷ volume of cylinders	4.4
BOILER.	
Type	Straight
Working pressure	200 lbs.
Diameter first ring	70 in.
FIRE BOX.	
Length	108⅛ ins.
Width	72¼ ins.
Depth, front	76¼ ins.
Back	66¾ ins.
Thickness of sheets, sides	⅜ ins.
Back	⅜ ins.

TUBES.

Material	Iron
Wire Gauge	No. 11
Number	314
Diameter	2¼ ins.
Length	20 ft.

HEATING SURFACE.

Fire box	195 sq. ft.
Tubes	3683 sq. ft.
Total	3878 sq. ft.
Grate area	54.25 sq. ft.

DRIVING WHEELS.

Diameter, over tires	72½ ins.
Diameter, wheel centers	66 ins.
Journals, main, diameter and length	10 in. x 12 in.
Journals, others, diameter and length	9 in. x 12 in.

WHEEL BASE.

Driving	12 ft., 6 in.
Total engine	31 ft., 4½ in.
Total engine and tender	63 ft., 0½ in.

WEIGHT.

On driving wheels	138,460 lbs.
On engine truck	39,700 lbs.
On trailing truck	42,300 lbs.
Total engine	220,460 lbs.
Total engine and tender	358,000 lbs.

Portable Crank Pin Turning Machine

INASMUCH as the outside end of a locomotive crank pin, from which projects the gudgeon screw, never becomes altered in shape, it follows that if a machine of a suitable character be attached to the screw, and facing against the end just referred to, the surface of the crank pin, which through use has become altered in form can be easily restored to its original shape and quarter.

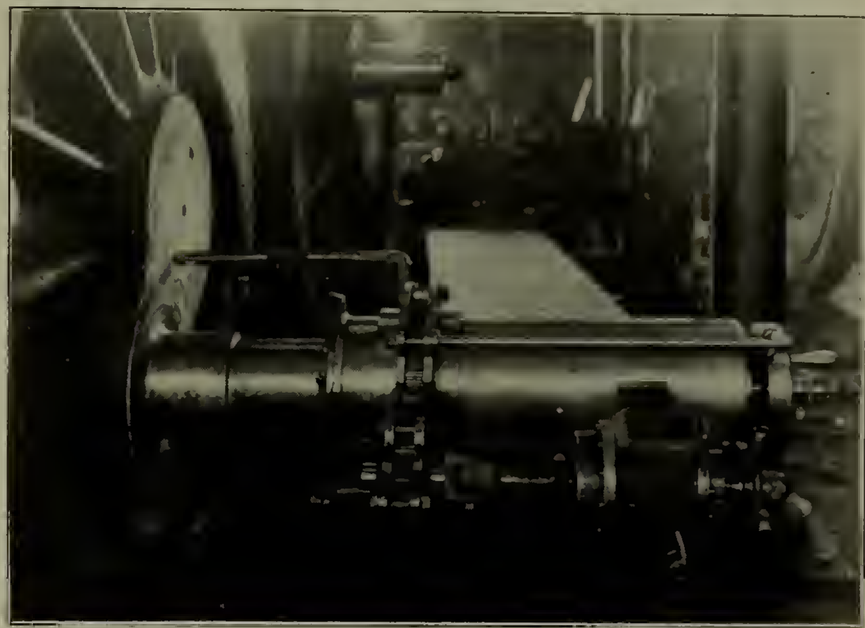
The accompanying illustration shows such a machine attached to the pin and ready for operation. The manner in which this machine performs the work is as follows:

After screwing the machine firmly to the end of the crank pin by means of the two handles, the latter are removed and the sliding sleeve is placed on the barrel. Attached to this sleeve are four lugs, containing the necessary tools for roughing, finishing, and filleting the crank pin. The tools are ⅝ in. round high speed steel. The gear wheel and casing are then slipped over the two feather keys, when by means of an air motor the sleeve is caused to revolve around the crank pin.

The forward or feeding motion of the sleeve is accomplished through mechanism contained in a hand wheel which feeding is either automatic in character, or the result of hand labor according as the gearing is engaged or disengaged. It is not necessary to stop the motor to perform this last action. Provision has been made for any lost motion accruing from ordinary wear and tear of the barrel and sleeve, by adjusting rings, which are screwed against taper split bushings on each.

The machine consists of four parts, no one of which is too heavy to be handled by even a boy. This crank pin turner can be adjusted to any pin having a threaded end by simply making a face plate to suit the pin, and the largest locomotive crank pin can be restored to its original shape in three hours. A great saving of time being thus effected, as compared with the practice generally in vogue of removing or filing the pin.

It can be used in any round house without removing the wheels from the engine, and is successfully operated

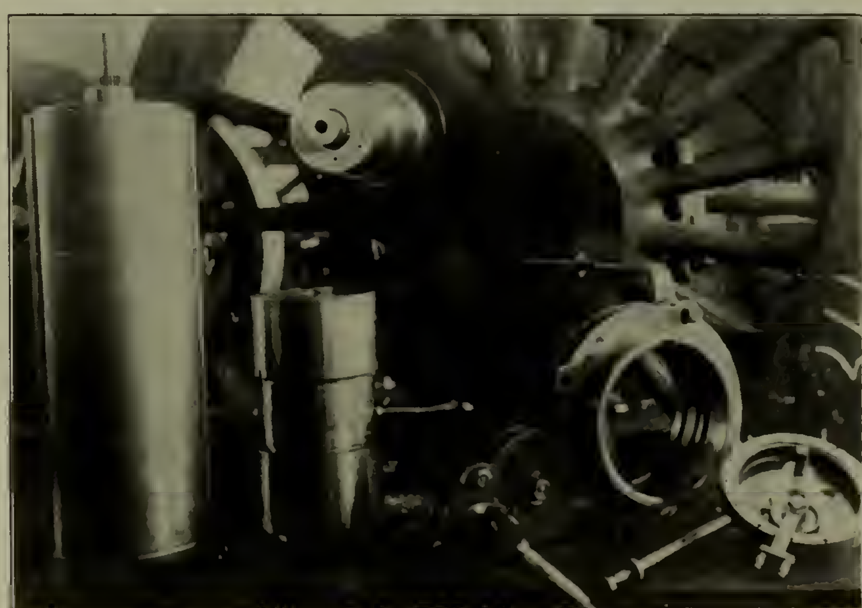


PORTABLE CRANK PIN TURNING MACHINE IN POSITION FOR BEGINNING CUT—GRAND TRUNK RY.

with 70 pounds air pressure through a "Little Giant" air motor.

As a result of several years' observation, it has been ascertained, that providing the main pins are maintained in a "true" condition, these in the front and back wheels require little or no attention. The number of rod breakages will materially be lessened, and the brasses will give a far greater mileage.

Several of these machines are in use by the Grand Trunk Railway Company, having displaced various



VARIOUS PARTS OF THE PORTABLE CRANK PIN TURNING MACHINE—GRAND TRUNK RY.

other makes. They were developed by Mr. M. H. Westbrook, machine shop foreman at Port Huron, Mich., to whom we are indebted for the illustrations presented.

A Practical Discussion of the Walschaert Valve Gear

THE Walschaert Valve gear has been introduced gradually into American locomotive practice during the last few years and its performance as compared with that of the Stevenson link is still the subject of investigation, as the relative merits are not yet fully established. The theoretical advantages of the gear are well established and have been thoroughly discussed but of the actual service given on the road and the practical value of the design in regard to hauling tonnage, break downs, repairs, lubrication, etc., little has been said, although these factors will determine whether this type of valve gear is to be continued as a feature of locomotive practice in this country.

The judgment of those who are directly concerned with the operation and repair of locomotive equipment is of practical value in determining the relative merits of designs and appliances and with this in view, the opinion of a number of prominent road foremen of engines relative to the Walschaert locomotive valve gear are given as indicating the practical advantages and disadvantages of the gear and the service obtained from it in actual service.

The first communication is as follows:—"The Stevenson valve gear is well known to all of us and needs no description. As long as the locomotives were of the American, or 8 wheel type on which all parts of the valve motion could be properly proportioned and was easily accessible for oil, inspection and repairs, we did not desire anything better. With that class of engines there was no difficulty in getting underneath to inspect them; set screws could be reached and tightened, as well as all nuts and bolts that were liable to get loose; oil holes cleaned out, packing examined in eccentric straps and on top of link blocks, every part of the valve gear could also easily be reached when oiling engine, and there was very little danger of any part being missed. With the heavy locomotives of the present day, with three and four pair of driving wheels placed together closely, our valve motion is not the simple affair it was with 8 wheel engines. Eccentric blades either have to be made very long and curved, or very short with curved transmission bar to transmit the motion to rocker arm, or use some other arrangement that increases the number of wearing parts which soon causes the valves to be out of square. On account of the larger diameter of eccentrics, they as well as the straps must be heavier and with a wider bearing surface to withstand the pressure necessary to move the heavy valves and link motion. As the eccentrics receive considerable up and down motion caused by uneven track, and side motion caused by side play between driving boxes and hubs, which movements are not to be communicated to the links, they are subjected to a twisting strain that without warning may cause them to heat, and a strap to break. The links and other parts are also made so heavy that failures are quite frequent from hangers or pins breaking. The eccentrics take up so much of the space between the driving boxes and that they are placed so close together that it is almost impossible to see if any of the nuts are holding the two halves of back-up eccentric together are loose until after the eccentric opens up, grips and breaks the straps, and we all know what a pleasant duty it is to pack a driving box cellar behind an eccentric. The valve gear cannot be thoroughly inspected unless engine is over a pit, and it takes something of an acrobat to oil those with large wheels. On account of giving this motion a thorough inspection, it does not receive the attention it formerly received.

The main advantage the Walschaert valve gear has over the Stevenson gear, is its accessibility; every part of it is in plain view of the engineer when inspecting or oiling the engine. This is not all however. There are no eccentrics or straps to heat, slip or break; no eccentric blades to slip or loose, no heavy links and transmission bars suspended from hangers which are liable to break. The valves if square and motion is properly put up when engine is put into service, remain so, and do not need the frequent adjustment that those having the Stephenson link motion so. While they cannot handle any heavier tonnage on a slow pull, they seem to handle their train easier when under headway. This, I think, is due to the construction of the valve gear, the valve receiving its motion from two points, one from the return crank, the other from the combination lever attached to the crosshead. The latter gives it the movement required by the lap and lead. If the valve had neither lap or lead the crank would give it all the motion required, both forward and backward. There being only one instead of two as would be required for the Stephenson motion; the crank is set at nearly all right angles to the main crank pin, where it is moving the fastest when it is opening the steam ports for the admission of steam, and should give a quicker port opening than the Stephenson gear, where the eccentric is moved ahead from this point the distance required to overcome the lap and lead of valve. The link is pivoted on solid trunnions attached to the guide yoke, which while allowing it to move freely, does not allow it to spring out of line, as is the case with the shifting link. While I do not believe that the Walschaert valve gear will enable a locomotive to haul any heavier trains, I believe it will enable her to take her train over the road easier, and in somewhat less time, and I consider its advantages are simplicity and solidity, accessibility for inspection, oiling and repairs; freedom from breakage of distortion, as there is nothing to get out of order if the motion is properly proportioned when placed on the engine; barring accidents, the motion should run from the time an engine comes out of the shop until she is returned for repairs, without any adjusting of the gear, unless, a new pin is required on account of excessive wear at some point. In regard to repairs, we have had a very few repairs to make, and they are caused by the connecting pins not being properly fitted by the builders, allowing the wear to come on the wrong part of pins and connections. This has been remedied, and I do not look for further trouble in that line. While we have not had any experience with the Walschaert valve gear on fast passenger engines, from our experience with heavy freight engines, I believe this gear is as well adapted for that service as for freight service, and I would like to see all large engines with this gear."

The opinion of another road foreman is expressed as follows: "What advantage has the Walschaert gear over the other engines with the Stephenson gear, and what difference is the cost of repair have you noticed? First, is accessibility to get at to oil, inspect and repair: Second, the absence of wear to the whole valve gear: Third, the constant lead: Fourth, the engineers and the round house folks side of it; on account of the convenience of the location, more accurate information can be had as to when the engine can be ready for service. as inspectors or engineers can look over on ash pit or outside tracks and note any defects, whereas with other gear we must wait until engine gets to a pit or take a chance on having to cancel an order that may have been O. K'd for the engine if she is given in before inspector has gone underneath.

In several months' service we had to make very little repairs to valve gear; in one instance valves were out and it was found eccentric rod was slightly bent. This was taken down and straightened and overcame the trouble. The absence of wear and difference in cost, on account of doing away with the heavy straps and cams on the eccentrics, various troubles are overcome, among which we may mention heating, causing breakage and serious and expensive delays. On some classes of engines it is not possible to see all the eccentric strap bolts, and I have known bad delays on account of strap bolt losing out or breaking. Again on large engines with Stephenson gear, the parts are so heavy that lost motion naturally accumulates very fast in the link gear owing to the connections being light in comparison to the weight of the motion and where there is much liability for dirt and ashes to get to oil holes, these parts wear unusually fast. This is not the case with the Walschaert gear, as there are few oil holes, and what there are, are provided with cavities for waste packing, also the pins and bushings are hardened and are of very liberal dimensions, so that the indications are now that the valve gear will wear as long as the engine will stay out for general overhauling, except such light repairs as can be made between trips. The valve rods being short, we have no trouble with the valve steam packing blowing; this can be appreciated by those having labored with defects of this kind. These troubles encountered in the way of lost motion and wear, reduce the efficiency of the engine considerably; that is equipped with the Stephenson gear is a drain on the coal pile, as engine cannot be worked to an economical advantage and will require more oil for the above reasons. The constant lead is an advantage of the Walschaert gear for it is possible to ascertain what is the best amount to give them at ordinary cut off, and to maintain it. With the Stephenson gear, the amount necessary to furnish desired cushion in full stroke, will increase to such an extent as to cause back pressure, when working in cut off, besides making the engine ride hard. To offset this, engine will be worked lower down on the quadrant than is economical otherwise. This also holds good where valves are not square and it is next to impossible to keep them square in cut off on heavy power, so therefore the engineer squares them with lever and wiredraws the steam account having to work such a light throttle. The Walschaert gear overcomes all of this. The lever can be worked at the most advantageous point to cut off and engine handles easily if reach rod and counter balance spring are properly looked after. The engineers like the Walschaert gear for this reason, and for their convenience to oil and inspect, and for absence of hot eccentrics and the frequent breakage. With regular engines there is not so much time lost by engines held for repairs. The engines are so much cleaner to work around and oil, while the eccentrics will not be run more than 30 miles on an average for an oiling the Walschaert gear will be run twice that distance if necessary. On the Stephenson gear, even if grease cups are used, the engineer will not feel confident that plugs are properly screwed down without trying them himself, and the same thing applies to inspection of keys and bolts which will require him to go under the engine. I have no figures at hand to show difference of maintenance of valve gear of the two types, and my information is based only on a few months' experience of the Walschaert gear, and may be somewhat biased on account of the nice performance they have given. Where Stevenson link motion engines that are new they also do good work with only a few failures, but when these engines were put on fast passenger trains, there were several failures from hot eccentrics, and a few on account of broken eccentrics, whereas with the Walschaert gear, this is eliminated. The fact that so many railroads in this country are ordering this gear on new engines, is fair proof of its efficiency, and I have no doubt but that it is the valve motion of the future."

Practical experience with the Walschaert gear as expressed by the road foreman quoted, shows that the performance of the gear in service is highly satisfactory in every respect as the Walschaert gear represents an investment in some cases of approximately $1,000 more than the Stevenson link motion, a relatively higher performance should be expected consistent with the extra cost, but practical experience with the gear, up to the present time, indicates that the points of superiority claimed, are fully justified by the results of service.

A Few Specialties of the Elkhart Shops

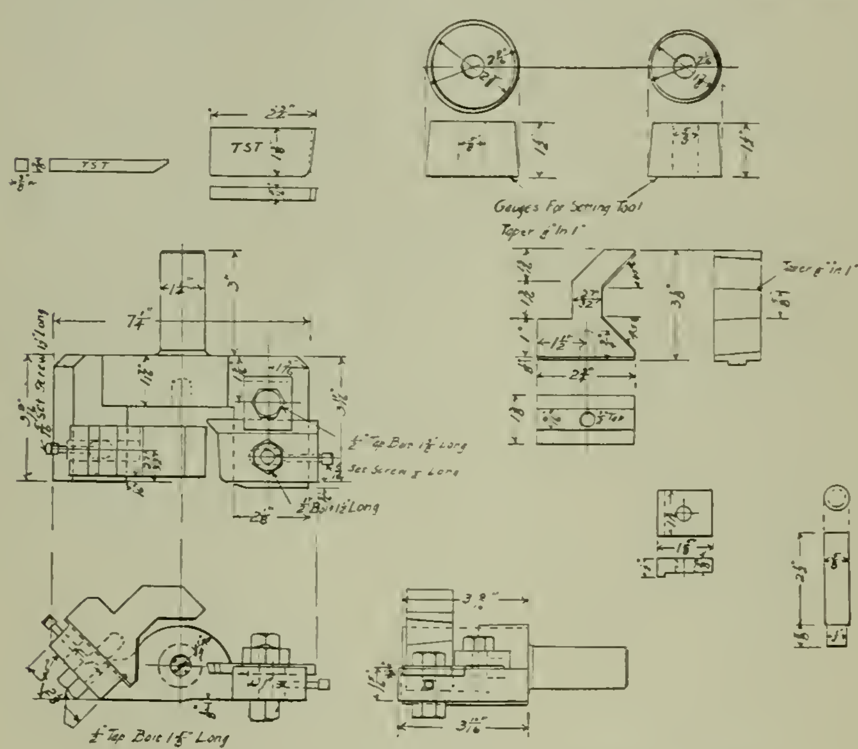
Lake Shore and Michigan Southern Ry.

(*First Installment*).

AMONG the characteristic features of a progressive shop, the development of specialities for increasing the output and improving the performance of old machines, is especially interesting as it indicates the resources and originality of the shop organizaton. The introduction of shop kinks and specialties also shows to what extent the output of a shop may be increased without the addition of modern appliances and machinery.

The average railroad shop has a large percentage of old machinery that will not turn out the amount of work required at the present time, but in a number of cases, the production of old machine tools has been increased by the use of jigs and specialties to a point which shows very clearly the value of such appliances as a factor in shop practice.

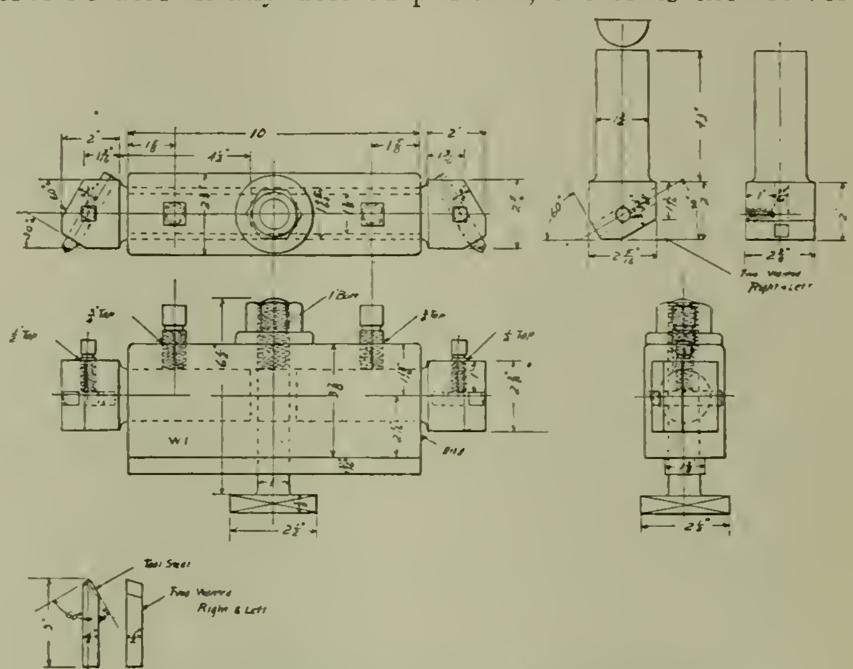
In this respect the Elkhart shops of the Lake Shore and Michigan Railway are noteworthy on account of the number of specialties in use, and the results accomplished by using them in connection with old machine tools. On page 353 of the RAILWAY MASTER MECHANIC 1904, several special tools in the Elkhart shops were described, but since then a number of specialties have been introduced which possess many features of interest. For turning up washout plugs a jig has been designed for use in a turret lathe, which is giving excellent results. The construction of this attachment is shown by the illustration and consists of a frame for holding the



ATTACHMENT FOR LATHE IN TURNING UP WASH OUT PLUGS—ELKHART SHOPS, L. S. & M. S. RY.

cutting tools and steady rest for supporting the plug during turning. The frame is provided with a shank which is gripped in the jaws of the lathe chuck. Two tools of self hardening steel, for facing and chamfering the plug, are adjusted in position by means of gauges, so that the rough plug is properly shaped in one operation. The gauges, are centered in the frame by means of a ⅝ inch pin, for correctly adjusting the tools. After the plug is turned up it is threaded in a Fox lathe. The drawings show the parts and construction of this attachment.

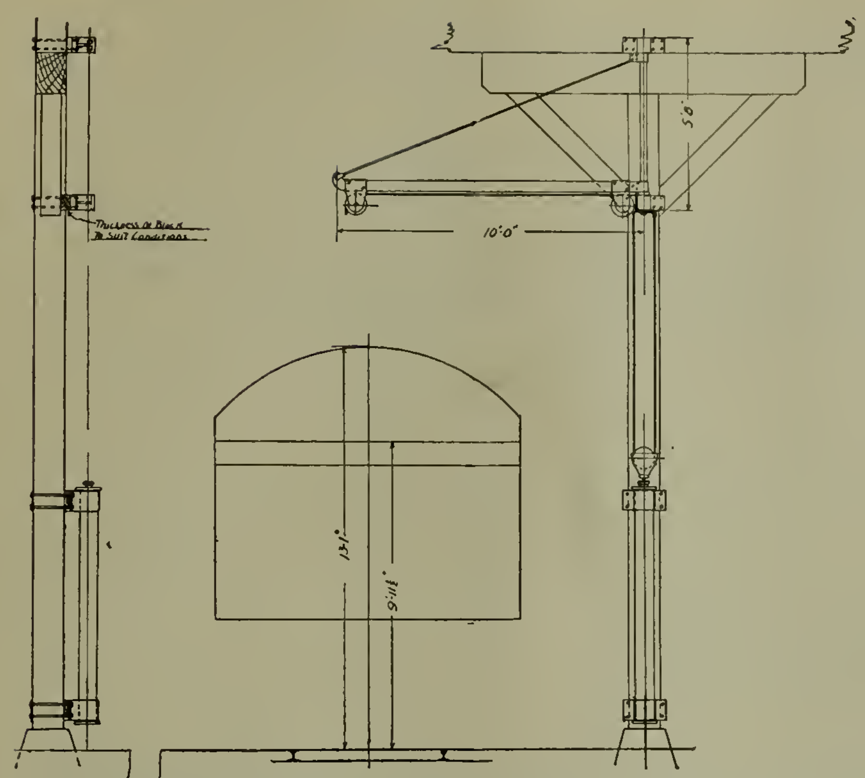
The ordinary method of turning up the faces of rocker arms has been improved upon by the double tool holder as shown in the accompanying drawing. A hollow tool holder 10 inches long is placed in the lathe tool support, which carries two tool holders fitted with right and left, self hardening tools which can be adjusted at various distances from the center to take in rocker arms of different widths. Two ¾-inch set screws clamp the tool holders in any desired position, the tools themselves



DOUBLE TOOL HOLDER FOR TURNING ROCKER ARMS—ELKHART SHOPS, L. S. & M. S. RY.

are adjusted and held in place by ½ inch set screws. By using this appliance the inside faces on both rocker arms can be faced at once, which represents a considerable saving in time where new work is handled. The drawing shows the construction of this labor saving tool holder very clearly.

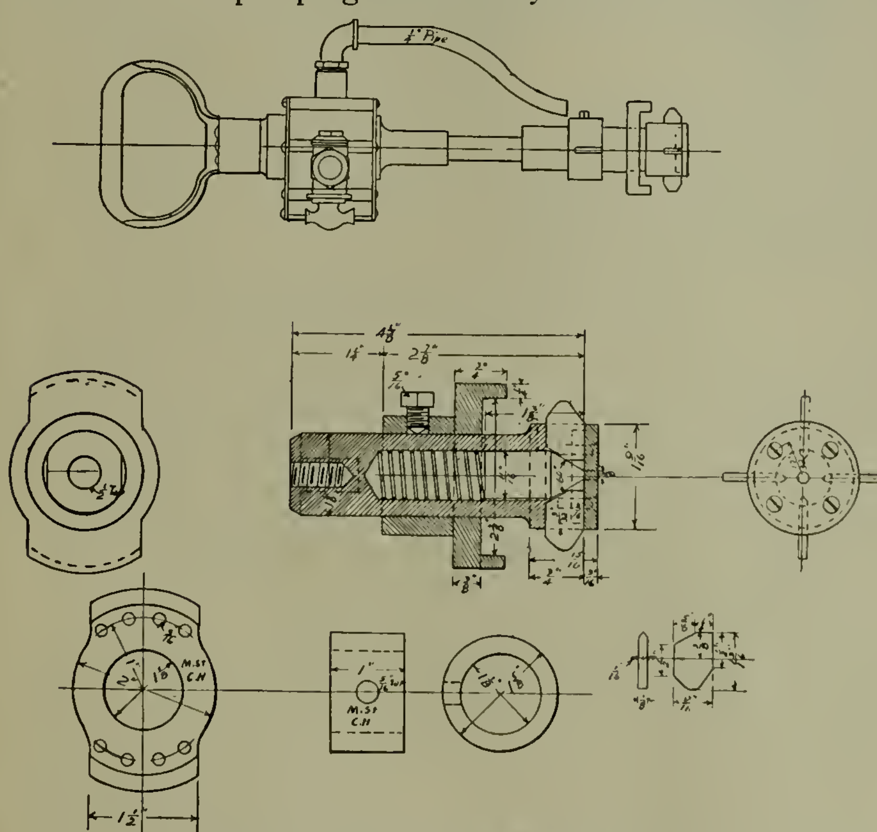
It frequently becomes necessary to load material on locomotive tenders for outside points and when it is heavy, considerable difficulty is encountered in placing it on the tender. In order to provide more convenient facilities for this purpose, a pneumatic crane is arranged on one of the roundhouse columns. The illustration of the crane shows its principal features and the method of operation. This appliance will materially help the movement of engines as a great deal of rush material is shipped on locomotives which takes considerable time to load in the ordinary way, beside quite a force of men is needed to handle the heavy staff frequently ordered. The engine is backed in the stall beside the crane whenever material is to be loaded and a couple of men will place any number of heavy castings, etc., on the tender in a very short time. The crane has proved to be an indispensable accessory to the roundhouse at Elkhart and is a feature that could be placed in every roundhouse with good advantage.



PMEUMATIC CRANE IN ROUND HOUSE FOR LOADING MATERIAL ON LOCOMOTIVE TENDERS—ELKHART SHOPS, L. S. & M. S. RY.

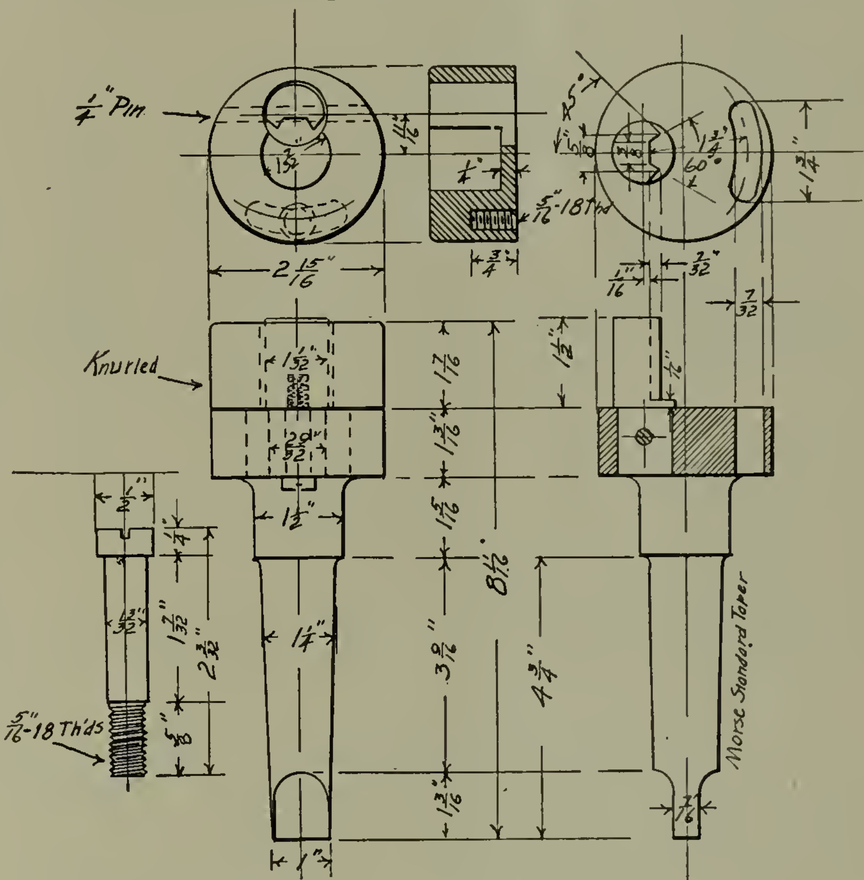
Considerable trouble was experienced with flues leaking after a certain amount of expanding was received from the Prosser expanders used in the roundhouses of the road. Upon investigation it was found that the flues were cracked from excessive expanding, due to an accumulation of cinders and ash in the shoulder of the flue, upon which the expander worked instead of on bare metal resulting in increasing the size of the flue to such an extent that cracks were produced.

By using the flue cleaner shown in the illustration, to remove the cinder in the shoulder of the flue before expanding was begun the trouble mentioned, was stopped entirely. The cleaner consists of 4 steel cutters ground to the shape of the flue shoulder and rotated by an air machine. A taper plug in the body of the device forces out the cutters, when pressure is added, until the cutting edges are against the flue. An adjustable collar is provided for holding the cutters in the proper place. The cinder dislodged is blown through the flue by the exhaust of the air machine, leaving a clean surface for the expander to work on. Before expanding is begun all the flues ends are cleaned by the cutter, which increases the time required to expand a set of flues, but the results obtained by the use of the device justify the extra time required as the trouble experienced from burst flues from over expanding, has been entirely eliminated. The cutter could be employed to advantage on roads where a class of coal is used which honeycombs the flues and flue sheet.



FLUE CLEANER FOR REMOVING CINDER IN SHOULDER OF FLUES—ELKHART SHOPS, L. S. & M. S. RY.

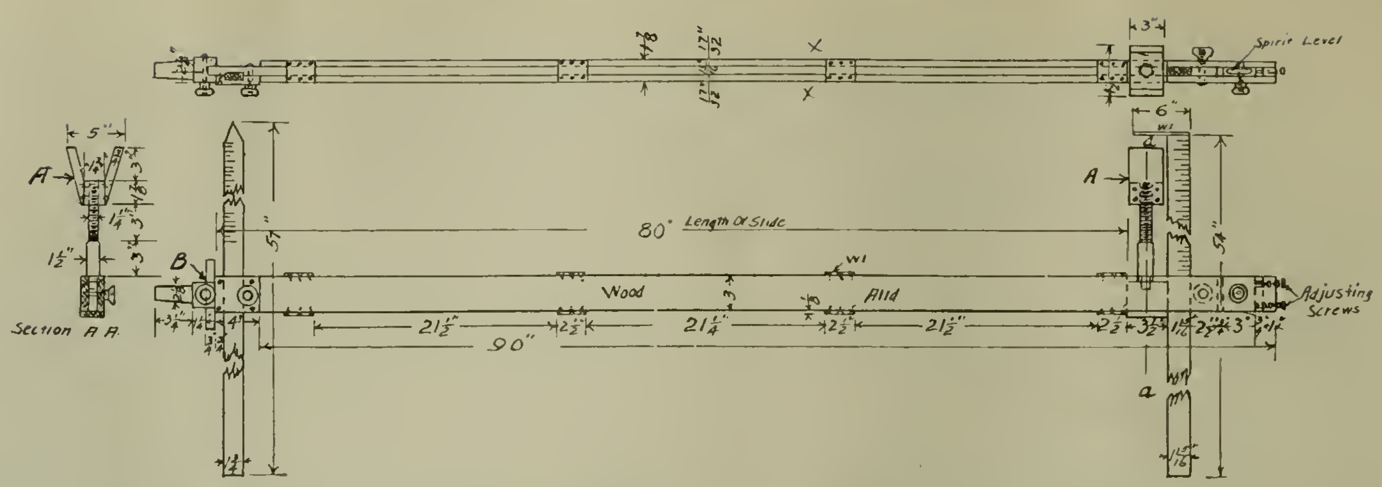
An automatic chuck for screwing in staybolts is shown in the accompanying illustration which possesses a number of original features. It is made for use



AUTOMATIC CHUCK FOR SCREWING IN STAYBOLTS—ELKHART SHOPS, L. S. & M. S. RY.

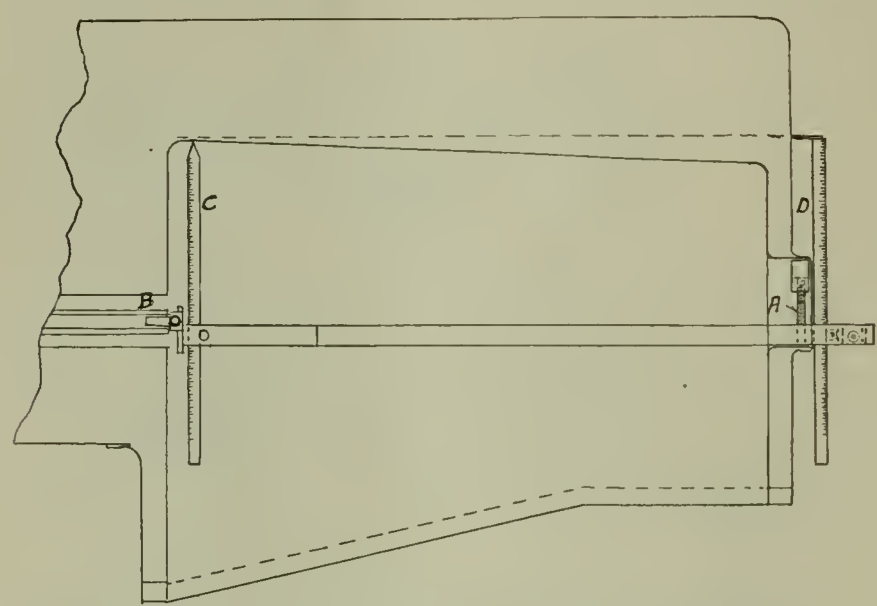
in a standard air machine and has a special design of jaw which grips the round end of the staybolt when the machine is stopped. As the use of this chuck avoids the necessity of squaring up the ends of the staybolts it is a more economical way of handling them, than the usual method employed. The chuck is of simple construction and can be made in the average machine shop tool room, by following the drawing which shows the various parts and the way they are put together.

An ingenious and satisfactory method has been designed for properly locating water glass and gauge cocks. A drawing of this gauge is shown in the illustration and consists of an adjustable wooden rod with one end fitted with a round taper plug for insertion in the end of the boiler tube and a small spirit level placed on the other end which can be adjusted in various positions by means of two thumb screws. In using this



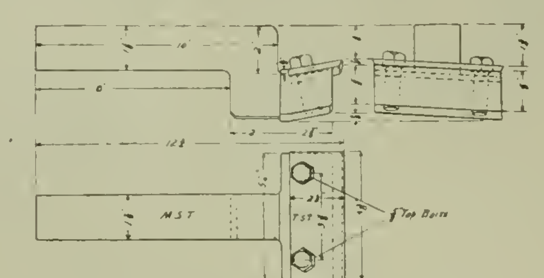
GAUGE FOR ACCURATELY LOCATING THE POSITION OF CROWN SHEET IN LOCOMOTIVE FIRE BOX—ELKHART SHOPS, L. S. & M. S. RY.

gauge the rod is placed on top of the engine frame and the spirit level adjusted until it stands level. The gauge is then placed in the firebox, taper plug inserted in the tube and the rod adjusted to the length of the firebox



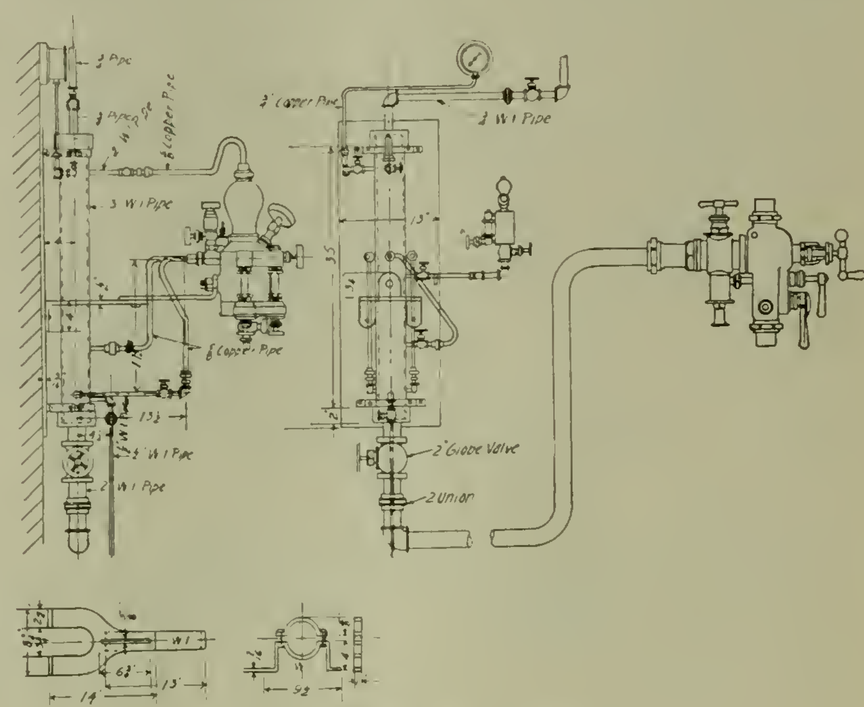
METHOD OF USING THE CROWN SHEET GAUGE IN LOCOMOTIVE FIRE BOX—ELKHART SHOPS, L. S. & M. S. RY.

and clamped in position by turning the screw "A" until it fits tightly against the fire door sheet. The position of the rod is then adjusted to level by raising or lowering the front end which is clamped by the screw "B." The slide "C" is then moved upward until the point touches against the crown sheet and the slide "D" adjusted to the height above the rod to the distance shown in slide "C." This will give a point on the back sheet the same height as the under side of the crown sheet, and will enable the water glass cocks to be laid off in respect to the crown sheet with accuracy. It will be noticed that this method is very simple and much more accurate than the usual devices used for this purpose.



SPECIAL PLANER TOOL FOR PLAINING CROSS HEAD SHOES—ELKHART SHOPS, L. S. & M. S. RY.

A number of special planer tools are in use at Elkhart, but with one exception they were described in the previous issue of the RAILWAY MASTER MECHANIC already referred to. The illustration a tool shows which planes the inside of both flanges and the face of a cross head shoe, in one operation. A 3/8 inch plate of tool steel is ground with 3 cutting edges and secured to a tool holder by means of two 5/8 inch tap bolts. The extreme cutting edges are ground to a specified dimension, as required by the particular cross head shoe, so that by feeding down the tool, the flanges are planed to the required width and the lower cutting edge



INJECTOR AND LUBRICATOR TESTING RACK—ELKHART SHOPS, L. S. & M. S. RY.

trues up the bearing face of the shoe. The tool holder is offset and turned at an angle which will give the cutting edges proper clearance and position, in regard to the work. By means of this device the time required to place cross head shoes has been considerably reduced, with a corresponding saving in expense.

An arrangement for testing lubricators and injectors which embodies an unusual principle is shown in the next illustration. A section of 3 inch pipe with caps on each end is mounted on a three-sixteenth inch plate which is bolted to the wall. A 3/4 inch steam pipe from the boiler is connected to the upper end of the large pipe, with connections for a steam gauge. Four lubricator pipes with suitable connections are attached to the chamber, with a stand for supporting the lubricator.

In testing a lubricator it is simply fastened to the stand and the pipes connected up and steam turned on, after which the lubricator is handled in the usual manner when in service. The steam pressure obtained from the stationary boiler is 100 pounds per square inch so that the test will not be under normal conditions until the pressure is raised to that carried by the locomotive from which the lubricator was taken. In order to obtain a higher pressure an injector is connected to the lower end of the chamber by a 2 inch pipe. Steam and water connections are made with the injector in the usual manner, and by operating the injector, water is forced into the chamber until the desired pressure as shown by the gauge, is reached. The water is prevented from entering the injector pipes by the steam which is entrapped in them, so that the test is made under working conditions.

This also provides a test for injectors and fittings are conveniently arranged for connecting them up to the necessary pipes. An injector is permanently mounted for testing lubricators while a separate set of pipes and fittings is provided for connecting up the test injectors. This arrangement has proved to be a successful means of testing both lubricators and injectors and is an original design which could be adopted in other shops with advantage.

Fire Extinguishers

By W. B. Landon, Chemist, Erie R. R.

OUR annual fire bill for the year 1905 is given as $150,000,000. This country has been called "Combustible America." It would certainly seem that there was more truth than fiction in this statement. The thousands of fires which caused this loss of $150,000,000 were, in one time during their brief existence, only a tiny flame, which a cup of water would have extinguished. It is at this period and right after, when the fire is in its incipient stage, that a good fire extinguisher is of value.

The simplest fire extinguishers we see on a railroad are pails filled with water or sand. Next are the water barrels full of water of solution of salt in water or solution of calcium chloride in water. The latter is the best solution of all as it can be made of such strength that the solution will not freeze at 10°, 20°, 30°, or 40° below zero depending on the amount of calcium chloride dissolved in the water, therefore it is excellent for a cold climate. This solution also makes an excellent fire extinguisher.

Hand grenades containing a solution of such salts as calcium chloride, magnesium chloride, sodium chloride, ammonium chloride, sodium carbonate, etc., have been used to some extent on the railroads. The hand grenade, however, is being relegated to the rear as better things have been found.

The dry powder chemical fire extinguisher has taken the place of the hand grenade and is very efficient in some kinds of fires. The dry powder chemical and fire extinguishers are made up as a rule largely of bicarbonate of soda commonly known as baking-soda, and a little inert material to keep the soda from caking. The bicarbonate of soda is valuable on account of the 52 per cent of carbonic acid gas contained which gas is liberated by the heat and acts as a blanket, being a heavy gas, thus keeping away the oxygen of the air and the fire going out from lack of same.

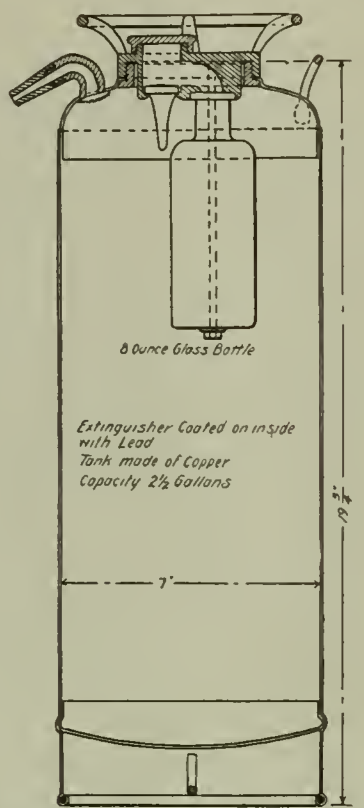
The liquid chemical fire extinguishers of 2½, 3 and 6 gallons capacity are superior to the dry powder chemical fire extinguishers. In this fire extinguisher acid of some kind, generally sulphuric, by varying methods is brought in contact with a solution of bicarbonate of soda, chemical reaction taking place, carbonic acid gas is liberated quickly, producing pressure and a stream of water, carbonic acid, etc., are carried to the fire. Water acts by lowering the igniting point, carbonic acid gas acts as a blanket as described above.

In some fire extinguishers, the bottle containing the acid is broken, the method used depending on the manufacturer. In fire extinguishers of this kind the pressure is not uniform, the greatest pressure being at first, when all the acid by the breaking of the bottle is liberated into the soda solution at once. Accidents have occurred with this kind of fire extinguisher by same exploding. The high pressure also tends to spray the stream, instead of carrying it to the fire before spraying.

The advantages of this class of machines are, that the acid bottles being stoppered, the sulphuric acid cannot absorb moisture and thus weaken the acid. It has been found by experiment that machines of this class, the sulphuric acid is just as effective when the acid was diluted somewhat, while with a machine in which the sulphuric acid was only delivered as chemical action took place, dilution should not exceed 25 per cent. There are several disadvantages to machines of this class. First, the high pressure produced; second, the tiny bits of broken glass were apt to stop up the hole from which the liquid was expelled; third, tend to spray the stream; fourth, somewhat expensive, as the bottle was destroyed. The second class of extinguishers acts in the same way as the first except, the bottle is not broken. The machine is generally turned upside down and a stopper, usually of lead, drops away from the bottle and lets all the acid into the bicarbonate of soda solution. Of course, you would not get any broken glass in this case, other than this, the objections would be the same.

Third class fire extinguishers when turned upside down, the sulphuric acid by various ways, is brought in contact with the soda solution and chemical action taking place forms a pressure which is constant. The sulphuric acid is only liberated as chemical action takes place and if all the soda solution be run out before the acid was used up, same would cease to flow. Machines of this type have the following points in their favor: First, pressure is even and not excessive at any time; second, stream carries nicely to the fire; third, no glass to stop up exit; fourth, no expense in renewing bottle; fifth, machine can be started and stopped at will.

Fourth class—Machines which use liquid carbonic acid gas in small cylinders. The liquid may be plain water or a solution of bicarbonate of soda or other chemicals. The machine is operated by a patented valve, which, on



CROSS SECTION OF FIRE EXTINGUISHER SHOWING ARRANGEMENT OF PARTS

lifting lever, is opened and the carbonic acid gas passes into a solution expelling same to fire. These cylinders are under about eight or nine hundred pounds pressure. This machine is very efficient. It has the advantage that the operator can use a variety of chemicals dissolved in water among which is calcium chloride, which, if present in sufficient quantities prevents freezing. This chemical cannot be used in the acid machines as the bicarbonate of soda would precipitate the calcium.

It has the disadvantage, that unless the cylinders are sold by dealers in any community that he will have to send away to get his recharged. While with sulphuric acid and bicarbonate of soda, these can be obtained as a rule in any community where there is drug store.

The former engineer of tests, Mr. J. G. Platt, and the writer, while giving the subject some study ran across a peculiar and yet natural occurance which led to the invention of a liquid fire entinguisher. The discovery was as follows: A common round, four ounce, sample bottle was partly filled with sulphuric acid, in which was a rubber stopper containing a glass tube bent at an angle a little greater than a right angle. When this bottle was inverted, the acid did not run out because the natural law prevented same but on dipping this inverted bottle of sulphuric acid in a solution of bicarbonate of soda, chemical action took place at the mouth of the tube carbonic acid gas being liberated, a small quantity of which bubbled up through the tube into the bottle relieving the vacuum. After some experiments, a machine was made on this principle which gave fine results. The machine could be started and stopped at will, the pressure was always uniform. No stoppers are necessary in bottle. A lead stopper is used, but this is in the tube part, connecting to the acid supply and drops down in the tube to fill same when the extinguisher is not in use. To prevent the absorption of moisture by the sulphuric acid and when the extinguisher is in use, the lead stopper drops back out of the way and has nothing to do with the flow of acid. In this extinguisher, the rubber hose is done away with, this is believed to be a point in its favor.

The illustration will readily show the points of this machine. First, Its simplicity; second, no bottle to be broken; third, uniform pressure produced by uniform chemical reaction; fourth, flow of acid not regulated by any device, but simply by the chemical reaction, the extent of this depending altogether on the diameter of the tube; fifth, no rubber hose to deteriorate and thus expense of replacement; sixth, the machine can be started or stopped at will.

Communication

Concerning Piece Work

Editor, Railway Master Mechanic:

I would be pleased to submit some comments upon your bright and thoughtful editorial appearing in the April number entitled,—"Concerning Piece Work."

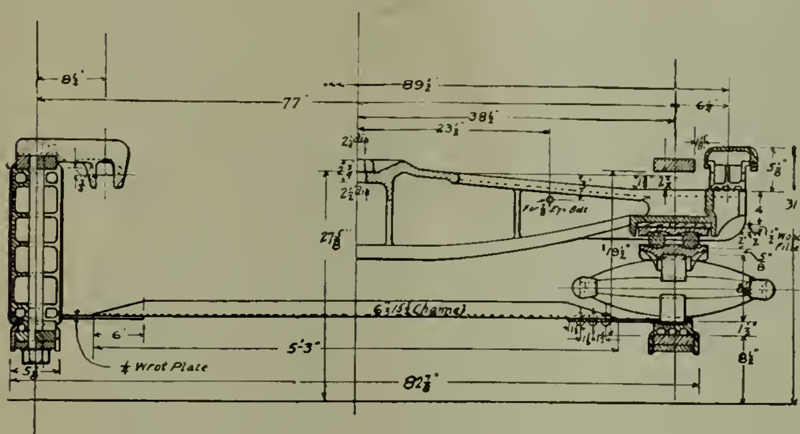
Thorough organization must be understood to operate piece work successfully. To attempt the system on any other basis, can only result in failure after increased expense and demoralization is exposed. To inaugurate it without a sympathetic and thoroughly practical knowledge of details, has in the past and will continue in the future to be a waste of time and thought on the subject.

In my opinion the system represents the only correct method of securing fair, equal, and correct returns from labor. Where the employe's lack of interest and confidence exists, the fault, as a rule, is easily traced to incompetent, direct supervision, attributable to forms of favoritism or bad organization.

It is very certain that the continued successful operation of the system requires constant care and eternal vigilance all the time, unmixed with foolishness at any stage of the game, on the part of the employer.

It is well to observe that where piece work has been tried and found wanting, that supervision is responsible. I believe this can be shown. And the same character of supervision directing day work will be found to be in a wretched state if the probe is but driven sufficiently far and instead of "unrest" with piece work, you will find very near all rest without it.

Schedules covering the principal standard parts should not only never be changed, but should (I predict some day soon, will) become universal among railroads. So far as my experience and observations go (with the exception of contract shops) it is not my understanding that standard railroads are in the habit of frequently changing schedules, this being admitted, every objection



CROSS SECTION OF LOCOMOTIVE TENDER TRUCK—C. B. & Q. RY.

and disadvantage is chargeable to supervision which at all times is easily accessible and subject to remedy in the way of improvement by the management. Sufficiently improved facilities (while not an absolute necessity in every instance) is unquestionably a great advantage, greater to the employer than the employe as I see the system.

It must be understood also, on this question of facilities, that there are splendid possibilities for the supervisor to do some extensive creating in the direction of numerous advantages, provided, as already observed, the necessary energetic organizing ability exists.

The last paragraph of your editorial is quite true. While there are two sides to the question, I think there can be only one so far as to where the responsibility lies when failure is apparent.

From a railroad standpoint the most decisive advantage to the system appears in the fact that its successful operation unquestionably denotes thorough organization, clean, fair, broad, honest and unselfish from the top to the bottom.

The method offers some genuine surprises in the way of advanced possibilities towards improvements.

The door of opportunity for economy is, unfortunately no wider than the door of failure, but the supervisor must be able to see the former and enter therein, or waste and increased expense will result.

Success hangs on harmony, ability, discipline and organization alone. Day work is ability's worst enemy, piece work, its best friend. Seniority in preference to merit in connection with either method, when apparent in railroad activity, is the mistake of the times as well as injustice to the public.

Piece work will promptly demonstrate its superiority under proper supervision and without this factor it will hastily retire from the field. The system I think will develop fully 40 per cent more expert mechanical ability in the employe than day work and given a supervisor with organizing ability, both will find details and experience are twin brothers. Knowledge of the former, is acquired through the latter; therefore, technicality in possession of either, is invincible and rarely knows failure.

This combination in charge of piece work, not only make duty, a love and pleasure, but transforms labor into recreation and play, carrying easily some 40 per cent more solid results than day work.

Yours truly,

D. T. Taylor.

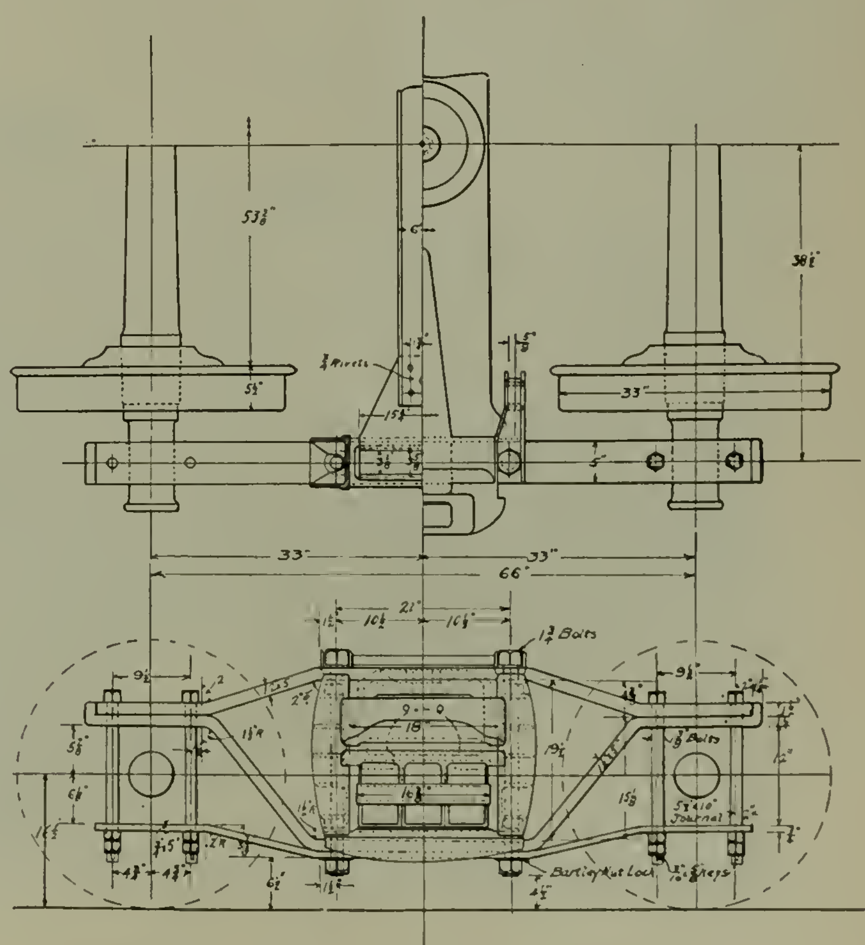
St. Louis, Mo.

Locomotive Tender Truck C. B. & Q. Ry.

THE Chicago, Burlington & Quincy Railway is using a truck under the tenders of their heavy engines which combine a number of desirable features. By referring to the illustrations it will be observed that the truck is of the arch-bar type, but instead of the usual rigid connection between the side frames, a spring plank is substituted which fits into a recess over each spring pocket. The spring plank is held in position by the weight on the truck, and as the tender springs are always under compression there is no chance for the plank to become dislodged when passing over frogs, etc.

By this construction greater flexibility is obtained with a more even distribution of service strains and shocks throughout the different parts of the truck. It is possible to dismantle the truck in a much shorter time than the usual design and repairs are made with equal facility.

The truck bolster is of cast steel, and in order to pro-



PLAN AND SIDE ELEVATION OF LOCOMOTIVE TENDER TRUCK—C. B. & Q. RY.

vide for lateral motion of the car two steel rollers are placed between the spring and bolster at each end. Hardened steel bearing surfaces of concave form prevent excessive wear and keep the rollers in place. The bolster is fitted one-fourth of an inch loose in the pedestal jaw and lateral motion above two inches each way is prevented by lugs cast in the bolster. The side bearings are of the gravity type and are set 6¼ inches outside of the side frames. The axles have 5½ by 10-inch journals and are spaced 66 inches from center to center. The truck has a total of some 80 parts, including nuts, split keys, etc. Excellent service is obtained from the truck under the most severe road conditions, which proves without question the merits of the design. We are indebted to Mr. C. B. Young, Mechanical Engineer, for the illustrations presented.

All Steel Postal Car

Southern Pacific Ry.

STEEL car construction has taken another step forward in the all-steel postal car just turned out by the Southern Pacific Company's Sacramento shops. The design is entirely original with the company's motive power department.

The protection of the entire train by interposing an uninflamable barrier between engine and coaches was one of the main objects of the designers of the car, as well as protection against telescoping and the reduction of deterioration to a minimum.

The principal features of the framing of the Southern Pacific car are two 12-inch I-beams weighing 31½ pounds per foot and extending through the buffer beam. On account of the depth of these beams, platform sills or draft timbers are not necessary, the draft gear being made secure to the lower flange of the I-beams. These I-beams are capable of over 200 per cent. more resistance to shock than the ordinary car with wooden sills. They are trussed with two 1½-in. rods which extend through steel castings in the end sills.

The flooring is formed of two courses of corrugated steel laid crosswise of the car, and between the two courses a layer of hair felt is placed. To provide a smooth floor surface, monolith is used.

The shape of the roof is elliptical, the usual upper deck being dispensed with. The framing of the roof consists of 5/16-in. by 1¾-in by 4⅝-in. angle irons, elliptically shaped to conform to the roof. A foot at either end of these angle irons is riveted to the side plates of the car. The outer roof lining is 1/16-in. sheet steel, extending down the side plate angle and is overlapped by the ⅛-in. steel plate forming the letter board sheet. The inside roof sheets are 1/16-in. steel sheets, flanged on the edges and riveted through the angle column, forming panels two feet in width.

The interior is lined with asbestos on the sides and ends, while the ceiling is of steel plate. The floor is composed of a fire-proof cement and all interior fixtures are either of iron or brass. The only wood used in the construction is in the window sashes. The entire outside as shown in the photograph is of riveted steel plates.

NEW ALL STEEL POSTAL CAR—SOUTHERN PACIFIC RY.

INTERIOR OF ALL STEEL POSTAL CAR—SOUTHERN PACIFIC RY.

The venilation is provided by Cottier ventilators placed radially on the roof and which can be regulated to suit the temperature of the car.

The ends of the car framing are composed of rectangular plates ¾-in. by 3-in., to which heavy angles are riveted and extend from end sill to top of car frame, to which they are substantially secured. The door framing is constructed of two heavy angles to give additional strength as well as utility. To take up heavy shocks on the end frames, a 5/16-in. steel plate 20 inches wide is riveted across the top framing of car.

The usual gas lighting system has been eliminated and electric lights generated from the axle substituted. The heating of the car is dependent upon steam heat furnished by the locomotive, and apparatus is provided for automatically regulating the temperature of the car. The ordinary stove is, however, placed in one corner of the car for emergency use.

In design the entire framing is so completely bound together that the most severe shock will tend to buckle the entire framing, but will render it impossible to telescope the car.

A Possible Cause for Wrecks

By H. M. Perry

THE investigations, both by the railroad and state authorities, as to the probable cause of the disastrous railroad wrecks of recent date, have brought out a number of theories, but we fail to find among them a word concerning a very prolific source of trouble in almost all railroad yards, namely, the derailment of cars and engines due to excessive loads on side bearings.

Many roads have had so much trouble of this kind with their bearings on locomotive tanks, while backing on curves, that they have stopped using them for switching except where it was absolutely necessary.

On a certain class of cars, the construction of which was such that the bottom frames were almost rigid, to such an extent that a jack placed under one corner would raise the end almost level, it was found that the only way of keeping them on the track on sharp curves was to give from three quarters to one inch clearance between the side bearings, with the result that it is almost impossble to ride on them, when running, owing to their excessive rolling.

The ordinary practice in passenger car construction and operation is to give only just a clearance between the side bearings, to prevent rolling, and as a result any deflection in the bolsters brings the load down on the side bearings which is the case in about nine-tenths of all cars now running.

As the outside rail on a curve is elevated from one-half to one inch for each degree of curvature and the easement or incline from the level rail to the elevation is from twenty to forty feet for each inch of elevation, it is reasonable to assume that as a car strikes a curve, a large proportion of the weight of one end of the car is transferred to the outside bearings of the forward truck, due to the elevation of the rail, and at the same time centrifugal force comes into action to still further increase the load on this bearing.

As the load has to be overcome by the flange of the outside forward wheel pressing against the rail it can be readily seen that the factor of safety at this point, under present conditions, is not large.

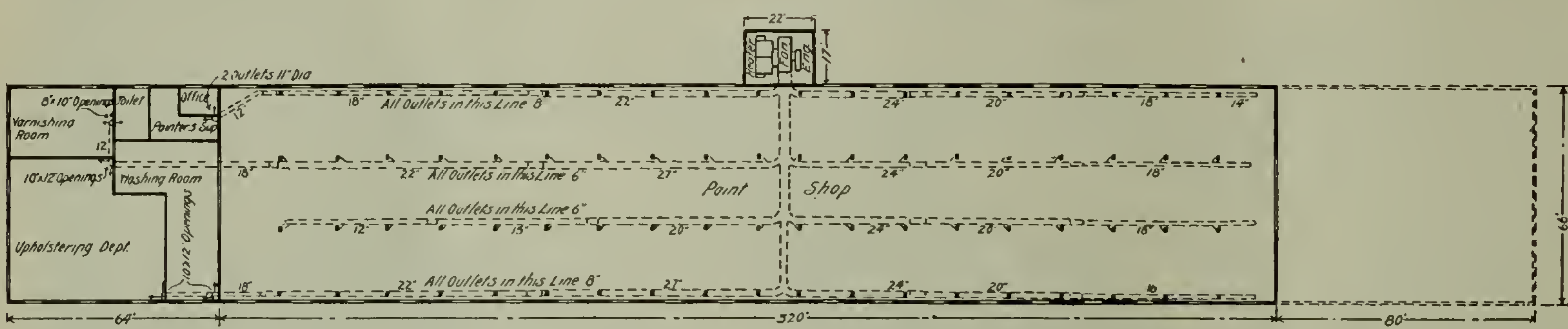
Regarding the question of friction between side bearings, we find that standard authorities claim a factor of friction between cast iron surfaces of from 50 per cent for rough castings to 20 per cent for smooth castings, and if a wreck occurred with trains of comparatively new cars it is reasonable to assume that the side bearings would be rough castings having a factor of friction of 50 per cent.

Under the foregoing conditions, we will assume that a sixty-five foot coach weighs 86,000 pounds, 60,000 pounds for the body and 26,000 pounds for the trucks, and carrying a load of 10,000 pounds; running at sixty miles an hour and strikes an eight degree curve; elevation of the outer rail 4 inches and centre of gravity of the car body 6 feet 6 inches above the rail, the load equally resting on center plates and side bearings when car is on a tangent.

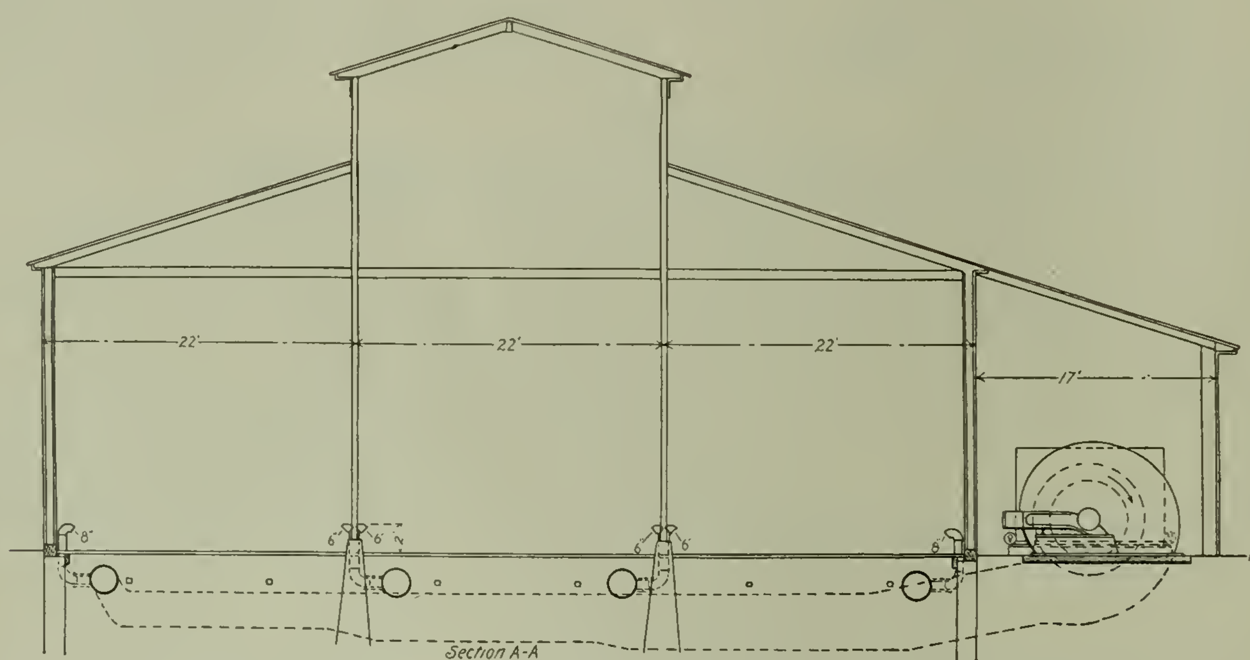
The weight of the body and load on the forward truck would be 35,000 pounds, of which something like 30,000 pounds would be on the outside bearing, due to the elevation of the outer rail and centrifugal force, and if these side bearings were of rough cast iron, as they would be under new cars, it would require a force of about 15,000 pounds to slide one on the other. It would make very little difference if there was any clearance between the side bearings, when the car was on a level track, as the centrifugal force acting in a horizontal line through the car body would force it down on the outside bearing with a power about equal to one-half of the weight of the whole end of the car and load, while a large amount of clearance between the side bearings becomes positively dangerous due to the rolling of the car and the added momentum of the rolling load.

Now in order to overcome this friction between the side bearings we have the pressure flange of the outside forward wheel against the rail which on the car specified, would amount to 48,000 pounds, the total weight of one-half of the body and load and one truck distributed over four wheels, or 12,000 pounds per wheel. Now with trucks having a seven foot wheel base and side bearings set thirty inches from the centre plate, we have a leverage, from the flange of the forward wheel on the rail, to the centre plate, of about fifty inches, against one from the centre plate to the side bearings of thirty inches, or one of five to three, which would increase the force against the rail to about 20,000 pounds, plus the additional weight due to centrifugal force.

In none of the calculations have we taken into account several factors all of which tend to increase the resistance of the truck in curving, or to reduce the available power at the flange of the wheel against the rail. Additional resistance at the centre plates or inequalities in the castings of centre plates or side bearings; rigidity in the under frames of cars which prevent them from winding or twisting to allow adjusting themselves to the elevation of the rail on curves, would both require



PLAN OF PAINT SHOP, SHOWING LOCATION OF DISTRIBUTING PIPES AND OUTLETS—NEW PAINT SHOP AT MIDDLETOWN, N. Y. O. & W. RY.



CROSS SECTION OF PAINT SHOP, SHOWING OF LOCATION OF FAN, DISCHARGE PIPE, DISTRIBUTING PIPES AND OUTLETS—NEW PAINT SHOP AT MIDDLETOWN, N. Y. O. & W. RY.

more power to overcome. The axles in a truck being parallel instead of radial, together with centrifugal force, tend to carry a car in a straight line or to ride over the outside rail, or an increase in speed to the point where centrifugal force would counter-balance our small margin of safety would result naturally in a derailment.

And what is a remedy for these conditions? If ordinary rigid side bearings require from twenty to fifty per cent to overcome the friction between them, why not apply a roller side bearing that will reduce this friction to one or two per cent and reduce the danger of derailment in a corresponding degree? No one disputes the fact that the friction can be reduced in this way.

Aside from the question of safety, the economy of the roller side bearing has been demonstrated, and the facts show that they will pay for themselves in less time than the life of one set of wheels, in the saving of flange wear alone, to say nothing of rail wear or draft of train. A recent test of roller bearings on electric cars, showed a saving of 17.8 per cent in power required to haul the train.

In the face of these facts railroad men can no longer afford to neglect this matter and refuse to apply a remedy, when several years' experience have demonstrated that such a remedy exists and has been in practical use for a number of years.

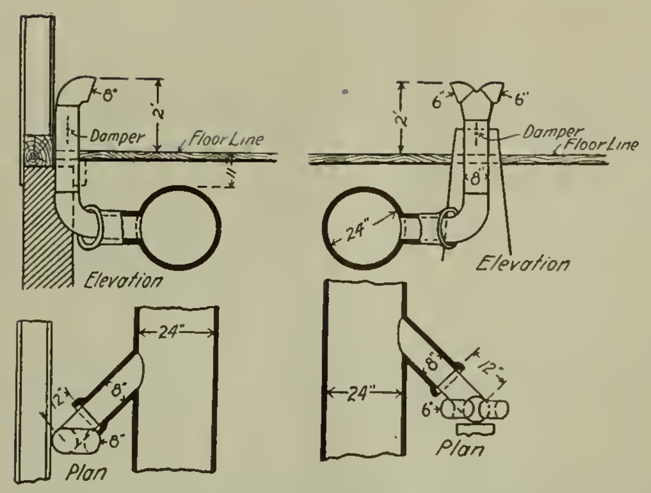
Heating the New Paint Shop at Middletown
New York, Ontario and Western Ry.

THE advantage of concentrating all the heating surface at a local point and maintaining a forced circulation of warm air throughout the entire building was accepted as sufficient reason for installing the blower system in the new paint show of the New York, Ontario & Western Railway at Middletown, N. Y. The building as at present erected is 384 feet long, but designed for an addition of 80 feet. Its total width is 66 feet, sufficient for three tracks with ample space to work between the cars. Wooden construction was used throughout, the interior being rendered especially attractive by the use of cold water paint. The entire building with its equipment was designed and constructed under the supervision of C. E. Knickerbocker, Engineer Maintenance of Way, assisted in the matter of heating and ventilation by the B. F. Sturtevant Company of Boston, Mass., who furnished the heating equipment.

This equipment consists of an 8-foot fan wheel enclosed in steel plate casing connected with a casing of the same material containing the heater. In this heater are compactly arranged 10 sections containing 6,800 feet of 1-inch pipe, across which the air is drawn into the fan and thence discharged to the distributing system. The rapidity of air flow produced by the fan increases the efficiency of the heating surface from 300 to 500 per cent above that of the same area exposed in still air. A direct-connected 8x12 engine drives the fan up to a maximum speed of over 200 revolutions per minute, which is sufficient to insure a velocity of about 3,500 feet per minute through the discharge pipe. The heater is designed for the use of high pressure steam, and arranged so that the exhaust from the fan engine may be completely utilized.

The complete apparatus is placed in a small lean-to mid-length of the main building. Its central position reduces to a minimum the cost of the distributing system. Beneath the floor and alongside each of the walls and the column piers run four tile distributing pipes branching from the main brick cross duct from fan. Branches from these pipes lead to floor level, the upper

INTERIOR OF PAINT SHOP SHOWING ARRANGEMENT OF OUTLETS FOR HEATING SYSTEM—NEW PAINT SHOP AT MIDDLETOWN, N. Y. O. & W. RY.



PLAN AND ELEVATION OF OUTLETS USED AT THE WALLS AND IN THE CENTER OF THE BUILDING—NEW PAINT SHOP AT MIDDLETOWN, N. Y. O. & W. RY.

portion of each being constructed of heavy galvanized iron, and so designed as to throw the escaping air at an angle toward the floor. As a consequence, there is maintained at floor level a constantly changing volume of warm air which naturally ascends across the painted surfaces of the cars, thereby increasing the rate of drying. The constant replacement of the rising air by the incoming heated volumes insures a fresh warm atmosphere, which is particularly conducive to rapid drying.

The outlets, which range from 6 inches to 8 inches in diameter, are spaced 16 feet apart so that practically perfect distribution and mixing is secured. Those in the middle of the building are protected from injury by the adjacent columns. The building is warm where warmth is desired,—at the floor. The small rooms at the end of the building are heated by the same system through risers extending up from the underground ducts.

In other arrangements of the blower system the air is distributed through overhead pipes carried upon the roof framing and provided with long discharge pipes extending downward to near the floor. Each method has its advantages, but the results secured at Middletown prove that the underground system can certainly give satisfactory results.

Automatic Connectors for Air and Steam

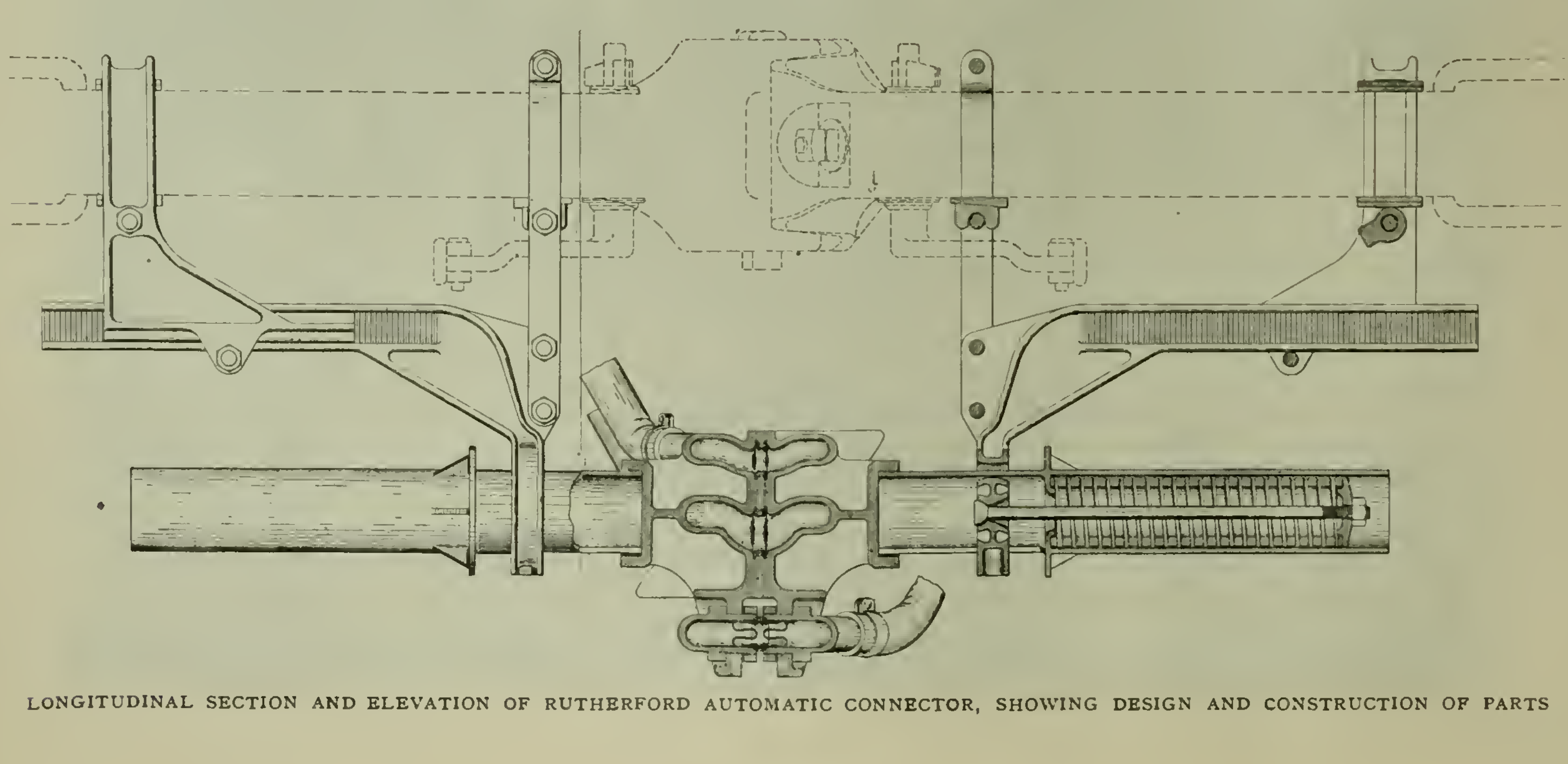
IN view of the interest manifested in the question of automatic connectors for air and steam pipes between cars and locomotives, the principal features of design of the leading types of connectors now in use, have been condensed into convenient form for reference. Each design of connector will be considered separately, the first one as follows:

RUTHERFORD AUTOMATIC CONNECTOR.

The Rutherford Automatic Connector has been designed to automatically couple air, signal and steam pipes between cars under the usual service conditions. By referring to the accompanying illustrations it will be seen that the body or barrel of the connector is carried by the slotted front half, entering the hanger and resting on a knuckle, part of the hanger and which fits loosely in the barrel. The barrel is held in the forward position up to the outside flange by the action of the coil spring, the front end of which engages a flange within the barrel and the rear end of which is controlled by the rod and cap. The forward end of the rod being held by its position in the center of the knuckle.

The action of the spring, which should have a tension of 400 pounds, and the outside flange of the barrel against the hanger, keeps the connector normally in a horizontal position and in the line of draft. When in normal position the connector face is 1¾ inches in advance of the vertical coupling line of the draft couplers.

The connectors therefore engage first and as the car coupling is being made the connectors force themselves backwards, freeing themselves from the restraining in-

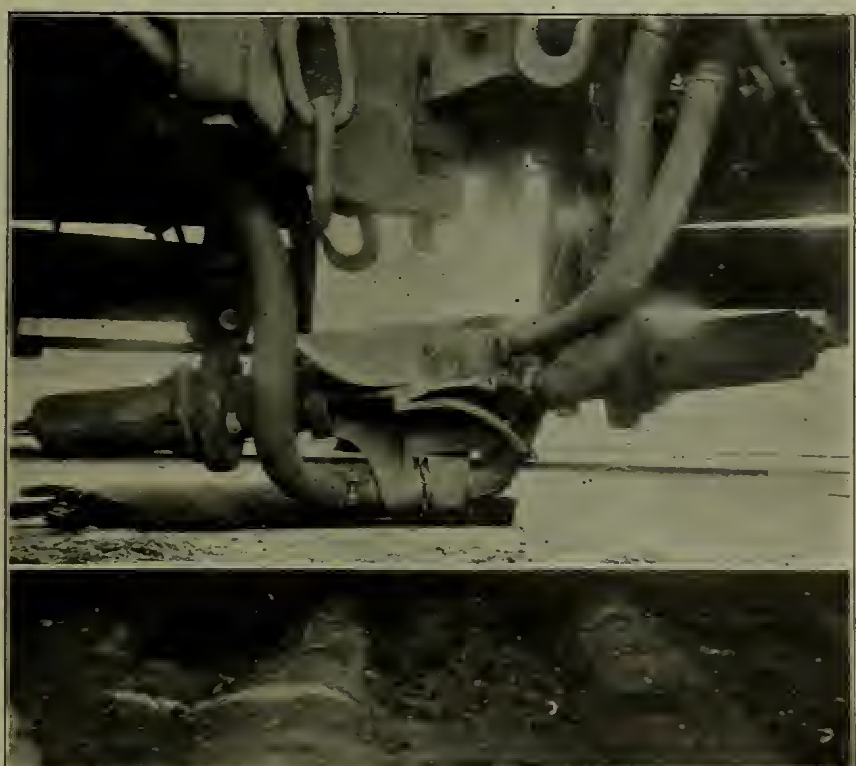


LONGITUDINAL SECTION AND ELEVATION OF RUTHERFORD AUTOMATIC CONNECTOR, SHOWING DESIGN AND CONSTRUCTION OF PARTS fluence of the flange against the hanger and enabling them to take without stress any position required by variations in height or direction. When the cars are uncoupled and separated the connectors return to their normal position at once.

The vertical lines of the face are 8 inches without the steam connection and 12½ inches over all, the horizontal lines are 13 inches, these long lines insuring an absence of "buckling" and leakage of the fluids. The gaskets for the air passages are of rubber, for the steam gaskets of copper. The hanger is fluted in its horizontal section, as are also the rear draw bar clutches, enabling these clutches to be attached anywhere along the draw bar that circumstances may require.

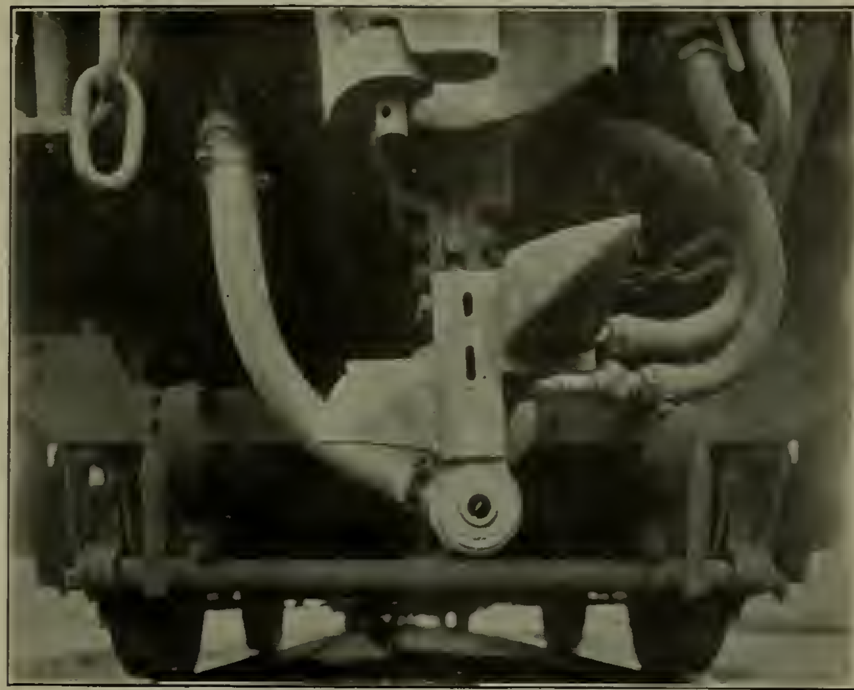
It will be seen that the vital feature of the connector is the facility with which it may take any position required by the ordinary variations of the cars with respect to each other, doing so without any stress and still returning to its normal horizontal position and in the line of draft as soon as the cars are uncoupled and separated.

The size and position of the horns are such that they will engage themselves through a variation of 7 inches in height and with a side variation greater than can be taken care of by the draft couplers.



SIDE VIEW OF RUTHERFORD AUTOMATIC CONNECTOR, SHOWING CONNECTORS COUPLED TOGETHER IN SERVICE

If it is felt desirable, the horns can be made enough larger to take care of a variation of 10 inches in height. These variations, of course, need only to be taken care of by the horns when the cars are being coupled. After the cars are coupled, the connectors will stay together as long as the cars will. These connectors have been developed slowly and every effort has been made to obtain criticisms and a great benefit has been derived from the criticisms received, the result being that the present design in actual service seems to do everything that an automatic connector could do, namely; connect each time the



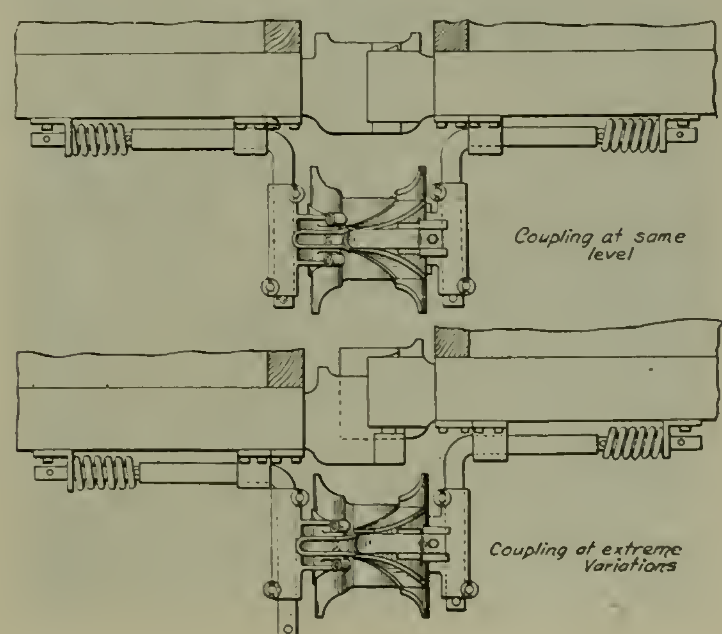
END VIEW OF RUTHERFORD AUTOMATIC CONNECTOR SHOWING METHOD OF ATTACHMENT TO COUPLER

draft couplers do; never leak after connection, and not get out of order.

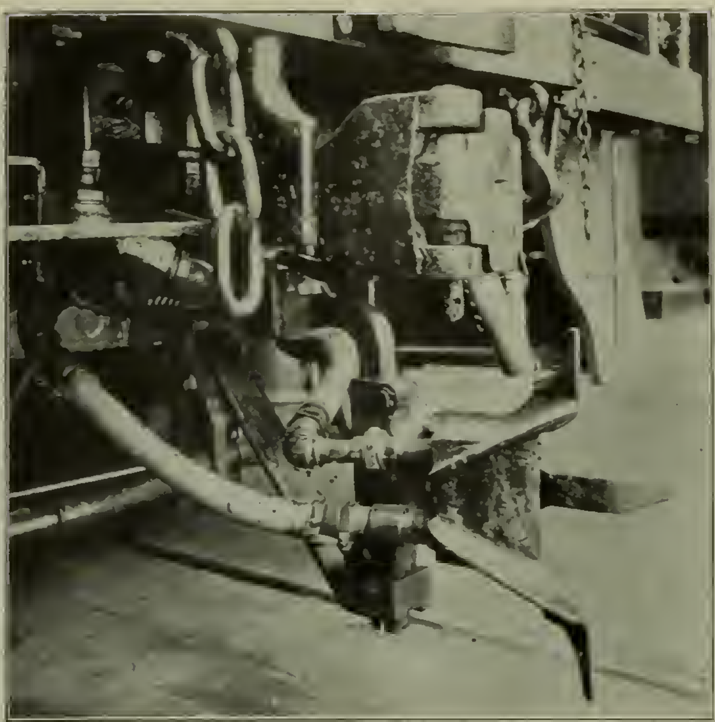
CARY AUTOMATIC TRAIN PIPE COUPLER.

The Cary Automatic Train Pipe Coupler, manufactured by the Cary Automatic Coupler Company, is a device for automatically coupling train, signal and steam pipes between cars. The general construction of the coupler is shown by the illustration.

The train pipe couplings are suspended from the car coupling heads by means of a special carrier; that is to say, one member of the pipe coupling is carried by one coupling head, and the other member is carried by the opposite coupling head. A spiral spring is arranged on each bar, near the rear of the coupling member to form a yielding buffer therefor. The forward end of each member is provided with an inwardly projecting shoulder, adapted to make the locking engagement with the heel of the opposite member. Each member has a yielding guide arm under the tension of a leaf spring. Each coupling member has on its back integral ribs, diverging



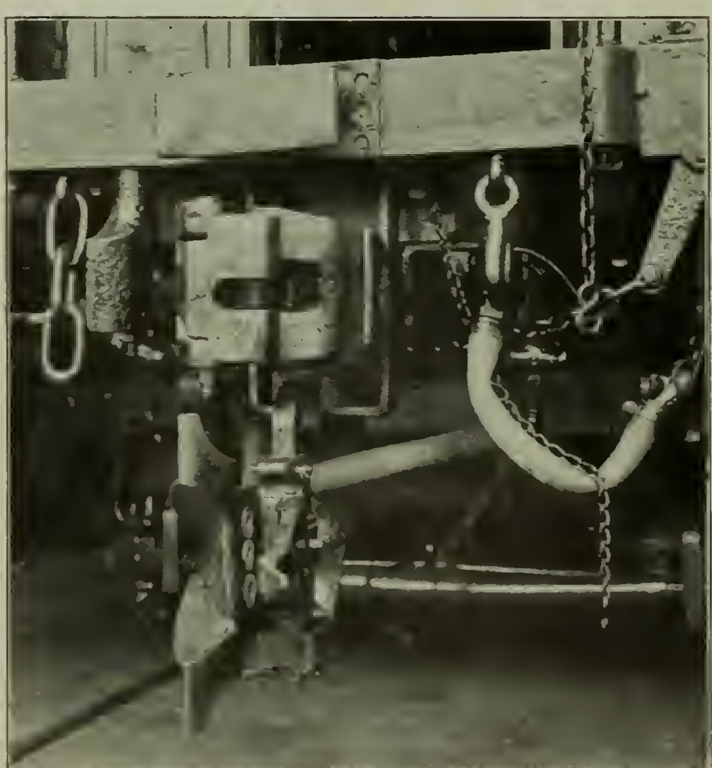
SIDE ELEVATION OF CARY AUTOMATIC COUPLER SHOWING METHOD OF COUPLING UNDER DIFFERENT CONDITIONS



SIDE VIEW OF CARY AUTOMATIC COUPLER, SHOWING CONSTRUCTION OF PARTS

at their forward ends, to facilitate coupling. The pipe coupling members may not at first lie in the same horizontal plane, and the arms will cause the members to assume the proper relative position when the cars are brought together. In the body portion of each member there is provided the air or steam passages, extending from the rear and opening in the face of the member, in which the gaskets are seated.

It will be noticed that the shoulders will not permit the gaskets to contract until each has advanced far enough to be in normal position, when the yielding arm with its spring, will force each member into position, and the shoulders, past the heel, into locking position. When the pipe coupling members are disengaged, by being pulled apart, the shoulders will cause the engaging faces to recede from each other and obviate displacement of our injury to the gaskets.

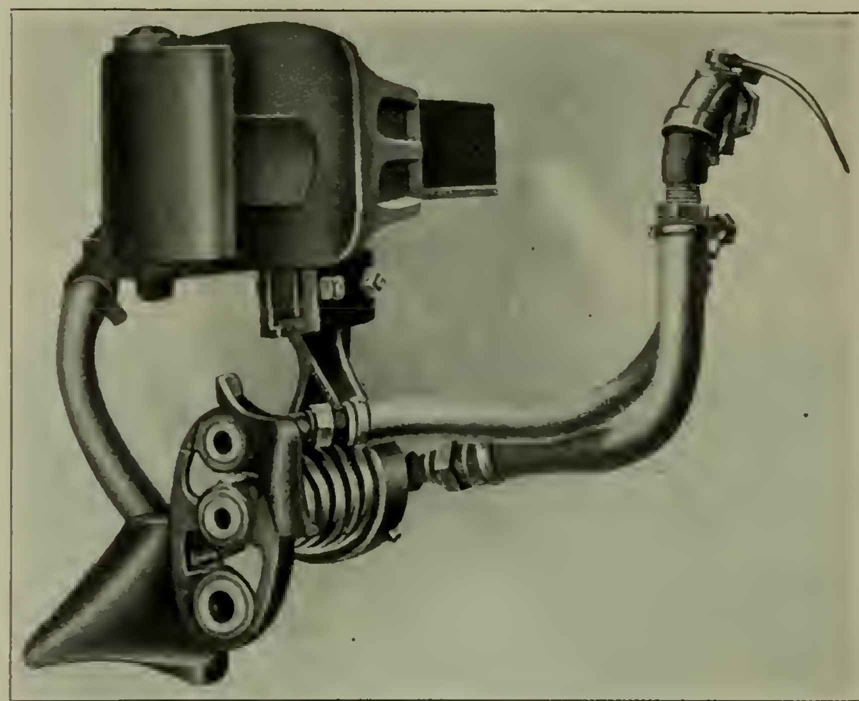


END VIEW OF CARY AUTOMATIC COUPLER SHOWING METHOD OF ATTACHMENT TO CAR COUPLER

The pipe coupling members interlock with each other automatically when the cars are coupled together, the spiral springs enabling these members to adjust themselves in proper relation to each other. The coupler being built on the side-port idea principally, is provided with sufficient adaptability to meet all the conditions now prevailing in variation of cars, and it will couple on sharpest curves. As to variation in height of cars, the apparatus will work up to the limit of 4½ inches.

FORSYTHE AUTOMATIC CONNECTOR.

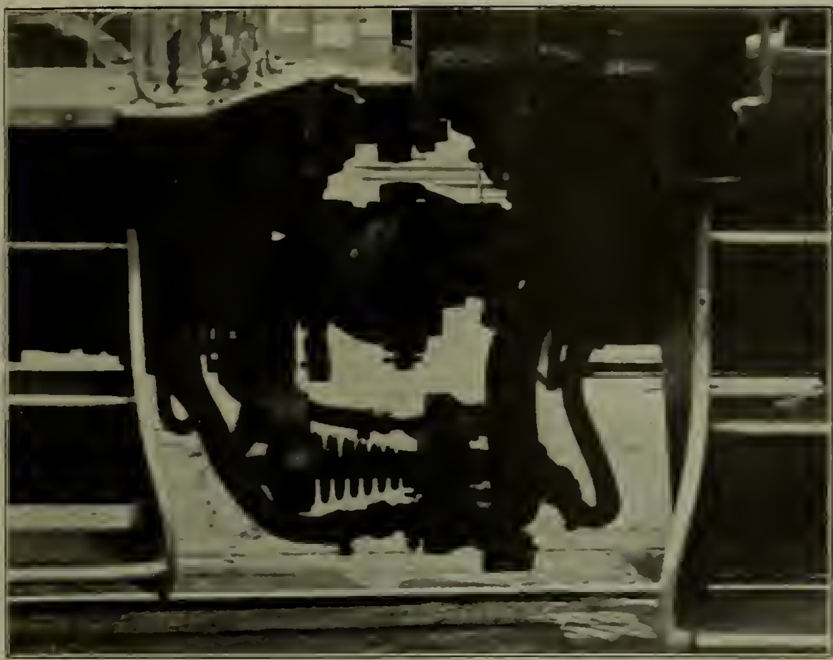
The Forsythe Automatic Connector, manufactured by the New York Air Brake Company, is designed to make a coupling of air, signal and steam pipes automatically, by means of connector heads, having face contact. Each connector head is provided with two guides which line up the connectors when the cars are being coupled and bring all pipe connections directly together. The guides



ELEVATION OF FORSYTHE AUTOMATIC CONNECTOR, SHOWING DESIGN AND METHOD OF ATTACHMENT TO COUPLER

also form four bearing points and prevent sliding of the faces of the connectors after the coupling is made. The pipe connections are all made at the back of the connector head. The connectors are suspended from the car coupler head, by means of a bracket bolted to a lug on the head and the faces of the connector heads are set 1½ inches in advance of the pulling face of car coupler knuckle. When the cars are coupled, each connector head is moved back 1½ inches against the conical spring. The compression of these springs holds the connector heads firmly together when the cars are coupled, and as the distance between the connector heads is always the same, the faces of the heads are held together with the same degree of compression under all conditions.

The connector head, spring, spring seat, etc., are held together by a special piece of pipe, one end of it being screwed into the head and the other end into an elbow to which the train pipe line is connected. The pipe is made of such a length as to bring an initial compression of one inch on the spring. This holds the parts firmly together. A key fitted at the end of the pipe near the elbow prevents the pipe from turning and keeps the con-



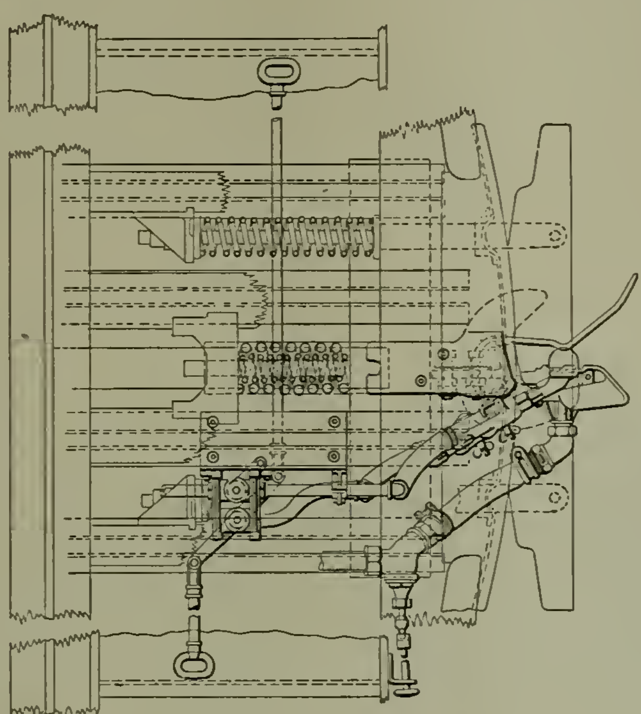
SIDE VIEW OF FORSYTHE AUTOMATIC CONNECTOR, SHOWING METHOD OF COUPLING UP TO ORDINARY HOSE CONNECTIONS

SIDE VIEW OF FORSYTHE AUTOMATIC CONNECTOR, SHOWING CONNECTORS COUPLED TOGETHER IN SERVICE

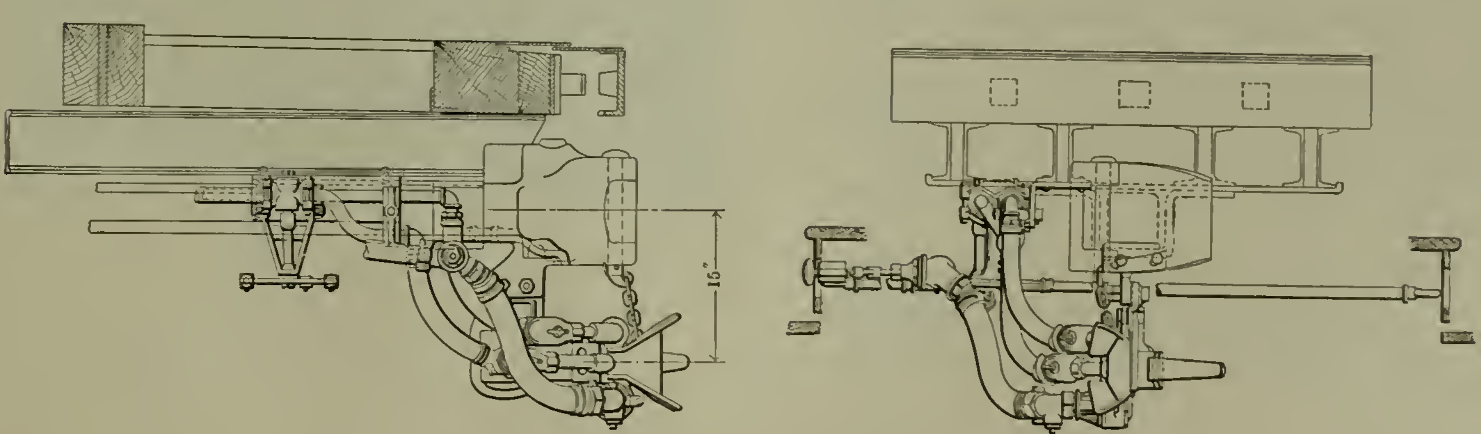
nector heads in a vertical position for coupling. The key and fingers are moved back away from the spring seats when the cars are coupled and the spring seats are revolved into ball and socket bearings, which allows the connectors absolute freedom of movement in all directions, sufficient to take care of inequalities in the height of cars, track, etc.

WESTINGHOUSE AUTOMATIC AIR AND STEAM COUPLER.

The Westinghouse Automatic Air and Steam Coupler, manufactured by the Westinghouse Automatic Air and Steam Coupler Company, St. Louis, is another design of automatic air and steam coupler for use on cars and locomotives. In this design the face of the coupler is parallel to the longitudinal axis of the car. The coupler head is supported by a hanger which is bolted to a bracket cast in the car coupler head and is held in proper position for coupling by a chain attached to the knuckle pin.



Each coupler head is provided with "V" and wedge-shaped guides and a guiding spring to bring the heads in register when coupling. The face of the heads are so designed that the gaskets of the opposing heads do not touch while coupling, until they are in register, when they are brought firmly together and held in place by means of the guiding spring. By this arrangement the gaskets are protected against wear. The pipe connections are made at the back of the coupler head by two different methods. In the first method, pipe nipples are used to connect the hose direct to the head, while in the second method the ordinary hand couplings are attached to the head and the hose from the car coupled into these. This allows the head to be readily detached when it is necessary to make a coupling with a car not equipped with the automatic coupler, while an adapter is required with the other design under the same conditions.



PLAN, SIDE AND END VIEWS OF WESTINGHOUSE AUTOMATIC COUPLER FOR PASSENGER EQUIPMENT, ARRANGED WITH INTERCHANGE COUPLING HOSE CONNECTIONS

In order to give sufficient elasticity to the supports of the coupler heads, so that the couplers will not be injured when cars are being coupled in the yards a volute spring is inserted back of the coupler support, which absorbs all shocks received by the heads during the act of coupling. The buffer hanger is made of malleable iron and all parts are designed to withstand the severest service. The bolt holes in the buffer hanger are elongated, allowing adjustment of the coupler heads to compensate for the variation in equipment.

Personal Mention

Mr. O. W. Ott, formerly with the C. B. & Q. Ry., has been appointed chief draftsman of the Oregon Short Line Railroad, with headquarters at Salt Lake City.

Mr. Joseph Bourke has resigned as general foreman of the C. B. & Q. Ry., at Lincoln, Neb., to accept the position of master mechanic for Kilpatrick Bros., railroad contractors.

Mr. James Simpson has been appointed master mechanic of the Fargo division of the Northern Pacific at Fargo, N. D.

Mr. C. M. Tritsch has been appointed master mechanic of the Maryland division of the Western Maryland at Hagerstown, Md.

Mr. J. F. Whiteford has been appointed general roundhouse inspector of the Atchison Topeka & Santa Fe at Albuquerque, N. M.

Mr. M. Parra has been appointed master mechanic of the Mexican Central at Tampico, Mex., succeeding Mr. A. G. Kirchner, mechanical foreman, resigned.

Mr. C. P. Diehr has been appointed master mechanic of the New York Central & Hudson River at Avis, Pa.

Mr. R. L. Stewart, heretofore general foreman of the Kansas City Southern, has been appointed master mechanic at Pittsburg, Kan., in place of Mr. W. B. Dunlevy.

Mr. W. H. Maddocks has been appointed assistant superintendent of machinery and equipment of the Missouri, Kansas & Texas, with headquarters at Parsons, Kan.

Mr. J. J. Hazel has been appointed master mechanic of the Broxton, Hazelhurst & Savannah, which has acquired the Ocilla & Valdosta, and will have headquarters at Ocilla, Ga.

Mr. B. Tarkington has been appointed road foreman of engines and equipment of the Midland Valley at Muskogee, I. T.

Mr. E. S. Walker has been appointed master mechanic of the Peoria Railway Terminal Company, formerly the Peoria & Pekin Terminal Railway, with office at Peoria, Ill.

Mr. C. A. Snyder, master mechanic of the Gulf, Colorado & Santa Fe at Cleburne, Tex., has been appointed master mechanic of the El Paso Southwestern at Douglas, Ariz.

Mr. R. M. Boldridge, formerly master mechanic of the Mississippi Central, has been appointed master mechanic of the Central of Georgia, with headquarters at Cedartown, Ga.

The jurisdiction of Mr. J. W. Small, superintendent of motive power of the Arizona & Colorado, the Maricopa & Phoenix & Salt River Valley and the Gila Valley, Globe & Northern, with office at Tucson, Ariz., has been extended over the Phoenix & Eastern.

Mr. William Miller, formerly master mechanic of the Denver & Rio Grande at Denver, Colo., has been appointed superintendent of motive power of the Western Maryland, with headquarters at Union Bridge, Md., to succeed Mr. I. N. Kalbaugh, resigned.

Mr. Frederick Mertsheimer, formerly superintendent of the machinery of the Kansas City Southern, has been appointed superintendent of the motive power and car departments of the Kansas City, Mexico & Orient, with headquarters at Sweetwater, Tex.

Mr. E. E. Austin has been appointed master mechanic of the third district of the Canadian Pacific, with headquarters at Nelson, B. C. The position of road foreman of the third district is abolished. The heaquarters of the master mechanic of the Pacific division have been removed from Revelstoke to Vancouver, B. C.

Mr. E. A. Westcott has been appointed assistant mechanical superintendent of the Erie Railroad, with office at Meadville, Pa.

Mr. Martin Ryan, foreman of the car shops of the International & Great Northern at Houston, Tex., has resigned and has been succeeded by Mr. M. F. Beuhring of Trinity, Tex.

Mr. Robert O'Blenis has been appointed storekeeper of the Erie Railroad at North Paterson, N. J., vice Mr. A. W. Cook, resigned. Mr. G. W. Hollister has been appointed storekeeper at Avon, N. Y., to succeed Mr. O'Blenis.

Mr. William O'Herin, superintendent of machinery and equipment of the Missouri, Kansas & Texas, has been given indefinite leave of absence to recover from injuries sustained some months ago.

Mr. R. C. White, master mechanic of the Birmingham Southern at Birmingham, Ala., has resigned to accept a similar position with the Birmingham Rail & Locomotive Co., of Birmingham.

Mr. John M. Lynch, formerly traveling engineer, has been appointed master mechanic of the Southwest division of the Chicago Great Western, with headquarters at Des Moines, Ia.

Mr. A. C. Adams has been appointed master mechanic of the Chicago, Burlington & Quincy Railway at Alliance, Neb., vice Mr. G. M. Reynolds, resigned.

Mr. M. C. Andrews, the first mechanical officer of the Boston & Maine Railroad, died at his home in Andover, Mass., May 3, 1907. Mr. Andrews was born Dec. 17, 1815, and became associated with the B. & M. soon after it was projected, taking charge of the car work about 1845. In 1866 he resigned and went to the N. Y., N. H. & H. at New Haven in the same capacity. He was elected president of the M. C. B. Association while with this road.

Roller Bearing for Cars

It is acknowledged that the present method of oiling car journals is not altogether satisfactory, as considerable care and expense is required to keep the journal boxes in proper condition. When an oil cellar is properly packed at regular intervals it will give good service, but if not systematically inspected and packed it will be liable to give trouble and cause delays from hot journals.

In order to obviate the difficulty and expense of maintaining the oil journal box, the Sharpneck Roller Bearing has been designed and put on the market by the International Anti-Friction Roller Bearing Company of Denver, Colo. The accompanying illustrations give a clear idea of the construction and arrangement of the bearing. A special journal box, having an inside circular cage, takes the place of the ordinary journal box. A series of six rollers are placed between the journal and the inside face of the cage, two annular rings holding the rollers in place. In this manner rolling contact is obtained instead of sliding friction with the usual journal and brass.

THE ANTI-FRICTION ROLLER BEARING APPLIED TO PASSENGER CAR

The rollers are of hollow or tubular form contracted midway between the ends. In the hollow ends of the rollers are arranged a series of soft flexible rawhide washers between which are arranged a series of hard inflexible washers. The soft washers absorb enough oil to lubricate the rollers for an indefinite period. After the washers have been arranged in the rollers as described steel clamping washers are placed in the ends of the rollers.

ROCK ISLAND COACH NO. 326 EQUIPPED WITH ANTI-FRICTION ROLLER BEARINGS

By alternating the lubricating and hard washers, a self lubricating anti-frictional bearing is provided which will wear and remain self lubricating for an indefinite length of time. The hard washers give rigidity and prevent undue wear and they hold the rollers in perfect line with the axle.

The car shown in the illustration has made over forty thousand miles, with no expense for lubrication , repairs or brasses and without a delay from hot boxes.

Universal Die Sinking Stand

In order to provide an appliance for faciliting hand die finishing and also to reduce the expense incident with the usual methods, The Hendricks Manfg. Co., Waynesboro, Pa., have perfected their Victor Universal Die Sinking Stand. By referring to the illustration the principal features of the device will be readily apparent.

By use of the worm and worm wheel shown, the operator can move the die toward or away from him, placing his work in any angle desired. The main head can be swung round sidewise, making an entire revolution if desired. The head is held stationary by means of a set screw. The top swivel head, in which the die shank fits, can be swung around either way and is also locked in position by means of a set screw. The main head is raised above, or lowered into base of stand by means of a screw, which permits of an adjustment of 4 inches. The height of the stand is 38 inches, diameter of base 15 inches and weight about 225 pounds.

UNIVERSAL DIE SINKING STAND

Notes of the Month

The offices of the Handy Car Equipment Co., which were formerly at 1340 Old Colony Building, have been removed to 617 Railway Exchange, Chicago.

The New York office of the Standard Railway Equipment Co. of St. Louis, Mo., has been removed from 122 Liberty street, to the new West Building, No. 90 West Street.

The Stoever Foundry & Manufacturing Co., Myerstown, Pa., announces the removal of its New York office to the eleventh floor of the new West Building.

The Youngstown Car Manufacturing Company, Youngstown, O., in order to meet the growing demand for its standard freight cars and all kinds of narrow-gauge cars, has completed plans for a new addition to its works. The improvements will include a new erecting shop of steel construction, 260 by 55 feet, in which will be installed a 5-ton crane. The contracts for this work have been awarded to the McClintic-Marshall Construction Company, Pittsburg, and the Morgan Engineering Company of Alliance, O.

The Norton Company, Worcester, Mass., and Niagara Falls, N .Y., manufacturers of grinding wheels made of alundum and other abrasive specialties, is to erect a large addition to its Worcester Works. They will extend the building designated as Plant 2 about 200 ft. in length by 111 ft. in width, which will more than double the present capacity. This will be fully equipped with kilns, mixing machines, shaving machines, etc., so as to permit of a large increase in output.

The Norton Grinding Company, Worcester, Mass., manufacturers of Cylindrical Grinding Machinery, Bench and Floor Grinding Machinery, Universal Tool and Cutter Grinders, are erecting a building which will double their present capacity.

The Graton and Knight Mfg. Co. Worcester, Mass., are sending out a plan of the Jamestown Exposition on a celluloid card and invite all who attend the exposition to make their exhibit their headquarters. Their exhibit is located in section 28, Liberal Arts building and they will have a competent man in charge to show visitors every courtesy.

The Norton Company have established a store at 48 South Canal St., Chicago, Ill.

At a special meeting of the Directors on the 7th inst., Mr. Wm. T. Dunning was elected a Director and Secretary of the Chester Steel Castings Co.

The New York office of the Standard Railway Equipment Co., has been changed to 90 West St.

Among orders recently received by the Bliss Electric Car Lighting Company, of Milwauke, is one from the Baltimore & Ohio Railroad to electrically light the Royal Blue Limited trains with the Bliss System of electric car lighting.

The general offices of the Magnus Metal Company have been moved from Buffalo, N. Y., to 111 Broadway, New York.

On the morning of May 9th., fire broke out in the plant of the Falls Hollow Staybolt Co., while the mill was in operation, the night turn just working the last heat of the night shift. Considerable damage was done to a portion of the roof of the main building, which, however, will not interfere with the operation of the mill to exceed twenty-four hours, and will not interfere with the filling of orders.

The Gould Coupler Company, New York, have recently issued a very attractive circular showing all the good points of the Gould Malleable Iron Journal Box. The illustrations are of a high order and show the construction of the journal box very clearly.

Mr. A. G. Hollingshead, who for some years past has been connected with the Standard Railway Equipment Company of St. Louis, with headquarters in Chicago, had been appointed assistant to the general manager in the sales department of the Ralston Steel Car Company, Columbus, O. Mr. Hollingshead will spend a large portion of his time traveling in the interests of the Ralston Steel Car Company, and will maintain headquarters both in Chicago and Columbus.

The Ball Chemical Company, formerly at No. 907 West Diamond street, Allegheny, Pa., has removed to the Fulton building, Pittsburg, Pa. The company has opened up a Chicago office at No. 53 West Van Buren street.

Mr. Robert C. Shaal, formerly with the General Storage Battery Company, of New York, has accepted the position of sales engineer of the Bliss Electric Car Lighting Company, as assistant to the vice-president, Col. Jno. T. Dickinson, with headquarters at the company's New York office, Night and Day Bank building, Fifth avenue and Forty-fourth street.

On May 1 the Chicago branch of Niles-Bement-Pond Company will occupy their new office on the sixth floor of the new Commercial National Bank building, Clark and Adams streets, Chicago. In this building will also be located many of the large engineering and steel companies.

Pratt & Whitney Company will abandon their show room and offices at No. 46-48 South Canal street, Chicago, and will combine their machinery sales department with that of Niles-Bement-Pond Company. The show room and stock of Pratt & Whitney small tools, and the small tools sales department, will be located on the ground floor of the new Plamondon building, Clinton and Monroe streets, where a complete line of Pratt & Whitney small tools and gauges will be carried in stock. Mr. Geo. F. Mills, who has for several years looked after the interests of these companies in the Chicago territory, will continue as manager of the Chicago offices.

Mr. C. B. Ault, who has been sales manager of the Homestead Valve Mfg. Co., Pittsburg, for the last two years, has resigned to enter another line of work, and has been succeded by Mr. P. L. Rhodes, formerly of the Pittsburg Supply Company.

A pamphlet recently issued by the American Locomotive Company is the seventh of the series which is being published by this company to include the various standard types of locomotives. As the title indicates this pamphlet is devoted to the Mogul type of locomotive and illustrates and describes twenty-five different designs of this type built for various railroads. The designs illustrated range in weight from 49,000 to 187,000 pounds, with hauling capacities adapted to a variety of road and service conditions, and the pamphlet as a whole constitutes a very complete record of the production of the company in this type of locomotive.

Mr. W. J. Dolan, who was formerly connected with the Remington Typewriter Company and more recently with the L. P. Smith Bros. of Syracuse, N. Y., has accepted a position in the sales department of The Dayton Pneumatic Tool Company, with headquarters in Pittsburg, Pa.

Technical Publications

"Locomotives, Simple, Compound and Electric."—By H. C. Reagan. Published by John Wiley & Sons, New York. Fifth edition. 932 pages, 494 illustrations. Price $3.50.

This book is written by a locomotive engineer who has compiled practical facts in regard to locomotives, intended for those especially interested in the subject. The design, construction and operation of simple, compound and electric locomotives is given in detail. Questions and answers on all points are given for the benefit of travelling engineers and master mechanics when holding examinations. The question of breakdowns and the method of temporary repairs is taken up thoroughly in regard to all types of locomotives. The four cylinder balanced compound and the superheater are treated in detail. A chapter is devoted to foreign built compound engines, showing old and new types. The electric locomotive, the electric generating plant and method of electric transmission are thoroughly discussed. The operation, method of control and the brake apparatus of the electric locomotive is taken up in the same manner as the steam locomotive. Illustrations are given for all the parts under discussion. The book is a complete treatise of steam and electric locomotive, design equipment and operation.

"Table of Volumes through Air ways"—By C. D. Kenderer. For sale by E. E. Meyer, Allegheny, Pa. Price 25 cents.

This table of volumes through air ways has been arranged on a sheet of card-board 8 by 11 inches, as a handy and ready reference for engineers who are handling problems of air transmission through large air ways. Figures are given in tabular form for the flow of air in cubic feet per minute for air ways of various sections and lengths under various rates of flow. An example is given showing the method of calculation.

"Opportunities"—By Industrial Dept., Rock Island Frisco Lines.

The Industrial Department of the Rock Island-Frisco Lines has issued a 160 page book called "Opportunities" which is calculated to be of great service to any manufacturer or business man in search of another location.

This book contains a concise write-up of each town and city along the 13,500 miles of railroad embraced in the Rock Island, Frisco and Chicago & Eastern Illinois Lines, and in parallel columns on the same page with the description of the community, is given a list of the existing openings for business houses, factories, mills and industries of all kinds.

Many new towns and cities have sprung into life along the large number of newly-constructed lines of the Rock Island-Frisco, and particularly in these communities numerous fine openings exist.

Any foundry man, iron-worker or manufacturer of machinery interested in changing his location can secure a copy by adddressing M. Schulter, Industrial Commissioner, Rock Island-Frisco Lines, St. Louis, Mo.

Railroad Paint Shop

Edited by
J. H. PITARD
M. C. Painter, M. & O. R. R.

Devoted to the Interests of
Master Car and
Locomotive Painters

Official Organ of the Master Car and Locomotive Painters' Association

In this issue is contained an excellent article on the best methods of handling passenger equipment, while passing through the shop, by Mr. A. J. Bishop of the Northern Pacific railway. We hope it may lead to a discussion of the subject, and that we may have the views and experiences and methods of others along this line. Why not help your official organ by so doing?

Some Rapid Whitewashing

The painting of large buildings by the use of spraying machines is already common, but the attachment of a similar machine to a railway car, so that it may deliver 425 gallons of whitewash an hour at 90 pounds pressure, and do its work at a speed of nearly 200 lineal feet a minute, is something new, and probably creates a speed record in the application of pigment. This is what has just been done in the tunnel of a London "tube" railway—the Central London. Says Albert H. Bridge, in The Street Railway Journal, (New York):

"To (the chief engineer) it seemed that the work of his department could be carried out far better if there were improved lighting, and further that the lighting of the tunnels would be more complete if the walls of the tunnels were whitened so as to diffuse the light, which otherwise was confined to the immediate neighborhood of the lamps themselves.

"It was evident that any whitewashing would have to be done by machine if it were to be completed within a reasonable time, as the period during which it is possible to do any work in the tunnels is limited from 1:20 a. m. to 4:20 a. m. on week-days, or to 7:20 a. m. on Sundays. It was Mr. Grove's (the engineer's) original idea to get a machine of the usual type supplied by makers of whitewashing and paint-spraying machines, and fix sprays usually hand-operated at the end of a car and imitate the hand motion as far as possible while the car was traveling slowly through the tunnel, the machine itself being driven by a motor. Some difficulty was experienced in getting the makers to depart from their standard practice, as they seemed to consider it impossible to get the intermittent motion for the pumps. While this was still under the engineer's consideration, attention was directed to a machine regularly used in the Kentish hop-fields for washing hops, and it was decided to adapt this for the purpose. The road wheels have been removed from the machine and the tank has been mounted in the car with a shaft from which a 6-horse power shunt-wound motor is driven. The pump is inside the tank. The head which carries the jets was removed and it was fixed at the extreme end of the car, twenty nozzles being added, making forty in all.

"The pump keeps the pressure at about 90 pounds per square inch, and it is found that at this pressure there is little tendency to choke if the whitewash has been thoroughly sieved. This whitewash is mixed in a large cast-iron tank which forms part of the water-softening plant in the railroad depot, and being close to the track, the car can be readily charged.

"Inside the motor-car, which was one of the Central London's own experimental multiple-unit cars, a tank was fixed holding about 1,200 gallons of whitewash, and this was connected to the small tank containing the pump. This pump keeps the whitewash churned up and well mixed, the cranks and the pump rods being all under the surface of the liquid. By means of resistances, and putting the motors in series, the car can be kept running at a speed of a little over two miles per hour, and at this rate it is possible to do about three-quarters of a mile in forty-five minutes, using about 850 gallons of whitewash and going twice over the work. Previous to the whitewashing, the same machine was used for washing down with water two or three times, so as to remove the dust which had accumulated in the course of five years.

"In practice the car goes up to the depot two or three times a night for a fresh supply of whitewash, so that as much as two miles a night have been done. It is not pretended that the finish is as good as could be secured by hand-work, but from a sanitary and lighting point of view it has practically the same effect. The labor is considerably less, of course, than required by hand operation.

"For more perfect work, it is Mr. Grove's intention, as originally proposed, to put the nozzles on a rocking frame to give them a radial movement of 18 inches or so."—The Literary Digest.

Priming, Puttying etc., before Cleaning

Editor Paint Shop:

At the approach of another convention of the Master Car and Locomotive Painters' Association, I wish to present through your columns some thought, not new but a little revised, upon a subject which to my mind is at all times an appropriate one, and one which will always command quite an amount of interest, and has always when presented brought about considerable discussion and improved method.

At the conventions of the M. C. & L. P. Association during years passed and at frequent intervals, one topic most numerously presented and possibly most thoroughly discussed, was with reference to the shops handling the cars. The cleaning, burning off, cutting in or recoloring and also the varnishing being the special features. While it is undoubtedly true that the near future will call for the painting of and the maintenance of steel constructed equipment the continued care of the old equipment will still be demanded and a service desired of as long duration as is possible. For this reason and upon the near approach of the holding of the 38th annual convention of the association I wish to introduce the old topic in a somewhat new form whereby I may cause a disturbance in the mind of my coworkers, and be a cause of a reminder that while we consider proper methods of painting new construction, we must not forget that the old still demands our attention. Some of the difficulties encountered in maintaining the old equipment will naturally appear when handling the new, and it is my aim in reviving the old topic to call to mind these necessities in connection with the new, that proper beginning may be had to if possible avoid some at least of the difficulties arising maintaning equipment in service. To introduce this subject I have reference to the benefit or advantage obtained in the shop handling of passenger car equipment. In order to do this it will be necessary to go into the matter with considerable detail. That there are benefits derived and advantages gained through mode of procedure in handling various classes of work is something which should command our attention as a thing worthy of consideration. In the handling of passenger equipment it is my opinion that we at the head of one branch of the work required may under varying circumstances secure benefit and advantage by the manner in which we handle that portion of the work assigned us. I therefore take up the presentation of the subject in the following order: First, to place a foundation for claims set forth, Second, to establish a base as other claims require for the building up of the construction of ideas embodied in the third. It should be borne in mind that in the preparation of this thought all is based upon an experience covering more than ten years, and is backed by an equipment numbering some 800 cars now in service. The following references to the handling of shop cars are applicable to those of steel construction as well as those of wood, changes of title of mechanic for repairs and possible abandonment of results by water excepted.

Taking the first or preliminary idea "Should the repairing of the body of a car be done before cleaning? I say yes. If thorough inspection is made of a car upon arrival at shops, defects may all be noted equally as well before as after cleaning. The repairs may be. and they should be done during time a car is being stripped of sash and other parts usually removed, and in majority of instances priming can also be done during this same period and thus be drying while we wait, at times, and this quite frequently second coat and even the puttying can be accomplished before the stripping is complete, it depending upon the class of equipment and the amount of repairs necessary. In any event, whatever is done during time car is being stripped is time gained, and having that advantage at least over waiting for repairs until after cleaning, that much time is saved, is gained, and the equipment placed again in service in many days shorter time, producing a more rapid and numerical output. Furthermore, repairing before cleaning may frequently avoid the necessity of a partial or additional cleaning owing to the possible soiling of the cleaned surface through repairs being done after the cleaning and even so in this demonstrating, some little advantage by time saved through repairing body before cleaning. Secondly, should the priming, second coating and puttying of the bruised or raw defects be done before cleaning? If so, what benefit is derived, or of what advantage this proceedure? Again, I have recourse to the origin of first claim, the taking advantage of the work during the stripping to gain time, and secondly the prevention of water used in the cleaning from coming in contact with the raw surfaces, thus avoiding the necessity of hours of lost time, hours of waiting for the dampness to dry out before farther successful procedure, thirdly the possibility of leveling the putty to the surface through the process of cleaning and producing a finished surface after cleaning ready for the application of color. Third, what benefit is derived or what advantage is there obtained by cutting or rubbing the old varnished surface with the stone instead of sandpaper? How is this best accomplished and why? Having stated that it was best that the repairing and the priming, second coating and puttying of all bruised and raw defects be done before cleaning for advantages claimed, it will be found that this mode of proceedure is but the preliminary step for much greater advantages, benefits and results, being repaired, primed and puttied we have reason to know that the surface is protected from farther damaging results by water, we have a surface prepared whereon results are produced that cannot only partially be had by ordinary methods. Knowing as we do that sandpaper without the use of much labor and this by practical men does not produce a level surface, that it does not cut down properly putty spots, if putty is rightly made and applied, that it does not cut away sufficiently the old varnished surface and does not produce the best surface for durable results, we resort to the other method of proceedure from which the benefit, advantages and most durable, most economical results are obtained, a result secured by using a low wage help as compared to the necessary high rate, the practical painter using sandpaper. Thus, time and money saved and better results as to durability assured, therefore we clain that there are advantages obtained and benefits derived by the use of the stone cutting or rubbing the old varnish surface that are not possible through any other method.

The mode of proceedure has been written upon by myself and was presented to our association some years ago. Little if any attention was given to this at the time and only once outside of my own little sphere have I known of it being referred to since, and that some three or more years later from away down east. However, I will endeavor to again make explanation in a little plainer and more detailed manner so that a proper understanding and a discussion may be had with a possible improvement of results. Having already scraped off all loose or scaling paint, cleaned out bruised spots with scraper, primed and puttied same the beginning of proceedure is not different to that commonly used by all. Soap and water, although a possible difference in the soap, the probable action is the same, all must use a soap of sufficient strength to remove the accumulated dirt, smoke, grease, etc., so that there is no probability of any question arising as to quality. As for our use, we take 16 bars common soap and 13 pounds sal-soda (commercial) dissolving same separately and then placing in a barrel. Add thereto, 50 gallons water. This after 24 hours forms a liquid or soft soap and is applied as is all other ordinary soap applications. The surface is then thoroughly scrubbed using brush and grade No. 1½ pulverized pumice stone to loosen and remove the dirt, etc. This is then washed off with water and is followed by the rubbing of the surface with the block stone "Results." We are all of us aware that the tendency of sal-soda or other ingredient used in emulsions or soap of sufficient strength to remove what we know as railroad dirt will to some extent soften the old varnish on the surface and if so, and of which there can be no doubt, it may readily be understood that the rubbing with the stone quickly removes this softened and loosened varnish, and leaves a surface smooth and level and as the putty as well as the surface become rubbed and leveled with some labor, we have when dampness is dried away, a surface unsurpassed for future handling. Of another thing we are also assured, and that is that there is no possibility of any soap substance being left upon the surface to cause future devilment. When we consider with this the old method of first cleaning to remove the dirt, then the wait for moisture to dry away before farther proceedure can be had we readily see the advantage of time gained, but when we upon the other hand can realize that in the waiting for the moisture to dry out that the softened and loosened old varnish has also again become dry and hard, we find ourselves placed to the necessity of hours of laborious sandpapering to remove this dead stock entailing a great loss of time and money in the extra labor required averaging something like $8.00 per car, and aside from this a loss of labor which might well have been used advantageously elsewhere, we are again made aware of the money benefit derived. Two years ago I presented a paper in convention in connection with the query. "Are cars being burned off before necessary?" I believe in my presentation of the subject I fully covered the requirements then presented and do now leave room to insert a quiry asking "Why are cars burned off?" To such a query numerous and varied replies might be brought out, however, with a view of bringing forward points desired to be presented in this paper helping possibly to substantiate the claims made, I will say that 90 per cent of the cars are burned off owing to the badly cracked condition of the surface, and here again we might make reference to the subject under discussion at our last convention, "What causes cracks and how can they be avoided?" I regret very much my inability to have taken part in the discussions at the conventions held in Washington, D. C., last year, owing to my then physical condition, part if not wholly due to the torrid atmosphere, but here in this healthful, this bracing atmosphere of this great Northwest where one's mind is clear and it is possible to keep a cool head, one may be able to concentrate his thoughts and bring them to bear upon things important, essential to good results, so that in presenting this paper I find it necessary to allude to the two subjects presented at previous conventions in order that I may be enabled to present the benefits and advantages obtained by mode of proceedure heretofore presented, as made reference to. The burning off of 90 per cent of cars is owing to the cracked condition of the surface, and as has been claimed cracking was largely due to varnish results, the benefits derived by mode of proceedure here claimed as advantageous, prevents the large accumulation of varnish upon the surface, prevents the laying on of quick drying color and elastic varnish over a perished surface or an accumulation of soft gum, and also keeping the body of the paint and varnish applied during the various shoppings at a much lower ebb, thereby avoiding largely the cause of cracks and therefore lessening the necessity of the early burning off of cars, and thus adhering to the fact that cars are not being burned off before necessary, although securing large number of years of service. It has been asked is there any way through or by which cracks can be filled or obliterated so as to avoid the necessity of burning off? Using the mode of proceedure under which this paper is presented I will say in many instances, yes, yes, a surface badly cracked may oft times be reduced in surface by proper removal of the old perished upper crust to so almost entirely obliterate the cracks, and although the surface may be colored over and revarnished two coats and the location of the cracks be slightly visible at the next shopping and car under similar treatment, surprising will be the results, and if not remembered or closely observed such a car may pass through the shopping and again go into service unnoticed and a wonder created as to how it all happened. I will here digress enough to say that it may make a difference as to the varnish used or to the length of service varnish is permitted to endure, but I am not discussing this matter at this time nor shall it be a part of this paper. I claim and I believe official records are sufficient backing, that a car treated at each shopping with the stone rubbing process will give from four to five years' longer service before the necessity for burning off is apparent, than is ever obtained by or through the old or common sandpaper method. Foundation used is well known and used by many, some with success, others with failure, so that any extra service cannot be entirely credited to the material used preparing the foundation; the painter applying and caring for same during the years is entitled to some little credit, and it is in this latter in which I claim the essential necessity for durable work, and that by the use of the block stone removing the perished varnish we derive the greater benefit and secure the advantage of a more economical and a more durable output. Records in my possession issued by the Pullman Co. dated Feb. 2nd, 1907, showing service of the paint and varnish on cars handled at our St. Paul shops and running overland through varying climatic conditions and temperatures show a number of cars now in service not burned off or repainted during 105 to 142 months, and these out of a possible 80 cars of this class, while a small few of these may now be in a fair condition for the use of the burner, assurance is assured that many will not get before the burner for another twelve to fourteen months to come. Why or how, is a record like this possible if the mode of proceedure in the handling of the cars during these years was not the prime cause of these results? These are not the results selected and presented merely through the opportunity afforded, nor that the writer might see his name in print; these are simple facts subject to investigation to inspection and willingness to abide by any finding, that these are the results obtained by the advantages gained in repairing body, priming, second coating and putting of all bruised and raw defects before cleaning and the removal of all superfluous accumulation of perished varnish by rubbing with the stone appear to me self-evident and seem to prove that the benefits derived are a more rapid output, a decreased cost in production and maintenance, a clearer surface free from cracks and blemishes, a more uniform, and a larger time service and the advantage of avoiding in a large measure unsightly cracks, unnecessary accumulation of paint, varnish and gum, and the more economical handling of equipment.

A. J. Bishop, Master Painter,
Northern Pacific, St. Paul, Minn.

Queries

The several queries asked in the February issue of the "Railroad Paint Shop" were:

1. What is the best method of maintaining the locomotive front end?

2. Should the heated parts of a locomotive be primed and finished the same as the other parts of the engine?

3. Can the paint sprayer advantageously be used in locomotive painting?

4. What, if any, are the advantages in painting a steel passenger car, over that of a wooden car.

5. In view of the increasing cost of cross ties, is it economical to treat them with wood preserves.

In attempting to reply to the above queries, it is mainly for the purpose of provoking a discussion on these important subjects. Our own views on these subjects possibly do not meet the views of all our readers, therefore it is earnestly desired that those who differ with us will write us their views for publication.

Regarding query No. 1, the most important and difficult element to be dealt with is heat; no paint has yet been discovered that will stand heat above a certain temperature, and those that are the most inflamable naturally will be the first to burn up when placed on any object subjected to as great heat as the front end of a locomotive, and especially when it is applied as it usually is, but a few minutes before the engine starts on its run.

The paints most commonly recommended for front ends, are those that have a coal tar base; such paints when heated have a tendency to melt, (which is characteristic of coal tar) and flow down and collect in a large unsightly mass immediately beneath the smoke arch, and to remove it requires much work and some thoughts, which if expressed would not appear well in print. There is no paint known that will look presentable after one trip, therefore the necessity of constant renewal would suggest the advisibility of selecting some paint that could easily be removed where it was not entirely burned away. Therefore, paints of a thick, tarry or gummy nature are the least desirable for this purpose, in fact, if the coatings burned away entirely, leaving nothing to be cleaned off, it would be far more satisfactory. This can be effected with a paint containing only sufficient oil to bind it and thinned to the consistency of a stain with turpentine, and applied as soon as the engine returns, in order to be dry when the engine enters upon its run. Paints of this character will not run and sag under the center of the smoke arch, but will burn almost entirely up, and what remains can easily be removed with a stiff wire brush.

There are instances where front ends are maintained by simply rubbing finely ground graphite or stone polish into the pores of the iron. By this method there is nothing to burn, and the rain does not affect it as much as might be supposed But under this method, it is important that the metal be first freed of all rust in order that the graphite may readily find a resting place in the pores of the iron. A front end to be maintained in this manner should be first sandblasted in order to open up the pores. Another method, and one that has some degree of merit, is to mix a strong soap solution, to which is added a small per cent. of linseed oil; this is applied with waste, and when it becomes tacky is rubbed over with dry lamp black or graphite on a piece of waste. This makes a very smooth and glossy front, and is not affected by heat nearly so much as paint of the regular order.

Regarding question No. 2, concerning the heated parts of a locomotive, the query may be answered in the affirmative, so far as the metal parts are concerned, but not including the cab if it is wood. The binder material in all paints used on the metal parts of an engine should be a good elastic varnish instead of oil, as the latter retards the work, and is more likely to blister under a high degree of heat, but where ample time can be given for drying, a small proportion of oil instead of varnish can be used with safety, and with equally good results. But in no instance should paints of a brittle nature, such as flat lead be used for priming; if lead is used there should be sufficient oil to dry with an egg shell glass, say about one fourth oil to three fourths of turpentine. Paints on heated parts if too elastic, will either shrivel or blister, and if too flat will flake off. We might answer the query by saying that the priming and other paints if properly mixed may be applied alike to the entire engine except the cab when made of wood, in which case it should be painted in accordance with the methods that usually obtain in coach painting.

Regarding question No. 3, concerning the use of the paint sprayer in engine painting, a fair test is necessary in order to demonstrate its effectiveness. There are many paints concerning which that do not appear at first sight. The first essential is a good machine, and next in importance is the regulation of the air pressure, and also the proper consistency of the paint. The paint sprayer cannot be used generally in locomotive painting; its province is limited to the engine frame, driving wheels, pilot, engine and tank trucks. These parts contain many intricate parts that cannot be reached with a paint brush, and can only be reached with the sprayer, and in about one tenth part of the time necessary to perform the same work even in an imperfect manner by hand. When the sprayer is used under full pressure or a pressure of about 100 lbs., the air within a very considerable radius becomes so densely impregnated with paint that it is practically impossible for any one, even the operator, to endure the ordeal for the space of time necessary to complete the job. This, however, can be regulated by attaching a reducing valve, and reduce the pressure to the lowest possible limit.

Another objection to some machines, is that the flow is too rapid, and the volume of paint is so great that it cannot be controlled and distributed evenly over the surface, with the result that the paint sags badly in places and presents an unsightly appearance. In order to do good work with the paint sprayer, it should be used only by an experienced painter, whose judgment and experience in the use of the brush and in the proper consistency of the paint is a necessary guide in using the sprayer. When all these conditions have been complied with there is a considerable advantage to be gained in the use of the paint sprayer in locomotive painting.

In the fourth question, regarding the advantages in painting a steel passenger car, over a wooden car, the advantage to be gained would be in the maintenance rather than in the initial painting, and in this particular the comparative cost of maintaining the paint on a locomotive and a wooden passenger car will furnish a slight idea, comparatively, as to what difference there would be in maintaining and also in painting a steel passenger car. In the initial painting of a steel passenger car, there is one feature to be encountered that does not obtain in the case of the wooden car, that of freeing the surface of rust preparatory to painting. This is a feature however that could be reduced to a minimum cost by exercising the proper care over the iron plates at the factory and priming same before rust appears. Owing to the difference in the nature of the two substances, wood and steel, much less oil would be required in painting the latter, and consequently much time would be gained, in fact the necessary drying period in no instance of any of the coatings except possibly the varnish, would exceed twelve hours, in which case no time need be lost in the various stages of the work, as the coatings could be so arranged as to dry over night, in which case the work could proceed without interruption just the same as that of the carpenter or other workmen from start to finish. This would be a welcome solution to the waiting periods for drying, which has always been a great disadvantage to the paint department as compared to the carpenter department, in which the work of building a car proceeds continuously without interruption. Another important consideration however, in painting a steel car, is that of the necessary heating and ventilating the shops in which such work is done. Steel is susceptible of a much higher degree of either heat or cold than wood, and in very damp weather when the temperature is rising, the low temperature of the iron will cause the moisture to congeal on the metal, and this in turn will not only cause an interruption of the work, but is also liable to cause very unsatisfactory work.

Proper heating and ventilation is also necessary for painting a wooden car, but owing to the comparatively high temperature maintained by the latter, even in extreme weather, and the rapidity in the change of the temperature of the same, in keeping with the atmospheric changes or conditions, would not probably affect the painting of the wooden car nearly so much as the steel car, under similar conditions. Therefore, it would seem that the steel car presents not a few advantages for the painter, both in the matter of painting and maintenance.

The fifth question, altho wholly apart from coach painting, is not unimportant in the economy of all railways, and owing to the increasing scarcity of wooden ties and the consequent increasing cost of same, and so unpromising has become the prospect of a future supply, that many roads have resorted to planting large acreages of the Catalpa tree, which is said to mature in about twenty years, and from which is obtained about thirty years service, while the average life of other ties of various kinds is variously estimated at from eight to twelve years. In the Southern states, the creosoting of cross ties, piling and telegraph posts, in recent years have attained large proportions. By this means the life of yellow pine ties is increased from eight years, which is its average life in its natural state, to 30 years, where the creosoting is properly done, and where the ties are kept covered with earth, so that they are not affected by the sun and air. At the shop of the writer, the experiment was recently made of coating the ties for a transfer pit, by dipping them into a vat of heated coal tar. It formed an excellent coating, and bids fair to add many years of service to the ties. It is very probable that coal tar as a wood preserver has been underestimated, as it not only contains a certain proportion of carbolic acid which is destructive to germ life, but it has the additional advantage of forming a water proof coating, which creosote does not. But where creosoted timber is kept submerged in water this additional coating is not entirely necessary, but on cross ties, it protects the exposed part of the tie; on this account it is preferable to creosote for preserving cross ties, and on account of its cheapness, and effectiveness, its use as a preserver on cross ties is advisable.

Secure Rooms Early.

Owing to the fact that other organizations will convene at St. Paul during the week of the Master Car and Locomotive Painters' convention, it is important that all members of the association who contemplate attending the convention should engage rooms at the Hotel Ryan (the convention headquarters), at the earliest possible moment, as it is the desire of the officials of the association, in order to facilitate the work of the sessions, to have all the visiting members possible domiciled at the same hotel. The rates are $3.00 per day without bath, and $3.50 and upward with bath.

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The Atlantic City Conventions

THE fortieth and forty-first annual conventions, respectively of the Master Mechanics and Master Car Builders Associations, were held June 12-19, 1907, at Atlantic City. The conventions were typical of the progress made by the railroads in whose interest they are held, as the sessions were more largely attended than those of previous years and the scope of the subjects considered and the interest manifested in the discussions were without precedent, showing clearly the growing importance of the associations in shaping the mechanical policy of railroads. The broad minded character of the discussions and treatment of the subjects before the associations, was a feature of the conventions just as in previous years and the recorded action will take its rightful place as the latest addition to the already valuable list of proceedings. The stamp of approval given by the railroads upon the associations was shown in the attendance, which represented the leading roads of the country and further proof of this may be seen in the publicity given the practices followed by the various railroads for the purpose of contributing information to the subjects under discussion.

The Master Mechanics Association held its convention first and in the three days' sessions covered the entire program of business. The reports of the secretary and treasurer were gratifying, as they showed the affairs of the association to be in excellent condition. The inspiring address of President Deems was an especially auspicious beginning for the convention, as his broad minded view of the problems of life and the way they should be met, created an impression which will long be remembered. The committee reports were up to the usual high standard maintained by the association, and the thorough manner of investigating the various subjects whish has characterized previous committee work, was at all times manifest in the reports submitted. With few exceptions the committees completed the investigations assigned them and the exhaustive nature of some of the reports gives a fair indication of the interest maintained in the work of the association. Under the subjects for topical discussion the apprenticeship system on the New York Central Lines attracted a great deal of attention, as the method of instructing apprentices described, offers a practical solution for this problem which has long been under consideration by the motive power departments of the leading railroads. The question of leaky flues is always one of vital interest and the individual paper by Mr. Wells on the subject was very interesting and instructive, as it brought out clearly the cause for this prolific source of delay to locomotives. The paper on shop cost systems by Mr. Lovell was also of timely interest as it presented the results of original investigations along the lines indicated, showing the practical advantages of the shop schedule in increasing output, and decreasing the cost of locomotive repairs.

The report of the committee on superheating showed that considerable progress had been made in improving the superheater for locomotive service and that from the present indications greater improvement could be expected in the future, along with a more extended use of the superheating device. In addition, the success of using superheated steam at low pressure was brought out and the possibility of a marked change in locomotive practice, if development along this line justified the outlook, from results readily obtained. The important question of proper spacing of flues in high pressure boilers was thoroughly discussed and while the wide bridge was generally favored and practice showed that better results were obtained with boilers having good circulation and slightly reduced heating surface due to the removal of a number of flues, the association did not feel warranted in making recommendations until the matter had been more thoroughly investigated. The committee appointed to consider the subject and outline the necessary tests to be made in order to definitely decide the question, should make a report next year to be followed by a series of tests at Purdue University.

J. F. DEEMS, PRESIDENT, AMERICAN RAILWAY MASTER MECHANICS' ASSOCIATION, 1906-1907.

W. E. FOWLER, PRESIDENT, MASTER CAR BUILDERS' ASSOCIATION, 1906-1907.

The convention of the Master Car Builders was held the week following the Master Mechanics' convention and all the enthusiasm and energy which characterized the first gathering was continued into the second. Through the influence of President Fowler, and the co-operation of members, the past year was one of remarkable progress and investigation for the association, as the proceedings will show. Not only were the affairs of the association improved in condition over the previous year, but the research and work of committees along various lines, touched a new mark, and stamped the year's work as the most successful and inspiring of the many which the association has enjoyed. In his address, President Fowler indicated the importance of the work of the association and pointed to the results already obtained as an inspiration to greater effort in the future. He brought out the point that the problems of the future would be more complicated than the past and for that reason greater care would be necessary in investigations as well as in employing more scientific methods. He suggested the desirability of the organization of an expert staff by the association, which would be qualified to handle such theoretical or practical investigations as would be required. The ultimate wisdom of this suggestion is apparent to all and although the time may not yet have arrived for such a move on the part of the association, the time is not far distant when the assistance of such a staff will be an actual necessity.

The cordial relations existing between the association and the Inter-state Commerce Commission was again emphasized by the presence and address of Mr. Moseley. He called attention to the value of the work of the association and the necessity of obtaining more general compliance with the adopted standards. With the sanction of the commission, the standards of the association for the protection of trainmen have been given the force of law, yet other ideas are being constantly adopted by those employed by members of the association in direct opposition to the recommendations made. The desire of the commission in seeking rather to encourage compliance with the law, than to prosecute failure to do so was emphasized.

The subjects under consideration by the various committees were rendered unusually important by the factors introduced in car construction and maintenance since the advent of heavy capacity cars and large locomotives. The report of the committee on cast iron wheels, clears up one of the most important questions which the association had to deal with and the beneficial results from the action taken will be immediate and certain. The general use of a standard wheel will not only result in greater economy, but will overcome one of the most serious difficulties with which the wheel makers have had to contend. Consideration of the report on tests of M. C. B. couplers brought out the greater need for a more satisfactory uncoupling device than the ordinary types now in use and in recognition of the importance of this, a committee was appointed to investigate the question thoroughly. A valuable report on the stresses to which wheels for 100,000 pound capacity cars are subjected, may be expected next year as Mr. George L. Fowler has undertaken to conduct a series of tests, which will throw light on the subject of which little is known. The topical discussions were all of timely interest and some of the points brought out will form the subject for future committee work.

Aside from the high character of the work performed the external features of the conventions in regard to the design and arrangement of exhibit booths on the steel pier represented a departure from former practice, which was universally appreciated by exhibitor and visitor alike.

At the Atlantic City Conventions

THE Fortieth and Forty-first Conventions respecttively, of the Master Mechanics and Master Car Builders Associations, held June 12-19, 1907, at Atlantic City, N. J., have broken all records of these two bodies, in point of attendance and the high class character of their transactions.

The two associations are to be congratulated upon the efficient work which was done in the meetings.

The exhibits were larger, more complete, more interesting in everyway, and there were by far a larger number of individual exhibitors than ever before in the history of the conventions.

Among the many prominent railway manufacturers who exhibited at the conventions were the following:

American Balance Valve Company, Jersey Shore, Pa.—American semi-plug piston valves after two years' (night and day) service over ports without bridges, semi-plug valves for simple and compound engines, Jack Wilson high-pressure slide valves for standard and for low-clearance cylinders, model of Walschaert valve gear with piston valves, model of modified Stevens valve gear with Jack Wilson internal-admission, low clearance, separately-actuated valves, giving extremely close distribution of steam. Represented by J. T. Wilson and Frank Trump.

American Brake Shoe and Foundry Company, Mahwah, New Jersey.—Steel back locomotive driver brakeshoes, steel back flanged coach shoes, steel back unflanged car shoes, steel back electric railway brakeshoes. Represented by W. S. McGowan, F. L. Gordon, F. W. Sargent, J. S. Thompson, H. S. Bradfield, E. L. Janes, E. J. Searles, C. C. Higgins, L. R. Dewey, E. B. Smith, L. J. Hibbard, Chas. Herron, F. H. Coolidge, B. H. Grundy, J. D. Gallagher and J. B. Terbell.

Anglo-American Varnish Company, The, Newark, N. J.—Samples and advertising matter. Represented by William Marshall and Franklin W. Fort.

Armstrong Bros. Tool Company, Chicago, Ill.—A full line of Armstrong lathe and planer tool-holders, Universal ratchet drills, improved tool posts for lathes, boring bars, bolt drivers for lathe and planer jacks. Represented by Paul Armstrong and John McBride.

Atha Steel Casing Company, The, Newark, N. J.—One B. R. & P. cast-steel truck bolster, one D. & H. cast-steel truck bolster, one Maine Central cast-steel truck bolster, two "Titian" steel motor gears. Represented by R. N. Barrows, G. T. Paraschos, C. W. Gennett, C. W. Owston and L. A. Shepard.

American Locomotive Company, New York.—Booth on the pier. Represented by W. H. Marshall, H. F. Ball, G. M. Basford, J. D. Sawyer and F. J. Cole.

Baeder, Adamson & Company, Philadelphia, Pa.—Model of a refrigerator car, showing the application of insulating material. Represented by H. J. Bellman and M. J. Murphy.

Bald Manufacturing Company, Pittsburgh, Pa.—The Miller quick-acting monkey wrench. Represented by Wm. Bald.

Baldwin Steel Company, New York.—Full line of Hudson high speed tools, twist drills, reamers, milling cutters, etc., Hudson high speed steels, crucible tool steel lathe tools. Represented by C. F. Simmons, J. A. Collon, Edward Milnor and W. L. Stone.

Best American Calorific Company, W. N., New York.—Oil burners and oil-burning furnaces. Represented by R. G. Wells, W. N. Best and L. D. Douglas.

Bethlehem Steel Company, South Bethlehem, Pa.—Staybolt irons, high-speed steel, special alloy steels, drop forgings and heavy machinery. Represented by W. C. Cutler, J. C. Halliday, G. J. Costello, R. D. Chapman, J. S. Hageman and O. H. Reynolds.

Bettendorf Axle Company, Davenport, Iowa.—Bettendorf I-beam bolster, Bettendorf all cast-steel truck, Bettendorf structural steel underframe with cast-steel and center-sill ends. Represented by W. P. Bettendorf, J. W. Bettendorf, G. N. Caleb, J. H. Bendixen and S. S. Shields.

Bliss Electric Car Lighting Company, Milwaukee, Wis.—Three types of axle-lighting equipments, one with Bliss constant potential bucker regulation, one with Bliss, N.

Y. C., constant potential booster regulation, one with Bliss Santa Fe constant current regulation. Various parts which go to make up the apparatus, disassembled. Types of standard car-lighting batteries. Represented by W. L. Bliss, John T. Dickinson, F. Urban, W. M. Lalor, Robert C. Shaal, L. Mau, John Bliss and Edwin H. Tower.

Boker & Company., Hermann, New York.—Intra-steel—a new semi-high speed steel, to be used as a substitute for regular carbon steel, also "Novo" steel, patent sections. Represented by Ellsworth Haring.

Bordo Company, L. J., Philadelphia, Pa.—Locomotive blow-off valves, locomotive gauge cocks and locomotive swing joints. Represented by L. J. Bordo, Edwin A. Knowlton, Edward W. Hodgkins, C. R. Weaver and C. W. Allen.

Bowser & Company, Inc., S. F., Fort Wayne, Ind.—Self-measuring hand and power pumps for handling all kinds of oils, also storage tanks and oil cabinets. Represented by C. A. Dunkleberg, W. T. Simpson and W. A. Pitcher.

Bradford Car and Manufacturing Company, Chicago, Ill. —Bradford draft gears, steel under frames, rocker bottom cars and steam and air connectors. Represented by H. C. Priebe.

Buchs & Son, A., Elizabethtown, Pa.—A gravity moulding machine. Represented by A. Buchs and C. A. West.

Buckeye Steel Castings Company, Columbus, O.—Major steel freight car coupler, Buckeye cast steel coupler, yoke and Buckeye cast steel truck bolster. Represented by S. P. Bush, J. C. Whitridge, A. H. Thomas, Geo. Broobey, G. T. Johnson and H. L. Winslow.

Buda Foundry & Manufacturing Company, Chicago, Ill. —Ball-bearing jacks up to 60 tons, locomotive jack on traversing base, ratchet track jacks, track lining-up jacks, Buda grinder with attachments for grinding Rich and twist bits, Buda replacers, Paulus track drill. Buda pressed steel hand-car wheels. Represented by W. R. Burrows, R. D. Bates, R. H. Hyland, R. M. Smith and T. J. Stocks.

Buffalo Brake Beam Company, New York, N. Y.—Solid brake-beams for all classes of equipment, forged steel brake heads, forged steel fulcrums, forged steel wheel guards, forged steel chain clips and steel backs for brakeshoes. Represented by S. A. Crone, R. C. Fraser, E. Strassburger, C. E. Barrett and E. C. Farlow.

Bullard Machine Tool Company, The, Bridgeport, Conn. —The 36-inch vertical turret lathe in operation. Represented by S. H. Bullard, J. W. Bray, Allen W. Ransom, H. C. Elliott, G. J. Stansbury, G. E. Merryweather, Charles G. Smith and W. J. Alles.

Cambria Steel Company, Johnstown, Pa.—One low side

PRESIDENT W. E. FOWLER AND FAMILY.

R. D. SMITH, W. F. M. GOSS.

MR. AND MRS. MARK A. ROSS, MRS. BRUCE V. CRANDALL AND MR. AND MRS. F. W. BRAZIER.

gondola car and one 100,000-pound capacity, Pennsylvania standard, hopper car on exhibit track. Represented by Mr. Sage.

Camel Company, Chicago, Ill.—Refrigerator car on tracks. Represented by J. M. Hopkins and P. M. Elliott.

Carborundum Company, The, Niagara Falls, N. Y.—Carborundum products. Represented by E. J. Eames, W. W. Sanderson, R. B. Fuller, C. C. Schumaker, Chas. Nicholson and C. O. Taylor.

Cardwell Manufacturing Company, Chicago, Ill.—Cardwell friction draft gear, Cardwell rocker side bearings. Represented by W. G. Krauser, C. H. Tobias and J. R. Cardwell.

Carey Manufacturing Company, The Philip, Cincinnati, O.—Carey's 85 per cent. magnesia locomotive lagging, Carey's standard flexible cement roofing, Carey's 85 per cent. magnesia sectional steam pipe covering, Carey's all-asbestos train pipe covering, asbestos paper, millboard and packings, asbestos-metallic packing and

C. A. SCHROYER, J. F. DEVOY, J. J. HENNESSEY, P. H. PECK.

E. V. SEDGWICK, S. G. ALLEN, J. S. COFFIN.

J. E. KEEGAN, ALEX TURNER.

GEO. W. WEST, F. M. GILBERT.

gaskets, standard asbestos-moulded covering, nonpareil cork covering and lagging, 85 per cent. magnesia cement, asbestos cement, asbestos fibers, asbestos cold water paints, magnesia roofing paint, etc. Represented by George D. Crabbs, Steve J. Bowling, N. S. Kenney, John G. Howley and W. I. Kelly.

Celfor Tool Company, Successor to Geo. R. Rich, Chicago, Ill.—High speed twist and flat drills in operation. Represented by Russell Dale, W. F. Heacock, and William Brewster.

Chicago Car-Heating Company, Chicago, Ill.—Vapor system of car-heating, pressure system of car-heating, steam hose couplers, vertical steam traps, horizontal steam traps, automatic train pipe valves and special devices for Baker heater. Represented by Egbert H. Gold, E. A. Schrieber, B. A. Keeler and F. F. Coggin.

Chicago Railway Equipment Company, Chicago, Ill.—Creco, National Hollow, Diamond, Kewanee, Reliance, Monarch, Sterlingworth and 96 types of brakebeams, Monitor bolsters, Creco roller side bearings for steam and street railways and Creco slack adjusters. Represented by E. B. Leigh, F. T. De Long, A. J. Farley, E. G. Buchanan, Fred G. Ely, Harry W. Frost, C. H. Williams, Jr., E. F. Leigh, B. F. Pilson, Raymond H. Pilson, H. W. Finnell, C. P. Williams and George A. Cooper.

Cleveland Car Specialty Company, Cleveland, O.—Pressed steel carlines for passenger and freight equipment.

MR. AND MRS. G. W. WILDIN.

W. F. HEACOCK, RUSSELL DALE, WM. BREWSTER.

THOS. ALDCORN.

MR. AND MRS. A. T. FRIES.

Represented by Geo. L. Weiss, W. S. Bidle, B. Haskell. J. A. Costello and Geo. B. Maltby.

Chicago Pneumatic Tool Company, Chicago, Ill.—Franklin air compressor, Boyer and Keller riveting and chipping hammers, Little Giant piston air drills in several sizes with plain and Corliss valves, turbine air drills, Duntley electric drills, grinders, blowers, hoists, compression riveter, magnetic old-man, drilling stands, etc. Represented by W. O. Duntley, Thos. Aldcorn, W. P. Pressinger, C. B. Coates, F. C. Severin, G. A. Barden, C. E. Walker, B. H. Tripp, Chas. Booth and Howard Small.

Columbia Nut and Bolt Company, Bridgeport, Conn.—Samples of the Columbia lock nuts. Represented by Fred Atwater.

Commercial Acetylene Company, The, New York, N. Y.—Acetylene safety storage system as applied to car and signal lighting, locomotive headlight, etc., car lamps and brackets, signal lamps, locomotive headlight tank cut open showing asbestos packing, tanks which went through fire on the Delaware Lackawanna & Western, railway appliances. Represented by W. P. Hix, Roger J. Faure, Oscar F. Ostby and C. N. Neilson.

Commonwealth Steel Company, St. Louis, Mo.—Models of transom draft gear for steel cars, transom draft gear for wooden cars, Davis counterbalanced locomotive driving wheel, tiregraph machine, separable body bolster for wooden cars, separable body bolster for steel cars and engine and tender trucks. Represented by

MRS. ALEX TURNER, MISS SCHULTZ, MRS. R. T. WALBANK, MRS. H. H. LINTON, MARION LINTON.

MR. AND MRS. W. E. SHARP.

Clarence H. Howard, H. M. Pflager, Geo. H. Howard and A. R. Thomas.

Consolidated Car-Heating Company, New York, N. Y.—Direct steam, hot-water and low-pressure car-heating systems, steam couplers, steam traps, steam valves, McElroy automatic electric car lighting system and electric heaters and switches. Represented by Francis C. Green, Cornell S. Hawley, James F. McElroy, Wm. H. Fulton, W. S. Hammond, Jr., S. B. Keys, C. C. Nuckols and T. M. May

Consolidated Railway Electric Lighting and Equipment Company, New York, N Y.—Showing standard D-type generator and Kennedy regulator and type F generator and A regulator, in operation, and several types of storage-battery, Kennedy system of axle lights. Represented by Patrick Kennedy, J. L. Watson, Thos. L. Maunt, Chester Terry and Barton H. Grundy.

Dearborn Drug and Chemical Works, Chicago, Ill.—Water purifying reagents and exhibit of the action of different kinds of boiler waters on locomotive boiler tubes. Represented by Robert F. Carr, George R. Carr, D. E. Cain, J. D. Purcell and H. G. McConnaughy.

Detroit Hoist and Machine Company, Detroit, Mich.—See Pilling Air Engine Company.

Detroit Lubricator Company, Detroit, Mich.—Three-feed sectional lubricator, three-feed No. 21 lubricator, with new type gauge glasses, a seven-feed No. 61 lubricator for super-heated steam locomotives. Represented by A. B. Wetmore, H. J. Lord, John Arnold and A. D. Homard.

Dickinson, Paul, Incorporated, Chicago, Ill.—Photographs and full-sized models of Dickinson cast-iron smoke jacks, ventilators and chimneys. Represented by A. J. Filkins, E. W. Hodgkins, W. A. Bither and J. A. Meaden.

Dixon Crucible Company, Joseph, Jersey City, N. J.—Dixons' silicia-graphite paint, American graphite pencils, Ticonderoga flake graphite lubricants, plumbago crucibles, pipe-joint compound, graphite air-brake and triple valve grease, and graphite greases and other graphite products for railroad use. Represented by C. H. Spotts, L. H. Snyder, J. J. Tucker, H. A. Neally, W. A. Housten, A. C. Bowles and R. A. Brown

EXECUTIVE COMMITTEE OF THE RAILWAY SUPPLY MEN'S ASSOCIATION,
L. O. CAMERON, GEO. N. RILEY, E. W. HODGKINS, W. B. LEACH, ALEX TURNER, J. E. MINOR, R. T. WALBANK, MARK A. ROSS, BRUCE V. CRANDALL.

Drouve Company, The G., Bridgeport, Conn.—Anti-Pluvius skylight and Lovell window-operating device. Represented by A. C. Bradley.

Dudgeon, Richard, New York, N. Y.—Thirty-ton Universal jacks of the railroad type, plain type and claw type; 30-ton Universal railroad jack of the independent claw type, 40-ton Universal railroad jack, 60-ton independent pump, Universal jack and test pump. Repre-

MR. AND MRS. D. C. NOBLE.

GEORGE BRYANT ON THE WATER WAGON.

sented by James W. Nelson, W. H. Maters and Frederick Tenney.

Duff Manufacturing Company, The, Pittsburgh, Pa.—Barrett track and car jacks, Duff ball-bearing screw jacks in all sizes and capacities up to 75 tons. Duff roller-bearing and cone-bearing screw jacks, Barrett and Duff journal jacks and traversing jacks. Represented by T. A. McGinley, Geo. A. Edgin and P. F. Kobbe, Jr.

Edwards Manufacturing Company, O. M., The, Syracuse, N. Y.—Models illustrating 30 designs of Edwards' window fixtures and 4 designs of Edwards' extension platform trap-door fixtures, samples showing metal windows and window-sash, Edwards' tin barrel-spring rollers, both pawl designs and the Edwards' special ratchet design, with roller brackets, both plain and worm gear, and samples of hardware showing special finishes in brass and bronze. Represented by Oliver M. Edwards, Edward F. Chaffee, Franklyn M. Nicholl, C. H. Rockwell, C. L. Eddy and George G. Norris.

Falls Hollow Staybolt Company, Cuyahoga Falls, O.—Samples of hollow and solid staybolt iron, manufactured of a blend of imported Swedish and native high-grade charcoal iron stock, samples of staybolt iron nicked in various ways, and broken to indicate the superior quality and fibrous texture of Falls Hollow and

M. A. GARRET.

THOS. PROSSER, GEO. H. BRYANT, ED. L. JANES.


F. A. BARBEY.


R. T. WALBANK.

solid staybolt iron, and samples threaded and bent double flat without fracture. Represented by C. M. Walsh, John Livingstone, F. C. Lippert and W. H. Dangel.

Farlow Draft Gear Company, Baltimore, Md.—Models of the Farlow twin-spring draft gear as applied to cars of the Great Northern Railway and Seaboard Air Line, showing the malleable iron draft sill; twin spring applied to channel draft sills for wooden under frame construction, Farlow attachments in combination with the Westinghouse friction barrel, twin-spring gear applied to cast-steel end sills, Farlow attachments in combination with the Sessions friction barrel, twin-spring gear applied to channel sills cut off from a wrecked car. Represented by I. O. Wright, Dwight F. Mallory, Bradley S. Johnson, John H. Farlow, M. A. Garrett and C. M. Garrett.

Flannery Bolt Company, Pittsburgh, Pa.—Several sizes of Tate flexible staybolts and tools for applying them to locomotive boilers. Represented by B. E. D. Stafford, J. Rogers Flannery, Harry A. Pike, W. M. Wilson and Tom R. Davis.

Franklin Manufacturing Company, Franklin Pa.—Reinforced corrugated asbestos roofing or sheathing asbestos shingles in assorted colors, asbestos building lumber, K. & M. 85 per cent. magnesia locomotive lagging.


MR CURTIS ELDREDGE, THE MAN WHO MADE THINGS MOVE.


MR. AND MRS. WILLIAM WHITE AND J. W. FOGG.

JAMES F. WALSH.

MR. AND MRS. DALE, MR. AND MRS. WM. BREWSTER, W. F. HEACOCK.

magnesia pipe coverings, asbestos pipe coverings, asbestos boards, papers, packings and textile goods, Ambler asbestos ring air pump and throttle packings, asbestos lumber smoke jacks, and asbestos roofings, 2 and 3-ply. Represented by R. J. Evans, Wallace W. Johnson, Geo. S. Stuart, Fred Alford, L. B. Melville, C. E. Wade, Chas. H. Stringer and W. C. Walsh.

Franklin Railway Supply Company, Franklin, Pa.—Franklin automatic locomotive fire door and fire door opener, Franklin driving box lubricator, Franklin flexible ball joint for steam air and oil connections, McLaughlin flexible joint, McLaughlin lock nut and Franklin journal bearing replacement jack. Represented by J. S. Coffin, A. G. Allen, B. H. Haskell, A. G. Elvin, H. S. Hayward, Jr., B. A. Krenz, J. Sinkler and Paul Weiler.

Galena-Signal Oil Company, Franklin, Pa.—Booth on the pier. Represented by J. S. Coffin, E. V. Sedgwick, Harry Hillyer, J. A. Roosevelt, William Walsh, William Holmes, E. W. Grieves, W. O. Taylor, E. G. Johnson, J. S. Patterson, J. S. Seeley and Alex Turner.

Garvin Machine Company, The, New York, N. Y.—No. 2 Garvin universal milling machine with new design dividing head, No. 22 vertical milling machine with rotary table, No. 14 vertical spindle milling machine,

JOHN T. BROWN.

JOHN RANDOLPH.

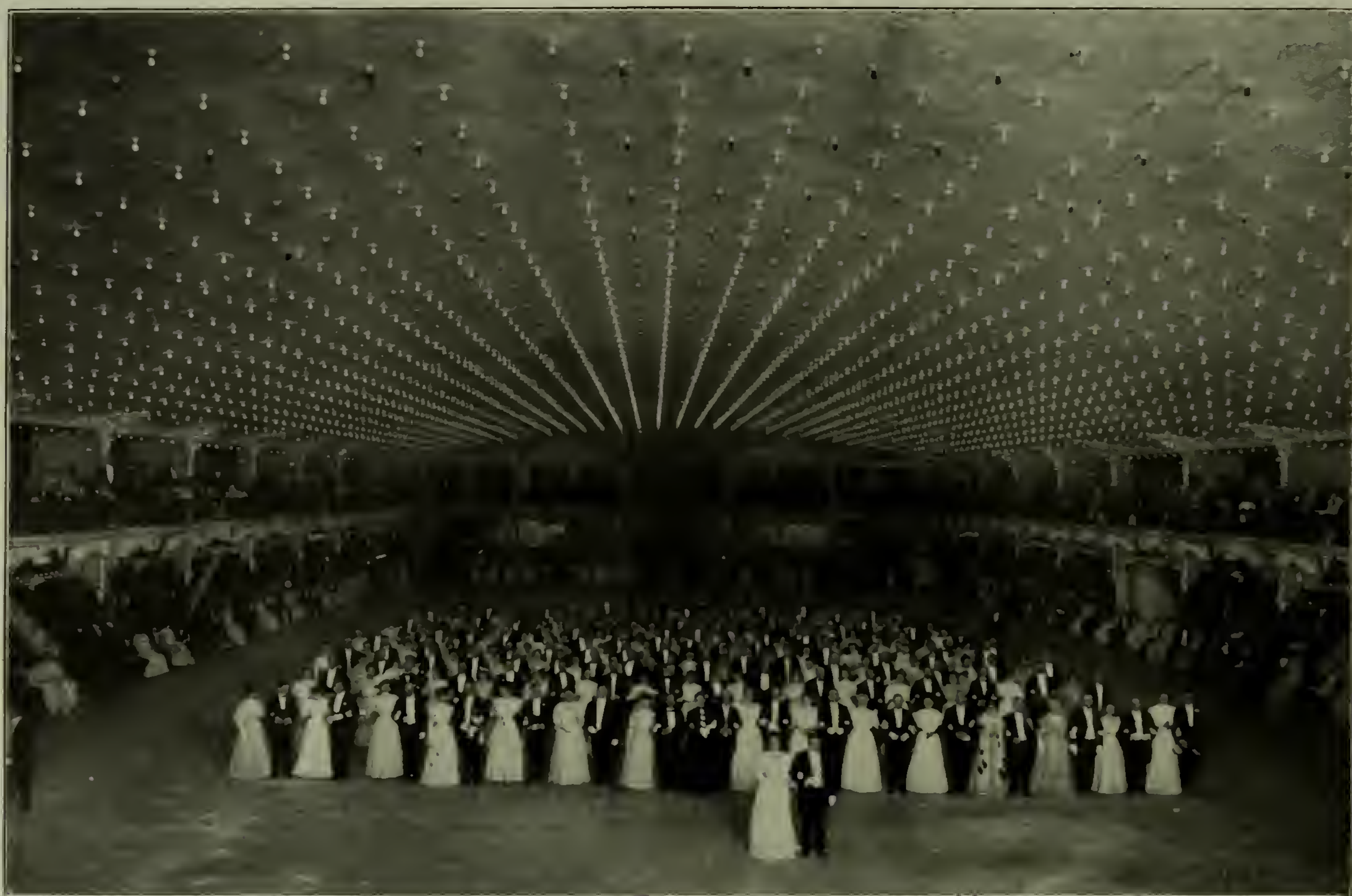
Garvin's latest pattern with adjustable rail, Garvin die slotter, four sizes of Garvin straight line milling machine vises, No. 2 Garvin automatic tapping machine, No. 14 Garvin plain milling machine in operation, motor-driven, column type millers to be provided with the Garvin solid top and extended knee. Represented by George J. Thompson and Roy Garvin.

Gisholt Machine Company, Madison, Wis.—Photographs of standard Gisholt "Big Bore" lathe, Gisholt combination lathe a chucking and bar machine with spindle capacity up to 7½ inches, Gisholt boring mills and universal tool grinder. Represented by Stanley G. Hanks, C. W. Johnson, Ellis F. Muther, J. E. Brandt.

Gold Car-Heating and Lighting Company, New York, N. Y.—Improved Gold systems of car-heating by means of direct steam apparatus as well as hot-water circulating systems, and a very simple and commendable car-lighting system using acetylene gas, improved steam couplers, automatic steam traps, temperature regulators, end train pipe valves, locomotive reducing valve, electric heaters, and refrigerator car-heating apparatus. Represented by Edward E. Gold, John E. Ward, William E. Banks, W. H. Stocks, Thomas Fildes, J. M. Stayman, J. O. Brombaugh, A. E. Robbins, Richard Voges, E. B. Wilson, Geo. F. Ivers, F. E. Weir and F. A. Purdy.

Goldschmidt Thermit Company, New York, N. Y.—Thermit for welding, repairing and re-heating molten iron; welded sections of locomotive frames, trolley rails, wrought-iron pipes, steel castings, etc.; firebrick molds for welding locomotive frames, and samples of nickel thermit, manganese, chronium, molybdenum, manganese-copper, manganese-tin, manganese-zinc, ferro-vanadium and ferro-titanium. Represented by A. M. Guenther and W. R. Hulbert.

Gould Coupler Company, New York, N. Y.—Freight couplers, tender couplers, tender buffers, steel platforms, Crown truck bolsters, Crown body bolsters, Gould bolsters, friction draft gear, buffers for stub end cars, vestibules, tandem draft gear and journal boxes. Represented by F. P. Huntley, S. R. Fuller, Jr., C. W. Gould, H. N. Loomis, T. L. McKeen and W. F. Richards.



GRAND MARCH, MASTER MECHANICS' BALL.

Greene, Tweed & Company, New York, N. Y.—Palmetto air pump and throttle valve packings, Favorite reversiable ratchet wrench, and Exacto packing gauge and cutter. Represented by H. S. Demarest, F. E. Ransley and B. M. Bulkley.

Grip Nut Company, Chicago, Ill.—A full line of square and hexagon shaped grip nuts, U. S. standard threads from ⅜-inch to 1¾-inch, and a line of semi-fininshed hexagon nuts for locomotive use. Represented by E. R. Hibbard, J. W. Hibbard, R. S. Wickersham and T. F. DeGarmo.

Hale & Kilburn Manufacturing Company, The, Philadelphia, Pa.—Car seats of all kinds, for steam railways and heavy electric railway cars, "Neverbreak" pressed steel "Walkover" seats, all-steel and fireproof upholstered seats as adopted for about 400 steel coaches under construction at the present time, and reclining and revolving parlor car chairs. Represented by H. T. Bigelow, A. F. Old, B. F. Pilson and S. A. Walker.

Hanna Engineering Works, Chicago, Ill.—Represented on pier by Thomas W. Pangborn Company, of New York, showing a pneumatic compression riveter in operation, electric and air driven screening machines, a No. 2 sand blast machine. Represented by John C. Pangborn.

Heath & Milligan Manufacturing Company, Chicago, Ill. —Reception booth on the pier. Represented by E. T. Trigg, H. O. Quest, W. R. Parker.

Helwig Manufacturing Company, St. Paul, Minn.—Helwig pnuematic staybolt clippers, Helwig reversible pneumatic motors (end spindle drills), Helwig portable pneumatic grinders, Helwig improved self-feeding flue expanders, and Helwig pneumatic hammers, for chipping, calking and riveting. Represented by J. Helwig and A. Helwig.

Hicks Locomotive and Car Works, Chicago, Ill.—Photographs and woods, one passenger coach. Represented by Geo. A. Berry, Elliott C. Smith and Geo. E. Pratt.

Homestead Valve Manufacturing Company, Pittsburgh, Pa.—Homestead valve, locomotive blow-off valve, straightway valve, 3-way valve and 4-way valve. Represented by P. L. Rhodes and W. R. Schuchman.

Hunt-Spiller Manufacturing Corporation, South Boston, Mass.—Cylinder bushings, cylinder packing, pistons, piston valve cages, piston valve packing, eccentrics, eccentric straps, driving boxes, shoes and wedges, crosshead shoes, and superheater headers. Represented by Walter B. Leach and John G. Platt.

Independent Pneumatic Tool Company, Chicago, Ill.—Thor pneumatic reversible and non-reversible piston air drills, reaming, tapping, flue rolling and wood-boring machines, pneumatic one-piece long stroke riveting hammers, pneumatic chipping calking and beading hammers, close-quarter piston air drills, pneumatic turbine wood saw and pneumatic hose couplings in operation. Represented by James B. Brady, W. O. Jacquette, R. S. Cooper, J. A. Porter, J. P. Bourke, Charles Parsons, R. D. Hurley, R. T. Scott, J. H. Davis, J. D. Hurley, A. B. Holmes, George A. Gallinger and Campbell Mathie.

GRAND MARCH, MASTER CAR BUILDERS' BALL.

Jenkins Bros., New York, N. Y.—A full line of Jenkins Bros.' radiator valves, automatic not-return valves, regular and extra heavy brass and iron body globe and angle valves, sheet packing, pump valves and gasket tubing, car-heating and air-brake discs, and Jenkins' Bros. extra heavy gate valves. Represented by Arthur C. Langston, Joseph J. Williams, Charles J. Jackson and Chas. W. Martin, Jr.

Justice & Company, Philip S., Philadelphia, Pa.—Forty-ton Reliance hydraulic jacks, 20-ton Reliance hydraulic jacks, 15-ton Reliance hydraulic car box jack, all lowered by thumb-key, and Justice spike puller. Represented by Philip Justice Mitchell and O. L. Wright.

A. H. WATTS, W. T. SMITH, J. G. PLATT.

WM. MAY, J. S. ANDREWS.

Kalamazoo Railway Supply Company, Kalamazoo, Mich. Root locomotive spring snow scraper, Moore track drills, bonding drills, with new chuck, flat drills, Kalamazoo velocopede and hand car wheels in three sizes. Represented by F. N. Root.

Kansas City Railway Foundry Company, Kansas City, Kan.—Rogers journal box, open end box, waste box and engine cellars, Fisher grain door. Represented by A. F. Reitz and J. A. Kennedy.

Kelly-Arnold Manufacturing Company, Wilkesbarre, Pa. —Automatic air and steam connector for use on passenger cars, automatic air connector for freight service, automatic device for detaching connector from draught coupler, flexible metal conduits, auxiliary connections for gum hose. Represented by George F. Royer, George E. Kelly and John J. O'Donnell.

Landis Machine Company, Waynesboro, Pa.—One 2-inch double-head bolt-cutting machine and staybolt cutter, showing staybolt machine without using the lead screw, different styles of dies for cutting special threads. Specimen of staybolt cut without using lead screw, showing accurate pitch. Numerous samples of work showing special threads and many operations of interest, capable only of being done on the Landis die. Represented by J. G. Benedict and H. L. Fisher.

Landis Tool Company, Waynesboro, Pa.—No. 16, gap grinder and No. 1½ universal grinder. Represented by T. H. King.

O. STEWART.

IN THE GOLD CAR HEATING CO.'S EXHIBIT.

J. D. HURLEY.

M. J. POWERS, N. A. CAMPBELL.

Lawrenceville Bronze Company, Pittsburg, Pa.—Malleable bronze castings, phosphor bronze ingots, journal bearings, driving boxes and side rod brasses. Represented by Edward Kerr and C. B. Ault.

Livezey, John R., Philadelphia, Pa.—Sheet and granulated cork for cold storage work and refrigerators, cork pipe covering for cold pipes, asbestos, air-cell coverings, etc., for steam and exhaust pipes, hard pressed cork for electrical insulation and flooring, models of cold-storage construction. Represented by John R. Livezey and Harry E. Souder.

Love Brake Shoe Company, Chicago, Ill.—Armbrust car and driver brakeshoes and driver brakeheads. Represented by C. W. Armbrust, H. G. Fuchs and W. H. Colebrook.

Lucas & Co., John, Philadelphia, Pa.—Comical mirrors, coach colors. Represented by William C. McMullin, E. W. Story and H. A. Clark.

Mason Regulator Company, The, Boston, Mass.—Mason locomotive reducing valves, Mason air pump governors, Mason pump pressure regulators, Mason elevator pump pressure regulators, Mason damper regulators, Mason belt shifters, Mason steam pump speed governors, Mason steam pump gravity tank regulators, Mason by-pass or water relief valves for power and electric pumps and Mason steam pump. Represented by William B. Mason and F. A. Morrison.

McConway & Torley Co., The, Pittsburgh, Pa.—Janney "X," Kelso and Pitt freight couplers, various designs of passenger car and tender couplers, Buhoup 3-stem

MR. AND MRS. J. A. LAMON.

W. R. PARKER, H. C. QUEST.

MRS. P. J. MITCHELL, MRS. D. BROWN.

MR. AND MRS. B. P. FLORRY.

passenger equipment applied to standard steel platform, and samples of miscellaneous steel castings for railroad work. Represented by E. M. Grove, William McConway, Jr., H. C. Buhoup, I. H. Milliken, Stephen C. Mason and G. W. McCandless.

Metal Plated Car & Lumber Co., New York City.—Brown metallic window strip. Represented by Garrett Burgert.

McCord & Company, Chicago, Ill.—McCord journal box, McCord draft gear, McCord spring dampener, McKim gasket force feed locomotice lubricator. Represented by J. A. Lamon, W. J. Schlacks, Clive Runnells, J. W. Cain, H. H. Newsom, D. J. McOsker, W. G. Dunham, Morrill Dunn and I. A. Randel

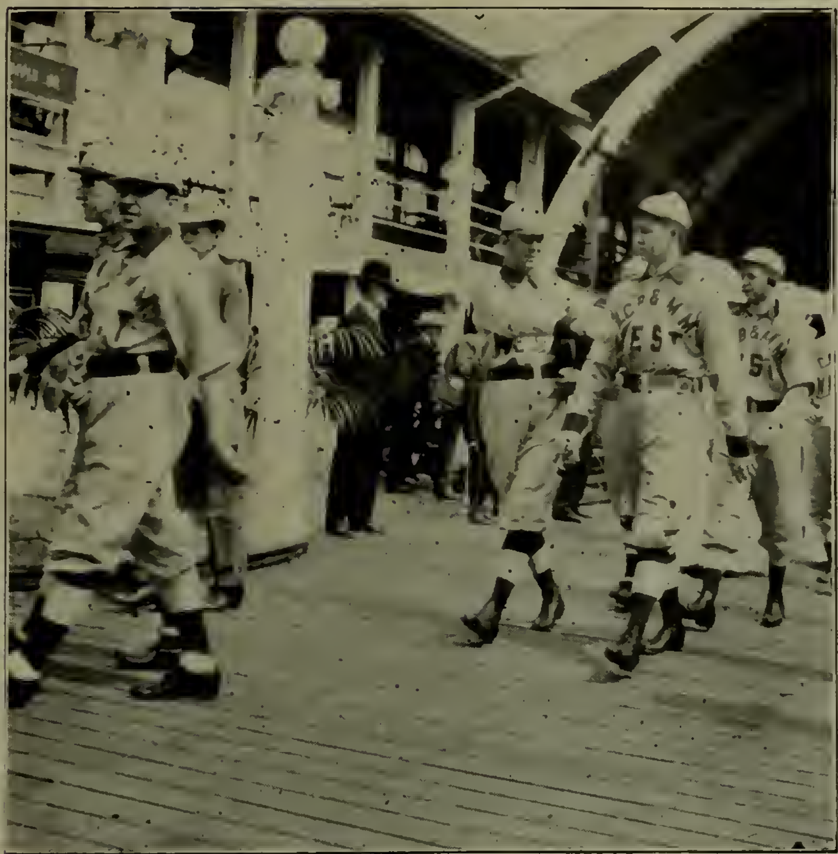
Modoc Soap Company, Philadelphia, Pa.—Soaps for cleaning cars, demonstration daily on the exhibit tracks. Represented by Henry Roever and J. D. Holtzinger.

Nathan Manufacturing Company, New York.—Injectors, lubricators, boiled checks, oil cups, steam fire extinguishers, boiler tester and washer, feed water strainers, locomotive whistles and boiler fittings, Coale muffler and safety valves. Represented by E. S. Toothe, J. C. Currie, J. E. Miner, Charles Kearns, Sanford Keeler and L. Minetree.

National Malleable Castings Company, The, Cleveland, Ohio.—Tower and Climax couplers for freight, passenger and locomotive equipment, special exhibit of coupler repair parts, special exhibit of coupler pivot

MR. FRANK A. MORRISON.

ELLSWORTH HARING, A. J. FILKINS, J. A. MEADEN.



THE "WEST."

THE BALL GAME.

pins, National safety car door fasteners. Represented by S. L. Smith, J. V. Davidson, F. R. Angell, J. H. Jaschka, J. A. Slater, K. R. Johnston, L. S. Wright, George V. Martin, H. D. Hammond, C. L. Johnson, M. C. Pilson and R. T. Hatch.

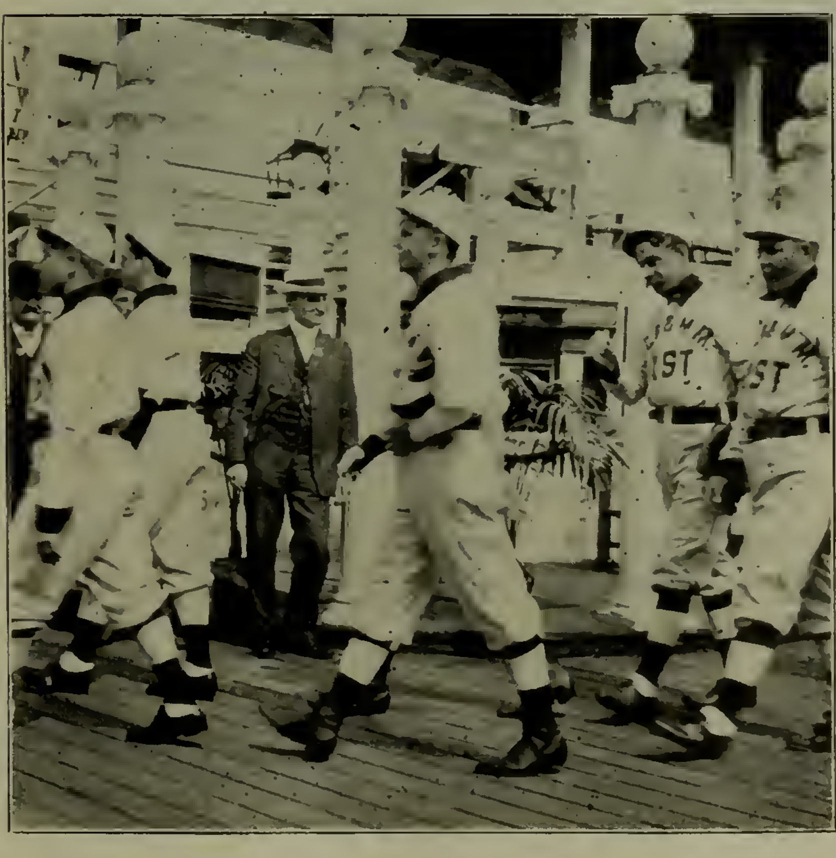
National Patent Holding Company, Chicago, Ill.—White boltless sectional piston head, Atlas side bearing, Atlas center bearing, National boiler washing system, National case hardening compound. Represented by W. White and Frederick A. Lester.

Norton Company, Worcester, Mass.—Alundum grinding wheels and specialties, India oilstones, alundum grain for polishing. Represented by George C. Montague, Arthur C. Scott and George A. Stone.

Norton Grinding Company, Worcester, Mass.—One electrically driven "gap table" grinding machine, for railway work in operation, pair of steel carwheels revolving on their journals, to show the accuracy with which these are ground by Norton wheel grinding machine. Represented by Hiram Cushworth and Hans Wickstrom.

Ostermann Manufacturing Company, Chicago, Ill.—The Ostermann grain door. Represented by R. B. Kadish.

Otis Company, Spencer, Chicago, Ill.—Tubes made by the Tyler Tube and Pipe Company, Hutchins Car Roofing Company's roofs, Solid Steel Tool Company's forgings. Represented by Spencer Otis, Wm. Baker, H. H. Hart and Wm. Latta, Jr.



THE "EAST."

THE SCORE GIRLS.

Pels & Co., Henry, 68 Broad street, New York City.—Johns' patent beam shears, Johns' patent plate shears, Werner's hand power punch, Werner's hand power bar cutter, roller trestles. Represented by Ingo Maddaus and W. L. Kerlin.

Pilling Air Engine Company, Detroit, Mich.—Locomotive turn-table mule, pneumatic geared hoists. Represented by J. C. Fleming.

Pyle-National Electric Headlight Co., Chicago, Ill.—Ladies' rest room in handsome booth on the Steel pier. Represented by Mark A. Ross, J. W. Johnson and H. W. Withington.

Rutherford Automatic Connector Company, Chicago, Ill.—Automatic connector for air, steam and signal hose on cars and engines. Represented by F. H. Rutherford and C. H. Carman.

Rubberset Brush Company, The, Newark, N. J.—"Rubberset" paint and varnish brushes. Represented by A. L. Holtzman and T. B. Denton.

Ryerson & Son, Joseph T., Chicago, Ill.—Lennox rotary bevel shear in operation, beveling steel plates, angles, etc., up to ¾ inch in thickness, motor driven, Ryerson portable automatic key seating machine in operation, cutting key-ways in nickel steel locomotive axles.

WESTERN BALL TEAM—DONALD PARSON, S. S.; C. H. CARMAN, LF.; F. W. MIDGLEY (CAPT.), IB.; J. W. TAYLOR, P.; G. A. GALLAGHER, C.; MR. JACKSON, 3B.; J. D. RISTINE, 2B.; J. M. BROWN, CF.; M. B. M'NULTY, RF.; F. O. BRAZIER, MGR.

Ralston Steel Car Company, The, Columbus, Ohio.—Ralston gondola dump car, Ralston steel underframe. Represented by J. S. Ralston, J. D. Ellison, A. G. Hollingshead, L. C. Brown, J. L. Connors, J. E. Tesseyman and C. W. Martin.

Republic Railway Appliance Company, St. Louis.—Republic friction draft gear. Represented by C. S. Shallenberger and H. T. Curd.

Rockwell Engineering Company, New York.—Oil furnaces for brass melting, flue welding, rivet heating, bolt heating, case hardening, forging, etc. Represented by F. S. Garrett and W. S. Quigley.

Cleveland vertical solid frame punch, motor driven with 36-inch throat and capacity to punch ¾-inch hole in ¾-inch material, working model of Ryerson flue cleaning machine, capacity to clean 500 boiler tubes up to 24 feet long at one time, working model of Continental boiler with Morrison corrugated furnaces. Represented by Gilbert H. Pearsall, Edward T. Hendee and Austin M. Mueller.

Safety Car Heating & Lighting Company, New York, N. Y.—Improved mantle lamps, flat flame lamps and single mantle lamp of 100-candle-power, models showing straight steam and hot water heating systems, steam couplers, traps and valves, buoy lantern. Represented by R. M. Dixon, D. W. Pye, E. F. Slocum, J. S. Henry, W. H. Hosper, Wm. St. John, Geo. E. Hulse, W. L. Garland, C. B. Adams, M. T. Elliot, H. J. McMinn, Lewis Judge, W. I. Thompson, A. Sebold and Geo. H. Chadwell.

Sellers & Company, William, Inc., Philadelphia, Pa.—Non-lifting injector and attachments operating under steam, lifting injectors, boiler checks, locomotive feed water strainer. Represented by Strickland L. Kneass, John D. McClintock and Franklin Martin.

Societe Generale des Freins Lipkowski, Paris, France.—Chapsal-Saillot's long freight train brake. The same brake is used on the Western railway of France and to be tried on the North Eastern of England. Represented by A. Saillot.

Sherwin-Williams Company, The, Cleveland, Ohio.—Locomotive finishes, car body system, steel coach finishes and enamels, varnishes and dry colors, railway specialties, rattan seat enamel, handcraft stains, metal paints. Represented by W. B. Albright, E. M. Richardson, Thomas Madill, J. H. Eames, F. A. Elmquist and E. M. Williams.

Standard Coupler Company, New York City.—Standard steel platform, Sessions standard friction draft gear. Represented by George A. Post, A. P. Dennis, R. D. Gallagher, Jr., E. H. Walker and George A. Post, Jr.

Standard Metal Manufacturing Company, Chicago, Ill.—Anti-friction S. T. B. car journal bearings, anti-friction metal. Represented by Donald C. Barbee and Carl E. Tandy.

St. Louis Car Company, St. Louis, Mo.—Sleeping car "Beulah," built for the American Palace Car Company. On exhibit track.

Standard Steel Works, The, Philadelphia, Pa.—Forged and rolled steel wheels and steel tired wheels. Represented by E. S. Lewis, H. DeH. Bright, Frank Carpenter, Charles Riddell, Oliver J. Bamford, Edward B. Halsey, George F. Jones, Harry W. Sheldon and William Penn Evans.

Stoever Foundry & Manufacturing Company, The, Myerstown, Pa.—½-inch automatic pipe threading and cutting off machine, capacity ¼ inch to 2 inches, automatic power pipe bending machine capacity 1 inch to 2½ inches. Represented by Ralph McCarty, Ed. R. Enston and A. A. Schaefer.

Storrs Mica Company, Owego, N. Y.—Copies of Storrs' calendar of railroad club and association meetings and

EASTERN BALL TEAM—L. J. HIBBARD (MGR.), SS.; T. W. DRIVER, C.; C. C. NICKOLS (CAPT.), 2B.; E. T. SAWYER, RF.; H. J. LAHEY, P.; C. L. MAHONEY, CF.; E. A. JOHNSON, IF.; BERT SELF, CF.; CHAS. MARTIN, 1B.; CHAS. ELLICOTT, 3B.

MR. AND MRS. W. B. LEACH, MR. AND MRS. H. L. LEACH, MRS. O. STEWART, ED. L. JANES, FREDRICK PARKER, CHAS. SNOW.

C. H. SPOTTS.

convention, advertising their mica headlight and caboose lamp chimneys; register for mailing list for quarterly numbers of this calendar. Represented by A. P. Storrs and Charles P. Storrs.

Stowell Manufacturing & Foundry Company, South Milwaukee, Wis.—Model of baggage car door fitted with adjustable hangers, Wilbern adjustable warehouse door hangers. Represented by D. J. Dalton and R. A. Nourse.

Symington Company, T. H., Baltimore, Md.—Symington journal boxes of various designs for standard arch bar trucks, special steel trucks, M. C. B. passenger trucks, M. C. B. electric trucks and special electric trucks, Baltimore ball-bearing center and side bearings of various designs for steam and electric service. Represented by T. H. Symington, E. H. Symington, J. F. Symington, C. J. Symington, D. Symington, W. W. Rosser, Carll Tucker, T. C. de Rosset, A. H. Weston and H. W. Baldwin.

Underwood & Company, H. B., Philadelphia, Pa.—Portable boring bar outfit for cylinders 12-inch to 26-inch diameter, two-cylinder steam or air motor for driving the above, portable rotary planing machine for flat valve seats on locomotives. Represented by A. D. Pedrick, C. O. Ralph and F. E. Emery.

E. B. GILBERT, GEO. A. COOPER.

MR. W. S. QUIGLEY AND THE ROCKWELL ENGINEERING CO., EXHIBIT BOOTH.

F. A. CASEY, E. B. GILBERT, JAMES KEEGAN, FREDRICK BAKER, FRANK ROBINSON.

Washburn Steel Castings & Coupler Company, The, Minneapolis, Minn.—Car couplers, boilers, car replacers, steel butter beams, friction draft rigging. Represented by E. C. Washburn and A. Munch.

Watson-Stillman Company, The, New York.—Hydraulic jacks, hydraulic rail benders, hydraulic crank pin presses, hydraulic bar straighteners, hydraulic wheel presses. Represented by George L. Gillon and Edward A. Johnson.

Wells Light Manufacturing Company, The, New York. —The Wells light in three sizes, the Wells standard oil gas lamp, Wallwork's patent universal electric lamp brackets. Represented by George H. E. Robinson and Howard Manahan.

Western Railway Equipment Company, St. Louis, Mo.—Acme brake slack adjusters, Western sill and car line pockets, Western brake jaws. Acme pipe clamps, Hoerr tandem draft gear, Linstrom eccentrics, Linstrom syphon pipes, interchangeable car doors, Hoerr car doors, Western truck end castings, St. Louis flush car door, Missouri car door, Downing card holders, Economy slack adjuster, Western bell ringer, car door

F. M. LAMSON, MRS. W. B. LEACH, FREDRICK PARKER, FRANK ROBINSON, CHAS. SNOW.

THOS. ROOPE.

JOSEPH T. RYERSON & SON, EXHIBIT AND REPRESENTATIVES.

fastenings, fish hook tie plates, brake jaws, tie dating nails. Represented by Louis A. Hoerr and S. H. Campbell.

Western Tool & Manufacturing Company, Springfield, O.—Expanding mandrels, adjustable reamers, portable vise stands, and tool stands, vises, tool holders, abrasive polishing wheels, scrapers. Represented by E. V. Galen and Henry Morris.

Western Tube Company, Kewanee, Ill.—Kewanee unions, Kewanee union specialties, high duty metal valves, malleable cast iron, and brass fittings, iron body valves and cocks. Represented by N. J. Higinbotham.

Westinghouse Air Brake Company, Pittsburgh, Pa.—Cross-compound steam-driven air compressor, self-locking angle cock, friction draft gear. Represented by John F. Miller, W. S. Bartholomew, E. A. Craig, W. V. Turner, R. H. Blackall, A. L. Humphrey, Joseph R. Ellicott, A. Johnson, F. T. Reese, I. H. Brown, T. L. Burton, H. S. Clark, C. C. Farmer, F. V. Green, J. P. Kelly, C. J. Olmstead, H. S. Kolseth, C. P. Cass, W. G. Clark, S. D. Hutchins, F. M. Nellis, George Westinghouse, Jr.

Wheel Turing Brake Shoe Company, Detroit, Mich.—Abrasive brakeshoes. Represented by J. M. Griffin.

M. D. FRANEY, T. H. GOODNOW.

E. A. WESCOTT, J. J. HENNESSEY.

R. P. C. SANDERSON.

JOS. DIXON CO. AND REPRESENTATIVES, MR. C. H. SPOTTS.

American Railway Master Mechanics' Association

Fortieth Annual Convention

WEDNESDAY'S SESSION.

THE fortieth annual convention of the American Railway Master Mechanic's Association was called to order by President J. F. Deems on Wednesday morning, June 12, 1904, in the music hall on the Steel Pier, Atlantic City, New Jersey. The convention was opened with prayer by Rev. Newton W. Caldwell, D. D., pastor of the Olivet Presbyterian church of Atlantic City. In a brief address, Mayor Stoy, of Atlantic City, welcomed the association and A. M. Waitt responded in behalf of the association to the address of welcome. After a few announcements by the secretary, Mr. Deems delivered the presidential address, in the course of which he called attention to the progress made in the transportation facilities of the country by saying that Omaha and Denver had been brought nearer to New York than Philadelphia was in 1764, when Benjamin Franklin used three and one half days in going the same distance by stage. In mentioning the unparalleled development of American railroads. Mr. Deems brought out that the Master Mechanics' Association had led in the endeavor which made this progress possible. He paid a tribute to the pioneers in railroad work and the solid foundation they built on, and indicated the responsibility of the present generation in maintaining the high standard of the calling as laid down by their predecessors. Continuing Mr. Deems said:

A legacy has been bequeathed, a legacy for which all preparation has been made, a legacy of opportunity which looms large in the future and awaits with rich reward the man who is prepared—the man who is prepared. We have received; what shall we give? We have inherited; what shall we bequeath, what shall we leave to aid in solving the problems of the future, many of which may be much more perplexing than those we are called upon to solve to-day? We may work in brass and steel, and leave the most perfect mechanism—we may develop and improve and evolve methods and practices until nothing more can be desired—we may reach perfection in all these, in mechanism, structure and method, and yet our bequest be a failure and itself a burden unless we provide that which is paramount, which is over and above the sum total of all of this, and for which, even to-day, events throughout the world are crying aloud—the man. A man prepared, experienced, earnest, hopeful and happy, consecrated to his work and ready to give the hand to the future.

This, my friends, as I see it, constitutes our greatest opportunity, our most imperative, our most sacred duty. If the man is provided, the machine will cease to be a burden and methods will come forth as the buds at the kiss of spring. Our own future, and the hope of that larger future which lies beyond, depends on our efforts, and our success in providing those who are to help us to-day, and upon whom at no distant day must fall our duties, our opportunities, our honors and our failures. Have we any greater, grander, more sublime obligation than this? Can we justify a pride in our life work, if we fail in this? If I can but bring to you this single message, if I can inspire you with this one thought, I am content.

REPORT OF SECRETARY AND TREASURER.

The report of the secretary showed the present membership of the association to be as follows: Active members, 819; associate members, 17; honorary members, 4; total membership, 876. The treasurer's report indicated that the financial affairs of the association were in good condition, with a sum on hand of $2,739.11. The receipts for the year were $5,530.66 and expenses $5,530.66. Both reports were received and referred to the executive committee.

ANNUAL DUES.

The recommendation of the executive committee fixing the dues of the current year at $5, the same as heretofore was approved.

Mr. J. Snowden Bell and Mr. L. H. Fry were elected associate members. Mr. W. C. Ennis, a member since 1881, and Mr. Henry Elliott, a member since 1869, were elected honorary members.

COMMITTEES APPOINTED.

The president appointed the following committees: On Correspondence and Resolutions: G. M. Basford, F. M. Whyte, L. R. Pomeroy. On Obituaries; on T. D. McDonald, E. W. Pratt; on J. L. Driscoll, Mr. McCuen; on A. Vallasnor, Mr. Sedgewick; on James Hardy, H. Trejellis; on John O'Brien, J. F. Walsh; on William Fuller, John McKenzie; on Thomas Coyle, G. W. Wildin; on J. W. Fildes, A. E. Mitchell; on M. Dunn, T. W. Demarest; on O. H. Jackson, William Garstang; on W. H. Lewis, David Brown; on D. O. Shaver, D. F. Crawford; on A. J. Cromwell, E. L. Weisberger.

In due course, Mr. W. G. Wallace, member of both the Master Mechanics and Traveling Engineers Associations, was extended the privilege of the floor as representative of the last named association and invited to take part in discussions.

REPORT OF COMMITTEES.

MECHANICAL STOKERS.

The report of the Standing Committee on Mechanical Stokers, appointed in 1905, was presented by the chairman, Wm. Garstang. As the tests of the Day-Kinkaid, Hayden and Krause stokers were not yet completed, by the various railroad companies, definite recommendations were not made as the data at hand was not sufficient for this purpose. Discussion of the report showed that a number of stokers appeared to give fair results in regard to feeding the coal to the firebox, but that mechanical weaknesses and defects in the construction of the stokers, rendered their use more or less unsatisfactory. One railroad has prepared designs of two experimental stokers and will begin tests in the near future, which will be included in the next report. The report of the committee was received and the committee continued.

TIRE SHRINKAGE AND DESIGN OF WHEEL CENTERS.

Mr. F. J. Cole, chairman of the committee on the subject named above, read the report of the committee. The recommendations made by this committee in 1905 and 1906 were received in regard to shrinkage allowance of tires; that is, shrinkage 1-80th of an inch per foot in diameter for cast iron and cast steel centers less than 66 inches in diameter and shrinkage 1-60 of an inch per foot in diameter for centers 66 inches and over in diameter. It was brought out in the discussion that a number of roads were using an increased shrinkage and that more difficulty was found with large tires on passenger engines than with the tire of the smaller engines. Mr. David Brown, (D. L. & W.) criticized the use of the lip on the outside of the tire as it was bad for shoeing and suggested that it be put on the inside of the rim of the wheel. He also called attention to the fact that the rim of the wheel centers were made narrower than they should be and that the tire should have more of a grip on the rim of the wheel than under present conditions. Mr. Cole (American Locomotive Co.) said that solid rims were preferable to parted rims and that several foundries were ready to make solid rims, so that it was possible to obtain them. In regard to the retaining ring, no particular design was recommended as there were so many styles in use, each adapted to varying practice.

LOCOMOTIVE LUBRICATION.

The next report taken up was that on Locomotive Lubrication and was presented by the chairman, Mr. D. R. MacBain (Michigan Central) who briefly outlined the work of the committee along the lines indicated by the report. For internal lubrication, 70 miles per pint for large freight locomotives and 80 miles per pint for large passenger locomotives was recommended as an amount necessary for proper lubrication. In commenting on this, Mr. A. E. Manchester (C. M. & St. P.) said that as a rule too much stress was laid on requiring a definite mileage to be made on a certain amount of oil, in order to keep down the excessive use of the same. He said that the real amount of oil required to properly lubricate an engine was a very uncertain quantity and largely governed by the skill of the engineer. Mr. W. G. Wallace (Ann Arbor) backed up these remarks by quoting his experience with engineers who made exceedingly long mileage per pint of oil and the methods they used in obtaining these results. Mr. W. G. Menzel (Wis. Central) believed that positive lubrication was necessary in order to supply the cylinders and valves regularly with the amount of oil needed. An automatic lubricator which would start when the engine does and not be dependent on the engine to start it was in line with his suggestion. Mr. J. J. Thomas (Atlantic Coast Line) suggested that a time limit be considered in apportioning the amount of oil to be allowed per mile, as much more oil would be required in making a run over a division in twenty-two hours than would be if only eight hours were consumed. The use of solid grease for lubricating driving boxes and pins was recommended as the experience with it was generally satisfactory. In closing the discussion Mr. MacBain brought out the point that an engine drifting, draws hot gases in the cylinders and burns up the lubrication, so that the walls of the cylinders and valves must be re-lubricated each time this occurs with a consequent waste of oil.

INDIVIDUAL PAPER.

THE APPRENTICE SYSTEM ON THE NEW YORK CENTRAL LINES.

A paper on this subject was presented by Mr. C. W. Cross, Superintendent of Apprentices on the New York Central Lines, who described in detail the methods employed in teaching the apprentices the use of drawing instruments and the fudamental principles of mechanics and mathematics. The paper attracted a great deal of attention and brought out an interesting discussion which showed the importance of the work and the general desire for a complete understanding of the system. The method employed is a radical departure from all other systems of education. Text books are not used and each apprentice receives direct personal instruction especially adapted to his needs. Practical shop questions are introduced and the underlying principles of mechanics and mathematics necessary to solve them are explained at the time. In this way the apprentice is taught practical lessons in a manner which appeals directly to him and he is led to follow a course of preparation which would be distasteful to him if presented in another way. Then four hours a week devoted to class work, have resulted directly in an increase of interest so that just as much work is done in the shop in the reduced number of hours and the apprentice is made a much more intelligent and capable man in the special work which he intends to follow. In the discussion which followed, the methods used in instructing apprentices on other roads were brought out by a number of men, among whom were the following: Mr. J. A. Pilcher, (N. & W.), Mr. D. R. MacBain, (M. C.), Wm. McIntosh, (C. of N. J.), and D. J. Redding, (P. & L. E.) The methods described by the gentlemen named showed that considerable variation in the plan of instruction existed on the various roads but that successful results had been obtained in each case. As the subject presented by Mr. Cross in outlining the New York Central plan attracted so much attention, the discussion was suspended until the noon hour of the following day. At that time Mr. W. B. Russell, Assistant Superintendent of Apprentices, outlined in detail the methods of instruction and some of the features of the work which have developed. Following his talk further discussion of the subject by the members took place, which showed the great interest manifest in the system of educating apprentices as followed by the New York Central. A committee was appointed to consider the development and advances made in the apprenticeship system during the coming year, in order to recommend an improvement over the present practice.

THURSDAY'S SESSION.

PROPER SPACING OF FLUES IN HIGH PRESSURE BOILERS.

The report of the committee on the above subject was presented by Mr. C. E. Fuller (C. & A.) chairman of the committee. The report gave replies from roads all over the country showing the particular practice followed in regard to spacing of flues. As the practice was at considerable variance due to different conditions, the committee did not feel warranted in making definite recommendations in the matter, but suggested that a series of tests be conducted to ascertain how much the bridges can be increased without detriment to the efficiency of the boiler, in regard to the steaming qualities and coal consumption. Following the reading of the report, Mr. John Tonge (M. & St. L.) presented a supplementary report which embodied the results of the system of flue spacing as followed on the Minneapolis and St. Louis Railway. The method consisted of reducing the number of flues in all classes of engines and arranging them in rows, slightly divergent at the bottom, which gave greater width of bridge at the bottom than at the top. The saving in cost of material and the reduction of flue trouble was also shown in detail. Mr. F. H. Clarke (C. B. & Q.) said that the question of flue spacing would have to be considered in connection with several other matters, the water used, the steaming qualities of the engine, circulation, etc. His experience led him to believe that wide bridges were not absolutely necessary when there was plenty of room between the flues and the shell, to allow for a good circulation outside the flues. Mr. H. H. Vaughan (C. P.) stated that he believed the question of flue spacing to be largely a matter of conditions as in a good water district boilers will give excellent service with 5-8 or 11-16 inch bridges, while in bad water districts bridges 7-8 inch or larger had proved advantageous. Mr. George Wagstaff (N. Y. C. Lines) said that the flue problem resolved itself into two things, good material and good care and that most of the trouble comes from the flues being filled up with cinders, etc., rather than from the spacing of the tubes. Mr. G. W. Wildin (Lehigh Valley) recommended that a boiler should be constructed for service in poor water and then it would be equally serviceable on any district on the road. Mr. J. F. Walsh (C. & O.) reported a case where a boiler with 48-inch shell had the number of flues increased from 125 to 165 and instead of getting twenty and twenty-four months service from flues only six months was obtained with the larger number. The advisability of conducting tests in the matter of flue spacing at Purdue University was discussed but the opinion prevailed that the committee be continued another year and report at the next meeting the best course to adopt in regard to settling the subject definitely.

INDIVIDUAL PAPER.

SHOP COST SYSTEMS AND THE EFFECT OF SHOP SCHEDULES UPON OUTPUT AND COST OF LOCOMOTIVE REPAIRS.

In the absence of Mr. A. Lovell (Santa Fe) the author of the paper, Mr. Harrington Emerson (American Locomotive Co.) abstracted the paper. He said the schedule itself would not reduce costs, except in cutting down the number of false moves made but it saves confusion and bunching of the work and permits the general foreman to exercise better supervision over his men. The advantages of the schedule are also shown in the way different gangs of men are worked to the best advantage, so as not to interfere with each other and permits the placing of responsibility immediately and correctly. Mr. Emerson thought that turning over shop administration to accountants was a grave mistake, as they could properly account for the way the money was spent, but were not able to say whether rightly or not. He said that the matter should be handled by those who could keep a closer check on the relation to the amount of work performed and the corresponding outlay of money or in other words use the schedule as a means of increasing the efficiency of the men and the shop. Continuing he brought out the value of knowing what the various costs in a shop were—that is the cost of direct labor, operating a certain machine, etc., as it is the only method which will enable one to know the actual cost of doing a certain amount of work and thus keep down costs down to the lowest possible point. Mr. Wm. McIntosh (C. of N. J.) described the method used in the Elizabethport shops of the Central Railroad of New Jersey in distributing the various classes of engines to certain gangs and making them responsible for their repairs when the engines are in the shop. In this way the gangs become perfectly familiar with their own type of engine and are able to handle the work quickly and to the best advantage.

REPORT OF COMMITTEES.

RESULTS OF USE OF DIFFERENT VALVE GEARS.

The report of the committee on the above subject was presented by Mr. C. A. Seley (C. R. I. & P.) and was largely a comparison between the cylinder performance of various types and makes of locomotives, equipped with the Stephenson and Walschaert valve gears. The discussion which followed showed that the Walschaert gear has given good service on all the roads which have used it and that the results in regard to steam distribution and break-downs on the road have been entirely satisfactory. Mr. F. F. Gaines (Cent. of Ga.) brought up to the point that the Walschaert gear was easy to inspect as all the parts were on the outside.

Mr. E. A. Miller (N. Y. C. & St. L.) said: In comparing the engine failures for four months of fifteen of the Stephenson link motion, eccentric motion, locomotives, with ten of the Walschaert, I will say that during that time we had twelve engine failures from some broken part of the valve gear on the eccentric engine, as compared with one failure of the Walschaert, twelve to one in four months. I think that about tells the story of the advantage of the Walschaert valve gear over the Stephenson link motion from a run of repairs and engine failure point of view. The engines with Walschaert gear had slide valves and those with Stephenson link, piston valves. In line with these remarks Mr. J. H. Manning (D. & H.) said: We have six large consolidation engines with Walschaert gear now in service, and have had them in service for eleven months, and we have not done ten cents worth of repairs, as far as putting in any pins or bushing, or anything of that kind is concerned, in eleven months. We have not done anything to them. We have twelve more which have been in operation about six months and have not done anything to them. We have fifteen heavy 10-wheelers, weighing about 130,000 pounds in fast freight service, equipped with the Walschaert gear, and they have not given us any trouble, and we think that speaks well for the Walschaert gear. We were forced to go into the large engines rather reluctantly on account of the inconvenience of inspection of the eccentrics and plates, and links, etc., but we are glad we went into it, and do not think we will get any more engines with links and eccentrics.

Experience on the Central Railroad of New Jersey with the Walschaert gear has been entirely satisfactory as the following from Mr. Wm. McIntosh will show. He says: We have a few engines equipped with the Walschaert gear, ten consolidations, very large capacity, and three passenger engines. The passenger engines we equipped experimentally, and they have been in actual operation over the mountain between Bethlehem and Scranton for a year and a half now and they have given excellent service. We are entirely satisfied with them. The freight engines were equipped largely as a matter of convenience, and have not disappointed in any way. They seem to work as well as the Stephenson link, and are more accessible and satisfactory.

BLANKS FOR REPORTING WORK ON ENGINES UNDERGOING REPAIRS.

In the absence of Mr. T. H. Curtis, chairman of this committee, Mr. E. W. Pratt read the report. Included in the report of the committee are five blank forms on which a complete record may be kept of the condition of engines from the time they require shopping within thirty days to when they are put in the shops. The additional forms include provisions for keeping account of the repairs made while in the shop. In commenting on this report, Mr. H. Emerson (American Loco. Co.) said: I am very sorry that I had not seen this paper earlier, because it is one that I find exceedingly interesting. I have, however, this criticism to make of it, that it outlines admirable records of what is going on in the shop, but it does not seem to me to be worth anything at all in determining the policy of what is impending with reference to railroad affairs. Now in looking over the repairs of a large railroad company, we find that certain divisions would suddenly go all to pieces, they would apparently be in first-class condition, and inside of thirty days there was no motive power available, all the engines in the shop virtually. That was the kind of thing we ran up against on our road, so a method was devised that took the matter very largely out of the hands of the operating officials as far as information was concerned. Every single engine was put on an efficiency basis, in the same way that the men were put on an efficiency basis. The average of all engines in the division had to average 100. If they did not average 100 it was evident that the engines were dropping backward and we would find ourselves in a hole. If on the other hand the engines averaged more than 100, on the monthly average we knew the conditions as to that division were satisfactory. In connection with that the tonnage by months for a series of years was plotted in connection with each particular division, so that it was possible to say, without asking anybody whatever, in a general way, exactly the period of the year when all the engines on any particular division would be required for very heavy service, and also the particular time of the year when it would be convenient to shop more engines from a particular division than at some other period.

Working along these lines it has been possible to plot the efficiency of the engines at any moment whatever, the efficiency of all engines on the division, and plan months ahead as to just exactly how many engines should go into the shop and to tell the master mechanic three or four months ahead—you must put so many engines into the shop next August, because if you do not put them in in August you will be in trouble in September or October, and that has introduced an entirely different method from the one with which I was formerly acquainted, for shopping and looking after engines. I believe a paper on that subject by the men who now have charge of the system, would be an exceedingly interesting one for this association at some future time.

The committee's report was accepted and the committee continued for another year to investigate along the lines indicated by Mr. Emerson.

DEVELOPMENT OF MOTOR CARS FOR LIGHT PASSENGER SERVICE.

The report of this committee was read by the chairman, Mr. H. F. Ball. The report includes data and information in regard to the various motor cars in operation in this country and abroad, and recommends the extended use of this type of car on roads where especially adapted.

TOPICAL DISCUSSION.

IS IT DESIRABLE TO ELIMINATE WATER GAUGE GLASSES ON LOCOMOTIVES TO ENFORCE THE USE OF GAUGE COCKS?

This subject was opened for discsusion by Mr. F. F. Gaines (Cent. of Ga.) who stated that he believed it was unnecessary to provide both water glasses and gauge cocks for the same purpose and pointed out the fact that good results were obtained with the use of gauge cocks and without the danger of injuring attendant on the use of water glasses. In the discussion of the subject. the consensus of opinion was favorable to the use of the water glass as an additional check on the gauge cock.

FRIDAY'S SESSION.

INDIVIDUAL PAPER.

THE CAUSES OF LEAKS IN LOCOMOTIVE BOILER TUBES.

The paper on this subject was presented by Mr. M. E. Wells (Wheeling & Lake Erie) and was of unusual interes.. In introducing the paper Mr. Wells said in part, as follows: The point is often brought out, where the bottom tubes leak more than the top tubes, that they are hotter and closer to the fire. You will note that I have quoted a test made by the Chicago & Great Western, in which the four tests shown point to the fact that the top tubes are warmer than the bottom tubes. I believe this is a fact, because there is no question in my mind but that the crown sheet is the hottest sheet in the fire box. When you come to consider that point, you will find that to be the case. Now, this is in contradiction of the customary idea that the fire line is the hottest place. I am sure you will find that a sheet set vertically to a fire is never as hot as one set horizontally over the fire, although it may be a little farther from the fire. One of the things in this paper that I want to bring out is the fact that the deterioration of the bottom tubes and the sides of the fire-box is not brought out by the fact that the sheet becomes hotter there than in any other place in the boiler, but on account of varying conditions in the water space.

There is one other point. I cannot really see where there can be much expected from cold air. I sent out to the larger railroad a list of questions, in order to get some information bearing on this subject. One of the questions I asked was, "Can cold air entering the fire-box cool the tubes and plates below the temperature of the water on the other side? Can cold air entering a fire-box cool the tubes or boiler plate, reasonably clean plates, any reasonable amount below the temperature of the water on the other side?" The majority of the men answering that question said no. When you stop and put some thought on the subject, there seems to be no other answer. You know that the influence of water on the inside of a boiler will keep sheet metal that is adjacent to it up to within a degree or two of the temperature of that water, in spite of any ordinary air condition. A large percentage of the same gentlemen who answered "no" to the question above, in giving the cause of leaky flues, gave cold air as the cause. Now, I think this has come about on account of the fact that the real cause has not been located freely, and cold air has been suggested in the absence of any better explanation.

Mr. F. P. Roesch (Southern) thought cold air had a great deal with making tubes leak and explained an experiment he conducted to show the effects of cold air on flues. An interesting discussion followed and in order to thoroughly discuss the subject, it was decided to receive written communications for publication in the proceedings.

COMMITTEE REPORTS.

PROPER WIDTH OF TRACK ON CURVES TO SECURE BEST RESULTS WITH ENGINES OF DIFFERENT LENGTHS OF RIGID WHEEL BASE.

The committee on this subject is a joint committee with the Maintenance of Way Association and due to an accident to Mr. Rose, the chairman, the committee had no report to make, but was continued until next year.

SUPERHEATING.

Mr. H. H. Vaughan (Can. Pac.) chairman of the committee presented the report, who said upon conclusion of the reading: Since writing the paper I have come to the conclusion from some facts we have learned about overheating of return bends, that the neglect of dampers has a good deal to do with the stopping up on the pipes. I do not believe the cinders will attach themselves to a cool return bend, and they do attach themselves very readily to a very hot one. We are not sure of that, but we think that is the solution.

I might say that a point has come up which I think is pointed out in the paper somewhere, but I have omitted to speak of it—that is, that there is a drop of pressure of from five to seven pounds under ordinary working conditions in the steam passing through the superheater. That makes the sight feed lubricator a better lubricator on a superheater than it is on a saturated steam engine. As a matter of fact, on account of our always having seven pounds or more difference between the boiler and steam chest in the superheater than in the ordinary simple engine, the sight feed lubricator worked just that much better instead of worse, and there is less trouble with it than there is on the ordinary engine.

As experience in regard to the superheater was comparatively limited, the discussion of the subject was practically confined to questions asked Mr. Vaughan.

A BLANK FORM TO GIVE THE HISTORY OF LOCOMOTIVE MOVEMENTS AT TERMINALS.

An abstract of the committee report on this subject was given by Mr. G. M. Basford (American Loco. Co.). In the discussion of the report Mr. F. H. Clark (C. B. & Q.) said: "We use a similar report, and have had it in service for a few years. We have found it very serviceable at times in locating delays to engines. You might probably get into a position where quick turning was necessary, and in a case of that sort I think this blank has a great many advantages. This experience was corroborated by Mr. Legrand Parish (L. S. & M. S.) saying that the Lake Shore had a similar blank which had given good results and that he thought it would be a good plan to continue its use throughout the year. Mr. H. H. Vaughan (Can. Pac.) did not believe that the blank was the proper thing to use, as the operating department could always have more engines ordered than the round house could furnish and thus make it responsible for the delay. He believed the better plan to charge up the mechanical department with the total time the engine was at a terminal and until it left the round house. Make the hours held the important item and watch that closely.

INDIVIDUAL PAPER.

LOCOMOTIVE FAILURES, RECORDS AND RESULTS OF KEEPING THEM.

A paper on this subject was read by Mr. E. W. Pratt (C. & N. W.) in the absence of the author, Mr. W. E. Dunham (C. & N. W.). In the discussion of the paper Mr. A. E. Manchester (C. M. & St. P.) thought that there would be too much delay in using the blank proposed and he favored a telegraphic report to be sent by the engineer at the first point where the train makes a stop. He also favored the use of a blank on which are reported the engine failures at the end of each 24 hours. This makes it necessary to follow up the delays closely and take quick action while the matter is still fresh. Mr. E. A. Miller (N. Y. C. & St. L.) said that a blank which they adopted two years ago whereby the engineer reports directly to the superintendent of motive power on the end of his trip the failures he had and the cause for them. By this means the engine failures were reduced more than 50 per cent in about six months.

TOPICAL DISCUSSION.

THE CORRUGATED TUBE FOR LOCOMOTIVE SERVICE, WITH THE VIEW OF BRINGING OUT THE REASONS AND ADVANTAGES OF ITS USE.

The subject was opened for discussion by a paper by Mr. G. W. West (N. Y. O. & W.) which described the results of the corrugated tube and the advantages of their use in reduction of flue troubles, live sparks from the stack and number of flues stopped up. The discussion was somewhat limited due to a lack of experience with the type of tube in question.

TOPICAL DISCUSSION.

WHAT IS THE BEST METAL FOR HUB-LINERS FOR DRIVING AND ENGINE TRUCK WHEELS AND THE BEST METHOD OF APPLYING AND THE LIMITING LATERAL HUB PLAY FOR SUCH WHEELS BEFORE REPAIRS ARE REQUIRED.

This subject was opened by a communication from Mr. J. F. Dunn (O. S. L.) who recommended the use of babbit metal applied to the face of the boxes as the best method for taking up hub wear. For lateral wear in driving boxes ⅝ of an inch is allowed and ¾ of an inch for truck boxes. The discussion of the subject was very general with widely different opinions in regard to the merits of babbit and bronze as hub liners. It may be said that babbitt was favored by the majority but the method of casting liners and brass integral, for driving boxes, as followed on the Lake Erie and Western has given excellent results. Mr. M. D. Franey (L. S. & M. S.) described this method as follows: "Some months ago I was delegated to investigate the method in use on the Lake Erie & Western, the method that was outlined and introduced by Mr. Hill at that point. It consists of pouring the driving box shell in the driving box proper. The shell is poured into the box and held in place by dovetails going through the upper portion of the driving box. These projections on the box or recess in the box, are slotted so as to form a dovetail. The interior of the box is then heated in the crown so that the lower portion, or free portion, expands probably ⅜ inch. A cast iron former is used for the circular portion of the brass and the brass is buried between the box and the former. We adopted the practice on our road, and it is our experience in pouring the brass that if the brass cools in the box it has a tendency to draw the box together on the lower portion. Where we pressed the press into the box in the customary method it would expand the box possibly one-eighth inch or more. In the method of pouring the brass of the shell into the box it has the opposite effect. When the brass and box cool we find the free end is drawn together about 1-16 inch. It has a double advantage. We find with this method it is possible to pour the brass at a lower temperature than when it was poured in the sand holes, and there is not the same tendency to segregate. It holds up better and gives a better ground and fracture and better bearing metal. We find in pressing the brass out that it requires from 80 to 100 tons to press one of these shells out of the driving box, notwithstanding that objections have been raised to the method on account of the claim that it does not give an equal bearing surface between the brass of the shell and the box. It is our experience that it does give that bearing surface. In addition, we pour the hub liner on the box at the same time we pour the shell, making the shell and the hub liner continuous. Where we use a steel box we pour the side-liners over the shoes and wedges and we are extending it to the pouring of liners in our eccentric straps. We find it gives a much better bearing than the same metal and same mixture poured in a sand mould, and find a definite saving in adopting this practice over the method of machining brass and pouring that into the box.

TOPICAL DISCUSSION.

RELATIVE MERITS OF OUTSIDE AND INSIDE DELIVERY PIPES IN CONNECTING WITH LOCOMOTIVE INJECTORS.

The discussion was opened with a paper by Mr. Strickland L. Kneass (Sellers Co.) who advocated the inside delivery pipe for mechanical and economical reasons, quoting the experience of the roads who used the inside pipe and the advantages they found from its use. The paper contained a great deal of valuable information, and was listened to with attention but was not discussed.

ELECTION OF OFFICERS.

The following officers were elected for the ensuing year: president, William McIntosh; first vice-president, H. H. Vaughan; second vice-president, G. W. Wildin; third vice-president, F. H. Clark; treasurer, Angus Sinclair; executive committee, C. A. Seley; F. M. Whyte; John Howard; A. E. Mitchell.

After the election of officers Mr. Mark A. Ross, in his usual graceful manner presented Mr. J. F. Deems with the past president's badge, which was as gracefully accepted by Mr. Deems.

Master Car Builders' Association

Forty-First Annual Convention

MONDAY'S SESSION.

THE forty-first annual convention of the Master Car Builders Association met in the music hall on the steel pier, Atlantic City, New Jersey, June 17, 1907. President W. E. Fowler called the meeting to order at 10 o'clock and the exercises were opened with prayer by Rev. Newton W. Caldwell, D. D., pastor of Olivet Presbyterian church. In his usual characteristic manner Mayor Stoy welcomed the members of the association and visitors to the city and Mr. F. W. Brazier replied to the address of welcome on behalf of the association.

President Fowler then delivered the annual address in which he called attention to the remarkable progress being made by the railroad companies in keeping up with the growth of the country and the part which the Association has had in that work. He reviewed the reports of the committees and pointed the results which had been accomplished.

REPORT OF SECRETARY AND TREASURER.

The secretary's report showed a total present membership of 614, composed of 377 active, 249 representative, 14 associate and 15 life members. The total number of cars represented by the association is 2,254,397 an increase of 207,070 over last year.

The report of the treasurer, John Kirby, showed a balance on hand of $6,640.69 and that the treasurer had not been called upon to furnish any money to the Association during the year.

ANNUAL DUES.

The action of the executive committee in fixing the annual dues at $4 per vote was approved.

After all the routine business was disposed of, the president called upon Mr. E. A. Moseley, secretary of the Interstate Commerce Commission for his usual address which has been a feature of the conventions for a number of years. In his address Mr. Moseley brought out the fact very forcibly that the government was not so anxious to prosecute violations of the law as to acknowledge and encourage all efforts to comply with the law. He gave a detailed account of the number of prosecutions for failures to comply with the law which showed that a large majority were for defects in the uncoupling device which could have been repaired for a comparatively small amount. At the close of the address Mr. J. J. Hennessey on behalf of the Association thanked Mr. Moseley for his address and assured him that it was the intention of the Association to cooperate with the Commission in their work.

By a unanimous vote Mr. John T. Chamberlain was elected a life member of the Association. Mr. Chamberlain has been a member since 1883 and served as president in 1900-1901.

REPORT OF COMMITTEES.

REVISION OF STANDARDS AND RECOMMENDED PRACTICE.

The report of the committee on Revision of Standards and Recommended Practice was presented by Mr. C. A. Seley (C. R. I. & P.) in the absense of the chairman, Mr. T. S. Lloyd. In order to save time, the changes recommended by the committee were considered by subjects. Most important changes suggested and adopted will be considered briefly.

In regard to standard journal boxes and contained parts the recommendations made and referred to letter ballot are as follows: For 5 by 9 inch journals, the inside dust guard restored at top and joined to inside wall with 3 inch radius; the opening in outside wall be enlarged at side and struck with 4 inch radius; the distance from center of box to inside of key lug increased 1-16 of an inch and inside bearing lugs narrowed 1/8 of an inch in order to make the application of brasses and wedges more easy. A lip be placed on the inside bottom of the opening for lid corresponding changes were also adopted for the 5½ by 10 inch journal box, with the exception of the last item.

The following changes in the design of axles were recommended and adopted. The radius between wheel seat and collar inside the hub, he changed from 1/8 to 3/4 inches and the fillet made coincident with face of wheel. The radii between dust guard and wheel seat changed from 1/8 to 1/4 inches.

A new drawing was recommended showing the essential dimensions governing the face and lugs of the brake head. The outer edge of the brake shoe to be rounded off like the inner edge and the face made flat, so that all shoes will be the same, thus obviating rights and lefts.

In considering specifications for standard brake beams, the distance from center to center was changed from 60½ to 60¼ inches and the distance of 51 inches from center to center of safety hangers approved. Two standard locations of the lever pin hole at 2 and 3 inches in front of the top of the brake-head lugs were adopted.

For hand brakes, the recommendation that a chain of 3/8 inch straight links was adopted, and that a machine bolt be used instead of a eye bolt to attach the chain to the brake mast.

TUESDAY'S SESSION.

COMMITTEES' REPORTS.

RULES OF INTERCHANGE, INCLUDING REPORT OF ARBITRATION COMMITTEE ON REVISION OF FREIGHT AND PASSENGER CAR RULES AND PRICE FOR REPAIRS OF STEEL CARS.

The "Arbitration" committee before submitting their report, met with a number of representatives of some of the prominent railroads and modified the report. The recommendation on page 2 in regard to advertisements on cars be considered, making the delivering company responsible for damages to cars due to unfair usage and liable to the cost of removing advertisements from cars. The date for final equipment of cars with M. C. B. standard air brake hose was extended from March 1, 1908, to September 1, 1908. In regard to the matter of handling cars not equipped with air brakes, it was recommended that, cars in interchange be not accepted without air brakes after September 1, 1907, and that loaded cars in interchange be not accepted after July 20, 1907, unless homeward bound. The committee recommended that, on and after September 1, 1908, all cars not originally equipped with retaining valves, owners responsible. It was suggested that the president appoint a committee to confer with the accounting officers to prepare a suitable rule or decide on the entire removal of rule 98.

TRIPLE VALVE TESTS.

The report of the committee on Triple Valve Tests was read by the chairman Mr. A. J. Cota (C. B. & Q.), and stated that it would be impracticable to conduct a series of tests which would revise the present code until the opportunity of conducting the tests on the new M. C. B. 100 car rack is obtained.

BRAKE SHOE TESTS.

The report of the committee on Brake Shoe Tests, as given by the chairman, Prof. W. F. M. Goss was preceded by a synopsis of the past work of the committee, arranged and presented by Mr. F. W. Sargent (American Brake Shoe & Foundry Co.). In introducing the report of the committee, Prof. Goss described the method used in testing brake shoes in the testing machine at Purdue by saying: "The provisions are such that our brake shoe testing machine may now be started and kept in continuous motion, the brake being applied, say 200 revolutions of the wheel, and then automatically released during 600 revolutions of the wheel, thus allowing a chance for the wheel and the shoe to cool, and after the 600 revolutions have been completed another application for 200 revolutions follows. In this way it is possible to secure a rather rapid wearing of the shoe, and in a single day's run enough reduction in weight of the shoe can be secured to give a satisfactory measure of wearing qualities."

In discussion of the report, Mr. G. W. West (N. Y. O. & W.), said that he considered the laboratory tests of brake shoes incomplete until checked up by service tests on the road. Mr. R. P. C. Sanderson (S. A. L.), considered the laboratory tests as reliable means for ascertaining the service of one brake shoe in comparison with another as all the uncertain and unequal elements of the road test are eliminated. Prof. Goss raised the question as to the advisability of determining the wear of brake shoes as well as the frictional qualities and it was voted that the committee when conducting future tests obtain data on both points. Mr. D. F. Crawford (Penna. Co.) believed that laboratory and road tests were both necessary in order to obtain all the information in regard to brake shoes as good laboratory records were not always borne out by the results of road tests. Mr. W. R. McKeen, Jr. (U. P.), suggested that the relative wear of the wheel be obtained as well as that of the shoe, and upon motion the suggestion was incorporated in the recommendations made to the committee.

TESTS OF M. C. B. COUPLERS.

In the absence of the chairman, R. N. Durbrow, Mr. R. S. Kleine (Penna. Co.) read the report of the Committee on Tests of M. C. B. Couplers. The committee's investigation of breakages and failures of steel couplers were conducted in a thorough manner and the results of the tests made constitute a valuable report on the question of coupler design. An examination of approximately 5,000 broken steel couplers and 3,000 broken steel knuckles, together with their locking device were made and the suggestions made were based on the defects observed. Mr. F. W. Brazier (N. Y. Cent.) said that within 30 days on the New York Central 2,492 couplers were broken, which shows not enough attention is being paid to the recommended practices of the association. He condemned the custom of buying repair parts from companies which did not make the original part, as they were frequently of different design and when applied would make the coupler inoperative. Mr. J. J. Hennessey (C. M. & St. P.) questioned the advisability of having 2½ inches clearance between the horn of the coupler and the face plate, as he believed that the shock of switching, etc., should be partly borne by the horn of the coupler in order to relieve the center sills of excessive strains. Mr. C. A. Schroyer (C. & N. W.) considered the amount of motion allowed a coupler was of importance on account of the effect of too much motion on the uncoupling device, in bending the arm, breaking the chain, clevice, etc. In discussing the proper amount of side clearance for couplers a number of opinions were expressed in regard to the merits of large or small clearance. Mr. Wm. McIntosh (Cent. R.) R. of N. J.) said that a number of cars having 3 inches side clearance had operated successfully for two years and he believed that the practice was the best considering all conditions. Experience of the same nature was quoted by Mr. T. H. Rassum (B. & O.) who believed that it was time more lateral movement was given all couplers, as it would do away with the use of temporary couplers on short curves, and reduce the excessive wear on the collars of the large journal. Although there were arguments raised to show the advisability of having a reduced coupler side clearance the general opinion expressed was for more clearance than past practice dictated. On motion of Mr. Schroyer, a committee was appointed to co-operate with the committee on Couplers to investigate the subject of uncoupling devices, with the intention of determining the simplest and most effective design.

REVISION OF RULES FOR LOADING LONG MATERIALS

The report of the Committee on Rules for Loading Long Materials was presented by the Chairman, Mr. A. Kearney. No radical recommendations were made, the report consisting principally, of suggestions in regard to typographical errors existing in the rules and certain corrections in the text involving the transposing of rules with their cuts in order to more properly group the rules for convenience in reference. The report of the Committee was received and referred to letter ballot.

CAST IRON WHEELS.

The report of the committee on Cast Iron Wheels was read by the chairman, Wm. Garstang (C. C. C. & St. L.). The committee recommended an increase in the width of flange and tread of 33 inch wheels for 60, 80 and 100,000 lb. capacity cars, in order to strengthen the design in accordance with the results of experience. About 15 pounds of metal was added to each wheel by reason of the changes made. In the discussion of the report the question of broken flanges, their cause, etc., was entered into generally and several views expressed. Mr. J. J. Tatum (B. & O.) thought that the limit on flange wear for 60 and 80,000 capacity cars should be 1 inch and for 10,000 capacity cars 1 1-16 inch as the higher limits proposed would result in a reduced mileage from wheels and without a great decrease in the factor of safety. His experience had been that more flanges were found broken with a full or almost full flange than those with worn flange below the limit. On the Pennsylvania Railroad the number of broken flanges on 100,000 pound capacity cars, as reported by Mr. R. K. Kleine, which fall below 1⅛ inches averaged about 50 to 60 per cent of the total and he believed that the increase in flange recommended would save a large proportion of the wheels now lost. Mr. W. F. Bentley (B. & O.) said that he had observed very few wheels with flanges broken below the 1 1-8 inch limit unless there was a seam in the throat and he considered that this matter should be gone into more thoroughly. Mr. A. W. Gibbs (P. R. R.) said that in 1904 the Pennsylvania increased the flange thickness to 1 1-8 inches and adopted the cored tread with the result that the failures of broken flanges began to fall off and were materially reduced in 1906, notwithstanding the large number of heavy capacity cars added to the equipment. Another cause for broken flanges was given by Mr. W. G. Menzel (Wis. Cent.) as that of wide gauge as he had found by investigation that wheels with broken flanges were invariably of wide gauge. Mr. R. P. C. Sanderson (S. A. L.) raised the question of increasing the 11-16 inch radius for the throat as very good results had been obtained from a 3-4 inch radius, and after the fillet was worn down breakage was liable to occur, thus making it important to have plenty of metal in the throat.

It was decided to mark the whole of the design in such a way as to distinguish them readily from those of the old design.

ARCH BARS FOR 80,000 POUND CARS.

The report of the committee on the above subject was read by the chairman, Mr. C. A. Seley (C. R. I. & P.) The committee recommended that the present standard arch bars may be safely used in trucks for 80,000 pound capacity cars having 5 foot 6 inch wheel base, but the spacing of the bends be increased. Also the turned up lips on the ends of the bars are unnecessary and should be eliminated. The column bolt washers was considered of doubtful value and the suggestion was made that it be omitted when the bolt holes in the top arch bar were countersunk. The report of the committee was accepted without discussion.

AIR BRAKE HOSE SPECIFICATIONS.

The report of the committe on Air Brake Hose Specifications was read by Mr. Le Grand Parish (L. S. & M. S.) The present status of the committee work was given and on motion of Mr. H. L. Trimyer the committee was continued.

CHEMICAL ANALYSIS OF AIR BRAKE HOSE.

The report of the committee on the above subject was read by the secretary of the association, Mr. J. W. Taylor. On account of a number of unavoidable causes the committee was not able to make a report of the investigations made but requested a continuation of the committee in order to report next year.

TOPICAL DISCUSSION.

SOLID STEEL WHEELS FOR PASSENGER CARS.

A very interesting discussion of the solid steel wheels for passenger cars was opened by Mr. G. F. Fowler wherein he gave the results obtained from various kinds of wheels under special tests. The efficiency of the steel wheel and its advantage over the cast iron wheel for passenger service was clearly brought out. He proved that shelled out spots in steel wheels were the results of slàg in the steel, and that steel wheels were easier than the cast wheels on track.

UP TO DATE CLEANING OF PASSENGER EQUIPMENT.

The subject of up to date cleaning of passenger equipment was opened for discussion with a paper presented by Mr. P. H. Peck. The paper embodied the results obtained in the passenger cleaning yard of the Chicago and Western Indiana Railroad where from 6000 to 7000 cars per month are cleaned. He believed that a yard should be equipped with both straight air and the vacuum system in order to properly clean a car. The cost of cleaning the various types of cars are given as follows: Ordinary sleeping car, $1.96; suburban coach, 32c; coach with oil lamps and closets, 26 2-3c; 50-ft. baggage car, 22c; 50-ft. combination mail and baggage, 27c; 60-ft. mail car, 47c; 60-ft. baggage car, 32c; wide vestibule coach, $1.29; combination coach and baggage, 63c; wide vestibule chair car, $1.48; platform coach, 48c; dining car, $1.85; parlor car, 76c.

In the year 1906, 89,026 passenger cars were cleaned at an average cost per car of 77.8 cents.

In discussing the question, the kind of cleaning that the cars received was emphasized as being the proper element to consider, rather than the average cost to clean equipment, as the amount of cleaning could be cut down until the cost was very low and although the figures show up good, the amount of cleaning be so limited as to render the service poor. The merits of the vacuum and straight air systems were discussed and the general opinion prevailed that a combination of the two systems was an advantageous arrangement for a cleaning yard.

PASSENGER CAR VENTILATION.

A paper on this subject was presented by Mr. Wm. McIntosh, in which he brought out the difficulties attending the question of proper ventilation for passenger cars. The limiting factors of the problem and the obvious necessity of having only the left over space for the ventilating apparatus, has checked the development of this necessary feature of passenger cars. The admission of the proper amount of suitably tempered air to a car and the corresponding withdrawal of the vitiated air from the car is a problem which has not yet been solved in a perfectly satisfactory manner. The devices arranged to ventilate cars are all deficient in one regard as ventilation ceases when the car stops. Mr. C. A. Schroyer (C. & N. W.) said that the ventilator they were using was giving very good satisfaction. A jacket was located on the roof of the car, of practically the same shape as the old Spear jack and the forward motion of the car scoops air into the jack and by means of a connecting pipe, the air is discharged into the car, through a radiator having 60 or 70 square feet of radiating surface, located directly inside the end doors of the cars. In this way air is foreed into the car when the train is moving and the crevices around the doors and windows take care of the discharge from the car. Mr. R. L. Kleine described the ventilator system in use on the Pennsylvania. The roof is made tight except the globe ventilators for sucking out the air. Two ducts are placed on every car, one at each end, just above the lower deck. On the top of the lower deck is a hood which has two openings, one in front and one back, with a damper for closing either opening, to agree with the direction the train is running. From the hood a boxing extends down to the floor of the car through a duct containing the heating pipes. From the two ducts mentioned fresh air is heated over the heating pipes and is delivered under the seat. The foul air goes out the top through the ventilators.

WEDNESDAY'S SESSION.

COMMITTEE REPORTS

HIGH SPEED BRAKES.

The report of the committee on high speed brakes was read by the chairman, F. M. Gilbert. An adjustable connection, for taking up slack on six wheel trucks was proposed by the committee. The connection had been thoroughly tried in service and found to be entirely satisfactory. The report was adopted.

HEIGHT OF BRAKE STAFF.

The report of the committee on the above subject was read by the chairman, Mr. E. A. Miller. The recommendation of the committee that the standard maximum height from rail to top of brake staff be 14 feet was adopted, but after some discussion, the remainder of the recommendation that "the standard distance from center of car to center of brake staff be from 18 to 20 inches," was not approved by the convention.

AUTOMATIC CONNECTORS.

The committee on automatic connectors had no report to make. Committee continued.

TANK CARS.

The report of the committee on tank cars was presented by Mr. C. M. Bloxham, who also made a few remarks concerning the advisability of omitting the stenciled capacity of tank cars in pounds from the sides of the car. The report covered a large number of points in regard to tank cars. As a great deal of confusion existed at interchange points during the past year in interpreting the specifications which covers construction "as strong as" and it was brought out that a car would be accepted by inspectors at one point only to be held up by inspectors at another point. In consequence, a meeting was held of representatives of a number of railroads handling a large number of tank cars and the points causing confusion were discussed and amendments suggested in the wording of the requirements. When the necessity for some regulation in regard to tank cars arose, the construction of this class of cars was in general bad and the committee recommended a standard which should be considered a minimum equipment, which was evidently considered by many owners to be an expression of the committee of what was good enough practice, consequently the need for more positive recommendations were necessary. The discussion in regard to the committees' report was general and many different points were considered chief of which was the question raised by Mr. Bloxham. The committees' report was accepted and it was moved that when the matter was presented for letter ballot, the question of stenciled weight of cars be considered separately from the rest of the report.

STRESSES TO WHICH WHEELS FOR 100,000 POUND CAPACITY CARS ARE SUBJECTED.

The report of the committee on the above subject was read by the chairman, Mr. J. F. Walsh. The report is as follows:

Your committee finds the subject assigned it a rather difficult one to report upon intelligently. There are a number of features in connection with it, which, in our opinion, could best be handled by being placed in the hands of a specialist, such as the plant at Purdue University, Lafayette, Indiana, or the Pennsylvania Railroad Company at Altoona, Pennsylvania.

We must consider:

First, STRESSES DUE TO LOAD IMPOSED.—As the present pattern of cast iron wheel provides the tread coned to a very much greater extent than the old type of wheel, it must, in our opinion, result in an excess of pressure on the wheel tread, resulting in a local deformation of that part of the wheel in contact with the rail; and these stresses recurring persistently, as the wheel revolves, tends to separate the fiber or fibers to an extent sufficient to produce a fracture.

Second, THE STRESSES THAT WHEEL FLANGES ARE SUBJECTED TO WHEN TRAIN ENTERS A CURVE.—The extent of these stresses depend on the curvature of the track, the speed of the train, and the weight of the load the car is carrying. The location of the center of gravity of the car also has its effect.

Third, THE EFFECTS OF BRAKE SHOE APPLICATION AND FORM OF BRAKE SHOE.—We believe all of these things could be handled to a very much better advantage by those who are especially equipped to carry out such tests, as the parties mentioned above.

The discussion of the report indicated the amount of interest taken in the question of wheel stresses. On motion of Mr. G. W. Wildin (L. V.) the report of the committee was accepted and that Mr. G. F. Fowler be instructed to make the tests, which he had outlined in regard to the subject and make a special report next year.

CLEARANCES FOR ELECTRICAL EQUIPMENT.

The committee on clearances for electrical equipment did not have a report to make and was continued for another year.

TOPICAL DISCUSSION.

LATERAL COUPLER CLEARANCES.

The discussion on lateral coupler clearances was opened with a paper on the subject by Mr. Le Grand Parish (L. S. & M. S.). In the discussion of the report on M. C. B. couplers the question of the proper lateral clearance for couplers was debated generally, showing that the question was one of vital interest and yet undecided. Mr. F. W. Brazier said in commenting on the paper that he believed more coupler side clearance was necessary as less trouble had been experienced with cars having greater clearance. The New York Central had made 2½ inch clearance standard, after investigating the relative service and results of different clearances and the record of the performance of cars under all conditions was such as to justify the continued use of the clearance named. Mr. J. F. DeVoy (C. M. & St. P.) took an opposite view of the question and based his argument on tests he had made, which showed that an increased side coupler clearance threw an excessive strain on the wheel flanges when a car was going around curves. He believed that a reduced clearance was preferable as it more evenly distributed the strains throughout the car body and relieved the flanges of any excessive side pressure. The liability of couplers passing each other was also reduced, with a consequent increase in safety to employes. Mr Parish stated in reply to this that the New York Central has had a number of cars in service over two years with a 4 inch side clearance on couplers and only one case of failure or breakage reported. Tests made to determine the relative efficiency of 1 inch and 4 inch side clearance for couplers, demonstrated beyond a doubt that the 4 inch clearance was more efficient, as the load was decreased over 25 per cent. Mr. G. W. Wildin (L. V.) brought out the point that all side strains from couplers when cars were going around curves were transmitted to the flanges and that the car body would not absorb these strains, making it necessary to provide sufficient side clearance to reduce the pressure on the flanges as much as possible.

TRUCK SPRINGS ON JOURNAL BOXES.

The topical discussion on the above subject was opened with a paper by Mr. F. W. Brazier (N. Y. Cent.), who called attention to the results obtained by the use of springs over journal boxes. He advised the use of springs over journal boxes as much better service had been attained from that type of truck than the usual design where the springs are placed under the bolster. The box truck with the spring arrangement as described had proved to be the most satisfactory truck for all purposes and as repaires were all handled in one place, less difficulty was experienced in keeping them in service on the road and repairs were accomplished in a shorter time. Mr. G. W. Wildin (L. V.) said his experience with the box truck showed that some difficulty was experienced with keeping journal box lids on, but some discussion on this point brought out the fact that generally no more trouble arose from this cause with the box truck than any other design. The question of more rapid journal wear in the box trucks was also discussed although a few resistances were presented which showed that to be the case, the general opinion was that no greater wear took place in journals in the box trucks than trucks of other designs.

After the discussion had been closed, Mr. J. W. Marden in a short talk called attention to the valuable work of the association in regard to standards, etc. President Fowler emphasized the remarks of Mr. Marden by saying that he had an opportunity of knowing how much this part of the association's work was appreciated in foreign countries. He further said that a rigid adherence to the recommendations of the association, would result in decreasing the difficulties of modern transportation.

Following a motion of Prof. Goss a unanimous vote of thanks was extended to President Fowler for his untiring efforts in behalf of the association.

ELECTION OF OFFICERS.

The following officers were elected for the ensuing year: President, G. N. Dow; first vice-president, R. F. McKenna; second vice-president, R. W. Burnett; third vice-president, T. M. Ramsdell; treasurer, John Kirby; executive members, F. H. Clark, D. F. Crawford, T. H. Curtis.

After the election of officers, Mr. Mark A. Ross, chairman of the executive committee of the Railway Supply Men's Association, presented Mr. W. E. Fowler with the past president's badge, after the usual custon.

Railway Storekeepers' Association

Fourth Annual Meeting

THE fourth annual meeting of the Railway Storekeepers' Association was held at the Auditorium Hotel, Chicago, beginning on Monday, May 20, 1907, and concluding on Wednesday. The first session was called to order at 10 o'clock on Monday morning by the president, N. M. Rice, who congratulated the association upon the success which the organization has attained, and especially upon the interest which was manifested in it by the executive and operating officers of the railways represented in the association. In concluding his address Mr. Rice said: I have been especially requested, by some of our members, to come out plainly and state the purpose for wihch the storekeepers have organized. For the benefit of those who may not know, I will state briefly the object of this Association, and why we are meeting today. It is for the purpose of exchanging ideas and experiences as to the betterment in method of handling, caring for, and use of material and supplies, in connection with the operation of railroads; by discussion and investigations, through which our members may agree on such joint action as will lead up to the greatest efficiency in the method of storing, handling, disbursing and properly and economically caring for material. I contend that we have proven to our superior officers, each year, that we are benefited by coming together as an organized body. First: By improved and more modern system in construction of Storehouses. Second: In decreasing cost of handling. Fourth: In increased efficiency in accounting. Fourth: Ready information in general storekeeper's office on all material in stock, without regard to its location. Fifth: Last but not least, the general harmony existing today between the store department and all other departments with which we come in contact. We know nothing which life has to offer, so satisfying as a profound good understanding, which can subsist after much exchange of good offices between men, each of whom is sure of himself and sure of his friend.

Following this address, Mr. J. F. Deems, general superintendent of motive power of the New York Central and Mr. W. E. Symons, president of the Pioneer Cast Steel Truck Co., both gave short talks to the association. The secretary read letters from the operating officials of a number of railways expressing their hearty sympathy with the work and aims of the association, after which the association proceeded with its regular business. The report of the secretary showed that there had been an increase in membership of 79 since the last meeting, the number of members at present being 260. About 150 members were present at the opening session, and later arrivals increased the number in attendance to nearly 200.

The first subject on the programme taken up was that on "Jurisdiction of the Storekeeper," papers being presented by J. H. Waterman, Chicago, Burlington & Quincy; H. A. Anderson, Pennsylvania Railroad; and N. M. Rice, Atchison, Topeka & Santa Fe.

At the session on Monday afternoon the first paper presented was that on "A Unit of Comparison," by George G. Yeomans, assistant to the president of the Wabash Railroad.

In conclusion, Mr. Yeomans said:

The total amount of money invested in material on the 33 roads under consideration is over $104,000,000.

As between the two roads which, tested by this method, show the best and the poorest performance, the latter company, if its stock of material could be reduced to the same relative basis as that shown by the former, would be able to release over $9,000,000; and if its stock of material were reduced only to the average amount per unit shown as carried in stock by all of these lines, it would still be able to release over $6,000,000 of the money it now has so invested, the interest on which is in the nature of a fixed charge against its operation. If the total stock reported on hand by all of the 33 railroads could be reduced to the basis of the best performance over $60,000,000 would be made availadle for other uses.

Don't make the mistake of thinking that this is a little thing. Every hundred dollars intelligently released from unnecessary duty adds at least $4 to the net income of the company at the end of the year, and the figures I have given indicate the number of times by which it may be possible to multiply that $100 perhaps in your own department.

Following Mr. Yeomans' paper I. R. L. Wiles of the Wabash and H. E. Rouse of the Chicago & Alton presented papers on "Reports and Statistics: Their Value to the Store Department.

At the session on Tuesday the papers presented the day before on "Reports and Statistics" were discussed at length and W. Wild, statistician of the Baltimore & Ohio, presented another paper on the same subject.

The next subject considered was "The Importance of Proper Loading of Material at General Storehouses to Conserve Cars and Expedite Delivery." Papers were submitted by A. Laird (Atchison, Topeka & Santa Fe) and S. M. Braden, general superintendent Chicago & Northwestern.

J. H. Callaghan (Canadian Pacific) submitted a paper on the "Modern Supply Car as a Factor of Economy in Distribution of Material," in which he described the three supply cars used on the lines of the Canadian Pacific east of the great lakes, and explained the practice in handling material. These cars are 41 feet long over frame or 40 feet 2 inches clear length inside, 9 feet 5 inches wide over frame or 8 feet 6 inches clear width inside with a clearance height inside of 8 feet. They are fitted up with shelving arranged to take care of the varions small supplies for stations, sections, etc. Oil tanks are provided with capacity of 1,500 gallons headlight, 150 gallons signal and 150 gallons car oil. Sleeping accommodation is provided for the man in charge and he can, when necessary, get his own meals. As the supply car men practically live in these cars from 22 to 26 days in the month, it is the aim to make them as comfortable as possible.

In regard to the saving in labor and time in filling requisitions and distributing material, Mr. Callaghan said: The car which covers the Atlantic division takes care of 400 requisitions per month, the Ontario division car 600 and the one running over the Lake Superior and the eastern division 550. These figures are based on the monthly average for the year 1906—say 1,500 requisitions are filled from the cars monthly. The evident saving from the nse of these cars is obvious and is a matter which should receive greater attention.

The next paper was on "Benefits to be Derived from Material Classification," by F. D. Reed of the Pere Marquette.

On Wednesday the extent to which the store department is beneficial to the motive power department was taken up and papers were presented by H. W. Jacobs, assistant superintendent motive power of the Santa Fe, and C. B. Foster, storekeeper of the Toledo, St. Louis & Western. Following this H. C. Pierce, general storekeeper of the Southern Pacific, presented a paper on "Shop Deliveries."

The closing session was held on Wednesday afternoon. The papers presented were a discussion on methods of keeping storekeepers' accounts by George Fleish (Gulf Colorado & Santa Fe), and papers on the subjects: "Is the Store Department Deficient Without a Traveling Storekeeper?" by C. F. Balch of the Rock Island and F. J. Zanone of the Northwestern.

"The Records That a General Storekeeper Should Have in His Office," by H. C. Stevens (Santa Fe).

"Reorganization of the Store Department of the Atchison, Topeka & Santa Fe." by H. E. Ray, storekeeper Santa Fe.

N. M. Rice, general storekeeper of the Santa Fe, was re-elected president, but declined to serve upon the ground that the interests of the association would be best served by conforming to the existing rule which limits the term of service in the presidency to one year.

The officers elected are:

President—J. M. Taylor, Illinois Central.

First Vice-President—J. H. Callaghan, Canadian Pacific.

Second Vice-President—D. A. Williams, Baltimore & Ohio.

Third Vice-President—J. W. Taylor, Chicago Milwaukee & St. Paul.

Air Brake Association

THE fourteenth annual convention of the Air Brake Association was held in Columbus, Ohio, May 14, 15 and 16, and was by far the most successful convention ever held by the association. The attendance was most gratifying, as there were some 200 members and 50 invited guests present, while the subjects under discussion were among the leading questions which are now before the mechanical department. The officers elected for the ensuing year are as follows:

President—George R. Parker, Great Northern.

First Vice-President—P. J. Langan, Delaware, Lackawanna & Western.

Second Vice-President—W. C. Hunter, New Brunswick Coal & Railroad Company.

Third Vice-President—J. R. Alexander, Pennsylvania Railroad.

Secretary—F. M. Nellis, Westinghouse Air Brake Company.

Treasurer—Otto Best, Nashville, Chattanooga & St. Louis.

Executive Committee—W. P. Huntley, Chesapeake & Ohio; H. A. Wahlert, Texas & Pacific; W. J. Hatch, Canadian Pacific.

Personal Mention

Mr. Wm. Baird, formerly general car foreman of the C., B. & Q. Ry. at St. Joseph, Mo., has been appointed general car inspector of the C., B. & Q. Ry., Lines West, with headquarters at Lincoln, Nebr.

Mr. Joseph Quigley has been appointed general foreman of the new Ferguson shops of the Queen & Crescent System, with office at Somerset, Ky.

Mr J. B. Cozart has been appointed division master mechanic of the Mexican Railway at Apizaco, Puebla, Mex., in place of Mr. E. I. Shipp, resigned.

Mr. Charles D. Barrett, heretofore motive power inspector of the Pennsylvania Railroad at Jersey City, N. J., has been appointed assistant master mechanic of the Camden division.

Mr. A. W. Wheatley has resigned as assistant superintendent of motive power and machinery of the Union Pacific to become general inspector of the American Locomotive Company at Schenectady, N. Y.

Mr. A. C. Adams, heretofore master mechanic of the Lehigh Valley at Sayre, Pa., has been appointed division master mechanic of the Chicago, Burlington & Quincy at Alliance, Neb., to succeed Mr. G. M. Reynolds, resigned.

Mr. William Schlafge, heretofore general master mechanic of the Erie Railroad, has been appointed assistant mechanical superintendent with headquarters at Meadville, Pa., and the former position has been abolished. Mr. G. O. Hammond, mechanical engineer, has been appointed assistant to the mechanical superintendent, and Mr. E. G. Chenoweth succeeds Mr. Hammond as mechanical engineer, both with headquarters at Meadville, Pa.

Mr. H. J. Tierney has been appointed mechanical engineer of the Missouri, Kansas & Texas, with office at Parsons, Kan.

Mr. G. C. Walther has been appointed foreman of car inspectors of the Conemaugh division, Pennsylvania Railroad, with headquarters at Verona, Pa.

Mr. G. H. Lickert, heretofore master mechanic of the Union Pacific at Denver, Colo., has been transferred to Omaha, Neb., as master mechanic.

Mr. D. C. Ross, heretofore general foreman of the car department of the Michigan Central at West Detroit, Mich., has been appointed master mechanic.

Mr. C. M. Harris has been appointed master mechanic of the Washington Terminal Company and Mr. J. B. McIntosh has been appointed superintendent of heat, light and power, of the same company, both with offices at Washington, D. C.

Mr. James J. Shannahan has been appointed general foreman of the Wabash shops at Peru, Ind., to succeed Mr. J. N. Robertson, transferred to the general foremanship at Ft. Wayne, Ind. Mr. Shannahan has been foreman of the boilermakers at Peru, Ind.

Mr. J. N. Robertson, general foreman of shops of the Wabash at Peru, Ind., has been transferred to Ft. Wayne, Ind., in a similar capacity, in place of Mr. C. E. Paul, resigned.

Mr. John Nicholson has been appointed superintendent of motive power of the St. Louis, Brownsville & Mexico, vice Mr. H. H. Kendall, resigned. A. J. Conrad has been appointed general foreman to succeed Mr. Nicholson in the Kingsville, Tex., shops.

Mr. C. L. McIlvaine, master mechanic of the Pennsylvania at Camden, N. J., has been appointed assistant engineer of motive power of the Buffalo & Allegheny Valley division, with office at Buflalo, N. Y., succeeding Mr. S. G. Thompson, transferred to the general managers office.

Mr. William Schlafge, general master mechanic of the Erie Railroad, has been appointed assistant mechanical superintendent, and the office of the general master mechanic has been abolished. Mr. G. O. Hammond, mechanical engineer of the Erie, has been appointed assistant to the mechanical superintendent and Mr. E. G. Chenoweth, draughtsman has been appointed mechanical engineer.

Mr. David Holtz, master of machinery of the Western Maryland, has resigned and his office has been abolished.

Mr. S. J. Merrill has been appointed master mechanic of the Union Pacific at Denver, Colo.

Mr. E. E. Austin has been appointed master mechanic of the third district of the Canadian Pacific, with office at Nelson, B. C.

Mr. C. F. Brigham has been appointed assistant road foreman of engines Chautauqua division Pennsylvania Railroad, with headquarters ot Oil City, Pa.

Mr. A. P. Glueck has been appointed district foreman of the Union Pacific, in charge of the motive power and rolling stock between Ellis and Junction City, Kan.

Mr. C. A. Snyder, previously master mechanic of the Gulf, Colorado & Santa Fe, has been appointed master mechanic of the El Paso & Southwestern at Douglas, Ariz.

Mr. D. D. Robertson has been appointed master mechanic of the Lehigh Valley Railway at Sayre, Pa., succeeding Mr. A. G. Adams. Mr. Robertson was until recently general master mechanic of the Fort Worth & Denver City.

Mr James McDonough has been appointed superintendent of motive power of the Vera Cruz & Pacific, with headquarters at Tierra Blanca, Mex. He was for 25 years in the service of the Santa Fe, latterly as traveling engineer, and was subsequently with the Rock Island.

Mr. B. S. Hinckley has been appointed engineer of tests of the New York, New Haven & Hartford R. R. with office at New Haven, Conn.

Mr. W. S. Kenyon has been appointed master mechanic of the Denver & Rio Grande R. R. at Alamosa, Colo., to succeed Mr. G. W. Mudd resigned.

Ostermann Grain Door

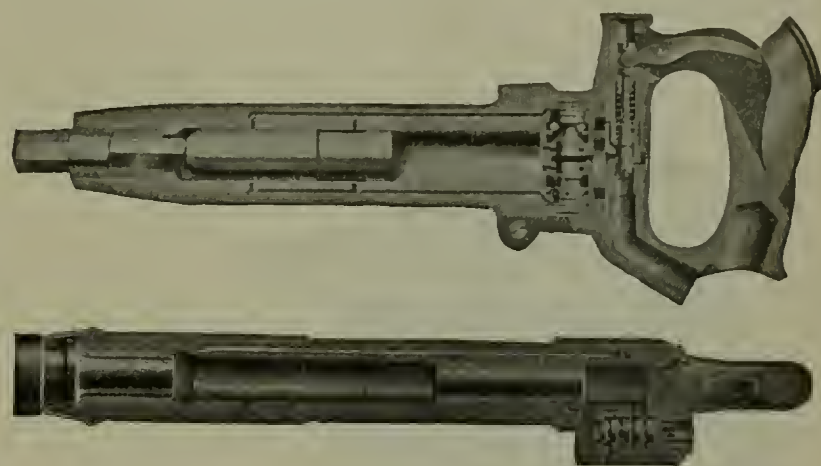
The Ostermann Manufacturing Company exhibited a model of a new patent grain door at Atlantic City, and the accompanying illustration shows a freight car fitted with this device. In the exterior view of the car the complete grain door is shown in position ready for loading, which provides for almost complete loading to the top of the car. The cast iron register in the bottom section is intended for unloading the grain, and it consists of a three-section register, the central one providing a sufficient opening for the rapid flow of grain. By revolving the register this opening is tightly closed, and is secured in this position by a hook. From the interior view it will be seen that the lower section of the door revolves about the lower corner, and is secured vertically against the side of the car when not in use. The upper section of the door is a substantial panel, which is iron bound and hooked to a 1-inch round rod extending along the side plate of the car. This rod has U-shaped bends which provide fixed positions for hanging the door either when in use or when the doorway is clear. When intended for loading the car, this top section is moved over to its position in the doorway and dropped down to the loops in the round iron above. The door is easily operated and actual test has demonstrated that this can be accomplished in from 3 to 4 minutes.

OSTERMANN GRAIN DOOR, CAR EMPTY.

Thor Riveting Hammer

One of the latest products of the Independent Pneumatic Tool Company, Chicago, is the Thor One-Piece Pneumatic Long Stroke Riveting Hammer, which has proved itself to be a reliable and satisfactory tool.

The main novelty and greatest advantage of this hammer is in its one-piece construction. The handle, barrel and valve block are all in one solid piece of steel forging, bored and milled in special machinery. Other makes of hammers have the handle and valve chambers in separate pieces and therefore require couplings, clamps, keys, lock nuts and other complicated devices which frequently get loose when the hammer is in operation and cause considerable delay, annoyance and expense by the necessity of their having to be tightened.



THOR ONE-PIECE LONG STROKE PNEUMATIC HAMMER.

The main valve of the Thor Long Stroke Hammer lies parallel with the main bore, but is not directly operated with the air in the downward stroke. When the plunger returns, it opens what is termed the auxiliary valve, the only office of which is to let in a small amount of air, which lightly starts the plunger downward. After a short travel in the downward direction, the main valve opens and lets in a great volume of air direct, and pretty close to the plunger. This hammer, therefore, from a gentle start gets an extremely forceful and quick blow, and quick striking blow and a quicker return, with practically no vibration.

They are made in several sizes and will drive rivets up to 1¼ inches in diameter. On account of their simplicity of construc-

OSTERMANN GRAIN DOOR, CAR LOADED.

tion, power and durability, they are conceded by mechanics to be the highest development of tools of their kind. This hammer or any other of the forty different sizes of hammers and piston air drills manufactured by the Independent Pneumatic Tool Co., will be sent to any responsible firm on approval, without expense.

New Forged Steel Brake Head

A very important factor in brake beam improvement is the forged steel brake head just brought out by the Buffalo Brake Beam Co.

From the illustration it will be observed that the forged steel head conforms to the M. C. B. standard, and is in the line of safety and economy, keeping pace with the rapidly increasing requirements for heavy equipment and fast service.

By the introduction of this head, the Buffalo Company now offers a brake beam, every part of which is of steel—a rolled steel section, forged head, fulcrum, chain clip and wheel guard—

FORGED STEEL BRAKE HEAD.

in keeping with the new steel era in car construction. Every piece is securely riveted to the section, leaving no loose parts, such as bolts, nuts, hooks or keys to work off. An important saving effected by the new steel head is the small cost of replacing the face plate of the head should it become worn by contact with the wheel through breaking or wearing of the shoe, it not being necessary to scrap the entire head.

It frequently happens with the malleable iron head that the key lugs break, permitting the shoe to drop to the track, usually with serious consequences. This cannot happen with the forged steel head, there being no lugs to break, the face of the head forming a greater bearing surface for the key.

Exhibit of C. Drouve Co., at Atlantic City

The exhibit of the G. Drouve Co., was a practical demonstration of the "Anti-Pluvius" skylight and the Lovell Window Operating Device and consisted of a booth ten feet by twenty feet fitted with swinging sash on three sides, the sash on one side being pivoted at the sides, on another pivoted top and bottom, and on the third hinged at the top to swing out at the bottom. These three runs of sash are equipped with the Lovell Window Operating Device, demonstrating its operation where applied to sash hung in any manner. The roof of the structure is covered with a hip skylight of the "Anti-Pluvius" construction. Inside the booth were shown models of different styles of skylight construction.

The "Anti-Pluvius" skylight was placed on the market several years ago and from the start met with the approval of leading engineers and architects who had long felt the want of a

EXHIBIT OF C. DROUVE CO., AT ATLANTIC CITY.

durable puttyless skylight. The supporting frame carries the glass in a firm but elastic grip that holds it in place perfectly but allows for expansion and vibratory movement. Each sheet of glass is supported independently from the next and nowhere comes in contact with the metal or other rigid surface. Under surface condensation, which is the bane of the old form of skylight on account of the drip therefrom, is made away with in the "Anti-Pluvius" by the U-shaped channel support which at all points projects beyond the supported edge of the glass. The "bridge" at the top of the supporting frame is of great advantage in skylights of large area, as it permits of moving about on the skylight without coming in contact with, or danger of breaking, the glass. The system is particularly adapted for train sheds, railroad shops, power houses, foundries, etc., where heavy structural work is required.

The Lovell Window Operating Device is too well known to require a lengthy description, its position being well established with architects and engineers who are very generally specifying it for buildings with long lines of sash to be operated.

Both the "Anti-Pluvius" Skylight and the Lovell Window Operating Device are patented and manufactured by The G. Drouve Company, of Bridgeport, Conn.

Ball Bearing Jack

The Duff Mfg. Co., Pittsburg, Pa., the sole manufacturers of Barrett Ratchet Jacks, is placing on the market a new ball-bearing lifting jack which embodies many new ideas and improvements and which will be manufactured in connection with the Duff Roller Bearing Screw Jacks. Some of the principal features of this jack are that the bearings cannot wear unevenly and that the balls are made larger than in other jacks, insuring easier operation, giving greater capacity and obviating any liability of their being crushed. Another important feature is the fact that

BALL BEARING JACK.

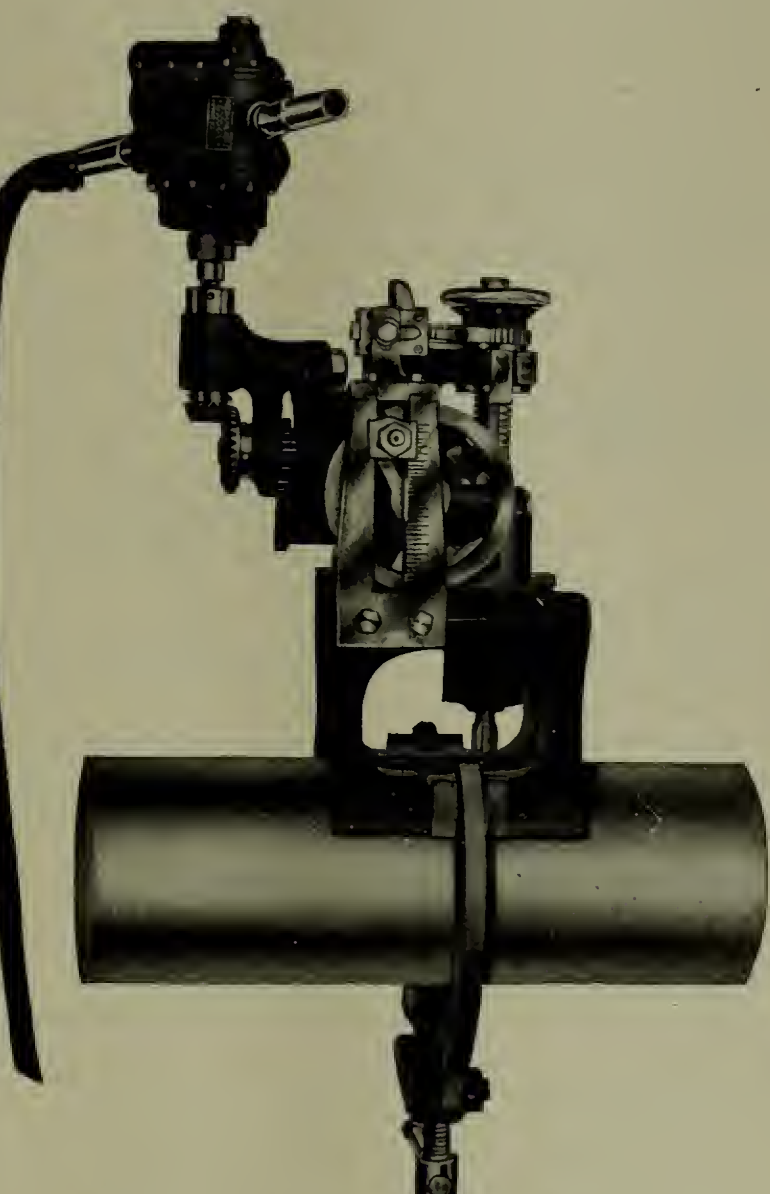
the gears cannot, by any possibility, come out of mesh; a most important point as any trouble of this kind would tend to derange the load and destroy the jack. Each of these new jacks has an additional bearing on the bevel pinion, insuring great ease of operation.

Duff Ball-Bearing Screw Jacks are made inerchangeable with the well known roller bearing jacks which this company has been building for several years, so that it is possible to use roller bearings in place of ball bearings when desired.

Now that jacks of this type are on the market, the Duff Mfg. Company is constructing the largest line of ball bearing, roller bearing and cone bearing ratchet screw jacks in the country. They are designed to cover all purposes and provide any bearing that the purchaser may specify.

Portable Automatic Key Seating Machine

An automatic key seating machine designed for cutting key ways in locomotive axles either before or after the engine is assembled, has been put on the market by Joseph T. Ryerson and Son, Chicago. By referring to the accompanying illustration the general features and construction of the machine will be apparent. The machine is operated by either air drill or electric motor



PORTABLE AUTOMATIC KEY SEATING MACHINE.

through a taper shank which fits the socket of the motor. The cutting is done within the base of the machine, thus making a compact construction and permitting its use for eccentric cutting on axles where the distance between eccentrics is limited. The base of the machine is 8½ inches over all. By the use of the machine the possibility of cutting the key seat in the axle except in the proper place is avoided and it can be used to recut old key seats which do not correspond with the keyway in the eccentric.

The machine is so designed that it will cut within one inch of the driving box and as both vertical and horizontal feeds are automatic no attention is required except to placing the tools in position. The cutting is done with revolving cutter which should operate between 300 and 450 revolutions per minute. The weight of the machine is approximately 100 pounds.

Armbrust Brake Shoe

The Love Brake Shoe Co. with offices in the Fisher Building, Chicago, put out on the market last August a new type of brake shoe—the Armbrust brake shoe for locomotives, tenders, passenger and freight cars. These brake shoes involve some new principles, chiefly among which are the following: 1st: Scoring at the shoe's center causes any accidental breakage to occur at that immaterial point. 2nd: Spacing lugs cast on the back of the shoe to space the shoe-body away from the brake head. enabling it to wear entirely out without danger of it wearing into the head, even should the shoe wear unevenly. 3rd: A steel connector cast in the spacing lugs on the back of the shoe (not in the body of the shoe, which would weaken it). The latter feature is for the purpose of holding broken parts, should accidental breakage occur at any points other than at the center, firmly in place until worn out. The scoring of the shoe at the center, causing any breakage to occur at that immaterial point, permits the shoe to adjust itself to the tread of the wheel thereby giving better service on the tires and adding to the life of the shoe. This also enables the shoe to fit the brake head at the four points of contact, taking the strain off the shoe and throwing it onto the brake head where it properly belongs.

The body of the Armbrust shoe, either car or driver, can be worn down to the steel connector, the scrap remaining amounts to about 3 pounds in the car shoe and about 10 pounds in the driver shoe.

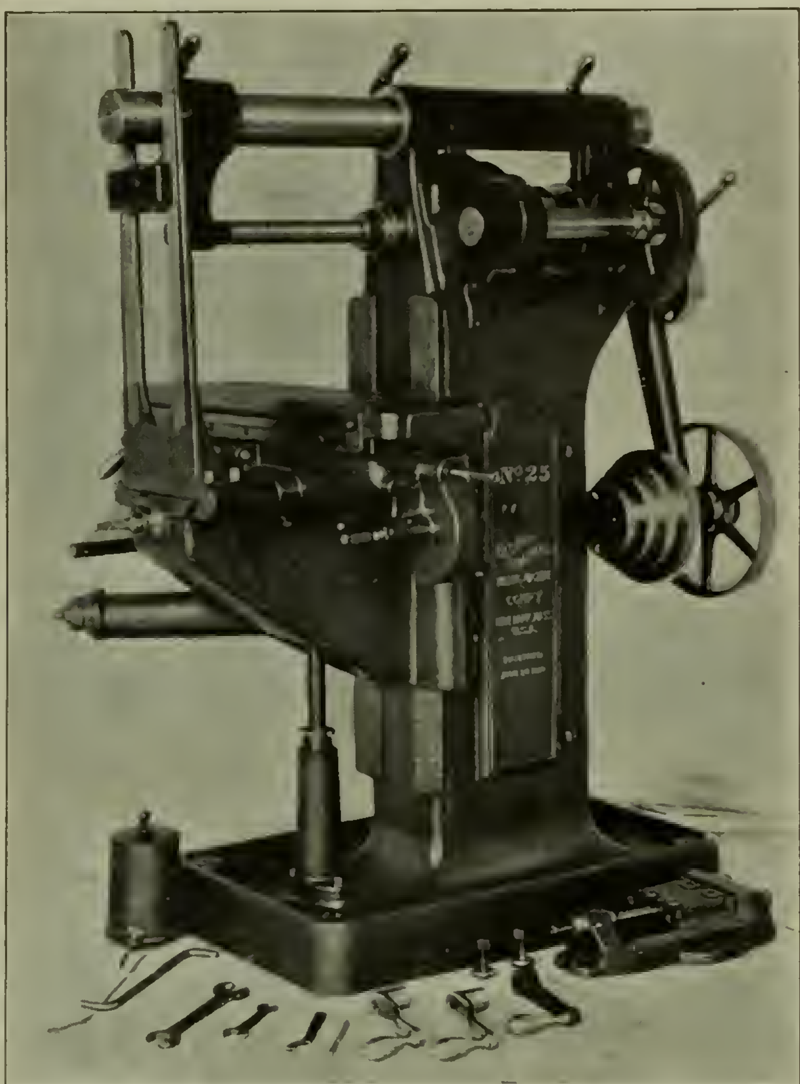
Aside from the above features in the driver shoe, it is pinned to the brake head the same as the car shoe, although where roads desire it can be constructed so as to bolt and hook on the brake head. On account of the former construction it is not necessary to have rights and lefts and, therefore, the road does not need to carry so much stock; also, as there are no rights and lefts to the shoe, when worn more on one end than on the other, can be turned, the same as is the practise in car shoes.

Plain Horizontal Milling Machine

The accompanying half-tone engraving illustrates the latest design of plain horizontal milling machines manufactured by the Becker Brainard Milling Machine Company. These machines are made in two styles, back geared and not back geared respectively, known as No. 25 and No. 26. In their design special attention has been paid to the requirements of the manufacturer of small machine parts, which are produced in large quantities. In bringing out the new model, special attention has been given to the feed works, that they may be able to withstand the full power of the driving belt and at the same time give good service in the rough usage to which these machines are subjected. This new feed is driven by belts which get their motion from the spindle of the machine by means of a train of gears, so arranged that the velocity of the belt is sufficient to drive all feeds that the main belt will stand. The changes of feed are obtained by four step cones and by interchanging the feed driving pulleys on the back of the machine, giving in combination eight changes from .007 to .100.

The table is operated by worm and hobbed rack, the worm being driven by means of a worm gear of large size and worm of coarse pitch and of correspondingly high efficiency. The arrangement for disengaging the feed is by a new and novel drop worm mechanism, by which the worm is thrown out of mesh with the gear and leaves in a patch at right angles with the axis of same, overcoming the objection of the old style gravity drop worm of clinging to the gear by friction alone. It also equalizes the wear on the worm gear teeth. The worm is also engaged and thrown out of mesh by the same lever, making in all a neat, convenient and positive method of automatically disengaging the feed and stopping the travel of the table at a predetermined point. The table is also supplied with a hand quick return of four to one ratio, allowing it to be returned to the original position in the least possible time.

The knee of the new model has been lengthened sufficiently so that a harness brace may be used for the arbor and still have a cross range for the table equal to that of the old style machines. This harness is especially worthy of notice and makes for convenience as well as rapidity. It consists of a brace which is gibbed to the knee slide; a clamp that is fastened to the arbor support yoke in a manner that allows it to be swivelled around its centers, allowing the brace to be removed without removing any bolts. This clamp is made fast to the brace by friction which gives a more rigid hold than the old style bolt washer and slot arrangement, at the same time allowing of a much stiffer



PLAIN HOROZONTAL MILLING MACHINE.

brace. The convenience of this device will be at once appreciated by the operator. The arm, which is a solid steel bar is adjustable lengthwise.

These machines are equipped with a rigid box knee and with a telescopic elevating screw, allowing the machine to be set in any position without regard to beams on floor construction, as the screw does not project below the floor line.

The base of these new model machines has been designed on the same lines as the other Becker Brainard machines, which are extra heavy, absorbing all vibration.

The ranges of the machines are as follows: Longitudinal feed, 34 inches; cross feed, 8 inches; vertical adjustment, 18 inches. Net weight of machine, 1650 pounds.

The spindle cone and back gears are of the standard Becker Brainard design, the spindle bearing being cylindrical in form, the wear being taken up by concentric compensating bronze boxes.

The appearance of the machine has in no way been neglected, since new patterns were made throughout. Great care was given to the symmetrical appearance of the machines as a whole, all corners being well rounded and the graceful outlines speak for themselves.

Notes of the Month

One of the novelties which created considerable comment at the Atlantic City conventions were the "Kantlite" cigars made by the Indestructible Fibre Co. As "Kantlite" is a fireproof material, the cigars would not burn and in that way attention was drawn to the "filler" which was not made to smoke, but to use for car headlinings, etc.

At a special meeting of the Directors of the Joseph Dixon Crucible Company, held May 31, to take action on the death of Vice-President and Treasurer John A. Walker, Geo. T. Smith was elected Vice-President, Geo. E. Long, Treasurer, and Harry Dailey was elected Director and Secretary.

Among the interesting exhibits at the Master Mechanics' convention, at Atlantic City, was that of the Goldschmidt Thermit Company. This concern exhibited three sizes of their new fire-brick molds, for welding locomotive frames. These molds represent a great advance in the process, as they do away entirely with the services of molders and pattern-makers, allowing the repair to be made in the round house or repair shop.

Daily demonstrations of the welding of locomotive frames were given in connection with the exhibit and formed a most important feature.

Other exhibits by the same company were their new wax patterns, interesting samples of repair work and specimens of the rare metals free from carbon, such as Chromium, Manganese, Manganese-Copper, Molybdenum, etc., produced by the Thermit Process and supplied by the company.

In announcing the purchase of the Wirt Electric Co., we desire to state for the information of our customers and those of the Wirt Company, that the manufacture of Wirt apparatus will be continued by us. Pending the incorporation in the Cutler-Hammer Catalog of apparatus of the Wirt type, the current Wirt catalog should be used. Copies of this catalog may be obtained from The Wirt Electric Co., Philadelphia, The Cutler-Hammer Mfg. Co., Milwaukee, or on application to any of our district offices.

The purchase of The Wirt Electric Co. will enable us to meet, more fully than ever before, the requirements of the trade. For many years certain types of Wirt apparatus have enjoyed an enviable reputation. Particular attention is called

The passenger department of the Santa Fe Railroad Company are sending out a beautifully illustrated song entitled "On the Road Called Santa Fe." The music is by Chas. T. Atkinson and the words by E. C. Potter. The song is dedicated to Geo. T. Nicholson, 3rd vice-president.

The Independent Pneumatic Company announce a remarkable increase in business and notwithstanding the output of the plant at Aurora, Illinois, was increased about 50 per cent. the company has been unable to meet the demand for the Thor pneumatic tools and appliances. Before the end of the year, the manufacturing facilities of the firm will be doubled.

Mr. C. H. Rockwell, formerly general car inspector of the D. L. & W. Ry., has resigned to accept a position as representative of the O. M. Edwards Co., Syracuse, N. Y.

Mr. J. G. Platt, who has recently resigned his position as master mechanic of the American Steel Foundries, Franklin Works, on account of his health, has accepted a position as mechanical representative with the Hunt-Spiller Mfg. Corporation. Prior to Mr. Platt's going to the American Steel Foundry, he was, for many years, engineer of tests with the Erie R. R. Co.

The Heywood Bros. & Wakefield Co. announce placing a contract with Frank B. Gilbreth, of New York, calling for the erection of a modern factory at a cost of $300,000, at Gardner, Mass. The contract, which is on the cost-plus-a-fixed-sum basis, specifies a main building, 75x425 ft., and an office building, 60x60 feet, each four story and basement, and of structural steel.

Technical Publications

Precision Grinding. By H. Darbyshire. 162-6x9 pages; 39 illustrations, 3 tables. Hill Publishing Company, New York. Price, $2.

The author of this book sets forth in this volume some valuable information which should be of service to users of grindng machines in general. He deals briefly and to the point with the advantages of grinding, describes various classes of grinding wheels and methods of making and grading them, discusses speeds and feeds of wheel and work and the effect on output and quality of finish, of coarse and fine grits, hard and soft wheels, broad and fine side feeds, etc. One chapter is devoted to plain cylindrical grinding and another .to plane surface grinding in which the use of the magnetic chuck is taken up along with other matters pertaining to this line of operations. Some causes of defective work such as temperature, improper methods of chucking, poorly fitted arbors, etc., are treated in a way that should make this section of the book especially useful to grinding-machine operators. The last two chapters of the book are devoted to laps and lapping, and measuring tools and gages, both of which subjects are of importance in connection with the finishing of precision work.

The Manual of Statistics for 1907. 29th Annual Issue. 1064 pages 5x7½ inches, with maps and diagrams. Price, $5.00. Published by the Manual of Statistics Co., 20 Vesey St., New York.

The Manual of Statistics for 1907, being the twenty-ninth annual issue of that standard reference publication, has just made its appearance. As usual, it contains in concise and complete form the information regarding railroad and industrial corporations of the United States and Canada, government securities, mining stocks and the grain and cotton stocks which are required by investors, speculators, and stock market interests. In fact, the 1064 pages of the compact and handsome volume present a greater fund of data and statistics of a practical character than any other work on such subjects; its utility being enhanced by an arrangment rendering reference to the contents of any section easy and satisfactory. The present edition also devotes much attention to the newer mining companies whose stocks have become such a feature in the stock markets of the United States, a class of organizations and securities on which full and accurate information is often difficult to obtain. It gives throughout evidence of accuracy and careful compilation and is brought down to date in its descriptive and statistical details, making the volume one which investors and all who are interested in the financial and other markets of the country cannot afford to be without.

Practical Mechanics for Shop Apprentices and Others. By James Powell. 54 pages-4x6½; 20 illustrations and figures. Published by the Witness Press., Montreal, Quebec.

This little book was written and compiled with the object of laying a foundation and preparing the way for a better education and technical knowledge for apprentices and others in engineering shops. It has been based on what will be actually needed and should be followed in conjunction with a course in mechanical drawing.

The author, as an apprentice, was connected with mechanics' institutes and technical schools and for some years was in charge of evening classes, teaching geometrical and mechanical drawing and has embodied the experience gained into book form, for the benefit of those who need this instruction.

Railroad Paint Shop

Edited by
J. H. PITARD
M. C. Painter, M. & O. R. R.

Devoted to the Interests of Master Car and Locomotive Painters

Official Organ of the Master Car and Locomotive Painters' Association

Paint as Applied on the Modern Steel Car

Keeping paint on the modern steel car seems to be a distinctive twentieth century proposition. About everything known in the material line has been resorted to in the effort to solve the problem, but, regardless of method and material quality of paint applied, the steel car (like old Mother Hubbard's cupboard) still remains bare, and if there is any comfort—the car painter has none of it.

Back to about the year of 1897, there were a number of theoretical paint experts whose ideas were exploited in the steel car manufacturer's interests, which ideas embodied the carefully figured out claims that, the then coming steel car would probably need re-painting every fifteen years, and, if re-painted before that allotted time, such operation would be more a matter of vanity than that of necessity on the part of the usually-so-credited, hard-headed dollar saving car official. But, as the steel car painting interests have long since been forced to realize the then-predicted paint life expectancy, must now be divided by the figure "5", which means that a steel car, with its great service abuse, should be representative-coated every three years, showing he unreliability of theory where weighed in the balance against time and practical results.

The steel paint trouble, we presume, is getting to be "a chestnut" through being so much discussed at our annual car painters' conventions; also at the railway officials' clubs throughout the country—but as the issue is yet seemingly unsolved, we assume that the matter is still open for a fair craft criticism as to cause, effect and possible remedy suggestions.

In our arrangement of the subject, we will first strike at the bottom source of the paint falling evil, which is undoubtedly caused by flash scale, which should be removed at the initial painting of the steel car. This, if a fact, would place the responsibility for existing paint troubles with the original official conservator of such building specifications, they only, being exclusively in position to dictate as to required quality of cleaning and painting as applied in the contract-make-up of the new steel car.

The originally promulgated idea that the steel car could be paint-maintained after the same manner as its wooden prototype, has long been exploded from the well known fact that the car of wood, in many instances, have been known to have been initially painted in such a manner as to last, with several latter renewals, for the service life of the car. It is true, that the wooden car never received the service abuse that the steel car receives; also true, that paint will adhere more tenaciously to wood than to a metal surface, which is less penetrative, and, as a consequence, more liable to cause applied paint to fall off bodily in the event of paint losing its elastic, protective life where sapped by weather exposure.

There is no question, but that the rough sandblasting of a steel plate will increase the adhesive and staying qualities of applied paint; that in case of paint abrasion there is less liability of spreading under corrosion, from the fact that the should-be removed dross matter is the greatest promoter. Along this line of argument, the idea occurs to us of suggesting the practice of removing all rust and flash scale from the structural car steel before assembling, we, as mechanics, believing that such character of sandblast cleaning to be not only practical, but the most economical as well, from the fact that the sandblast machine could be designed and operated on old well known automatic machinery principles, which would do the blast grinding at a minimum of both time and labor cost. Also, that when metal surface is thus freed of dross matter, that it be sheltered from the weather, as much as possible, in order that there may be no re-occurrence of corrosion.

We advance this preparatory cleaning proposition after having had a somewhat similar practical experience on a small scale, in which this sheet cleaning scheme was put into practice on locomotive tender steel. After such cleaning, which was done with sheets lying flat on the ground, with the operator standing on it, the cleaned surface was heavily coated with a tough primer, which, in no instance in stated experience, was so badly marred in assembling that it could not be touched up and continued as a safe primary coat.

Some such machine designed for sheet cleaning, we judge, should appeal to the economist on shop space, as the space required for some such self feeding, sand grinding device would not need to be nearly so large as that of a similar cleaning plant devised for the more cumbersome blast cleaning of a steel car body after construction, which under no present known condition, could be blast cleaned without intelligent human agency at the nozzle.

The matter of steel car paint as applied at the initial painting, is another consideration worthy of note. The hurryup practice of applying more than one coat of protective paint a day should not be encouraged nor practiced by the man of paint. Care should also be exercised that no excessive amounts of dryer be used in either body or joint paints—the joint paint especially, as it cannot be renewed, under any circumstances, during the service life of car.

The best of paint stock, where applied under forced drying conditions, is no better than the cheapest; if so, why go to the expense of using the best, if best is to undergo the ruinous dryer-loading-up process in our zeal for turning out fast work as is our practice to-day?

As a car painter, we have profitted much in our past experience of test re-painting steel cars, with probably some of the best and worst of the often so-styled special steel car paints, which, as a rule, were applied to the best advantage of the material—regardless of any fast shop schedule. The test paint—also shop practice paints, giving us the best elastic wearing results, were, without exception, the carbon and graphite blacks and grays where applied over iron oxides, red oxide and carbonate of lead under coatings, or where made up in combination with one of the several excellent inert fillers, used to create body and increase oil suspension.

The heating facilities of the steel car paint shop should equal that of the passenger car paint shop, from the fact that the metal surface of the steel car should be perfectly free from moisture before primary coats are applied, which will, if covered up, create an under corrosion, which, afterwards, shows up (as termed) pinhead rust, which no amount of best applied paint will hold down; notwithstanding the claims of some people who sell paint guaranteed to penetrate and back clinch all kinds of flash scale; also to dissolve piled-up rust and neutralize any old kind of corrosion that nature or the elements may deposit on a steel surface. The men who sell such miracle working paints are usually of the Col. Mulberry Seller's (creation) type, who saw the same kind of visionary millions in eye water.

In summing up, we will say that, we expect that many of those more financially interested, will criticize us for taking up the matter of cleaning and painting the steel car so seriously, but, as we always tried hard to avoid being taken for a "straddler" on the important paint issues, we hope our effort in behalf of the steel car will invite more encouragement than condemnation—through interesting others more able to take up the subject where we leave off, with the view of still further reminding the many official readers of the "Railway Master Mechanic" that it would be a good thing for them to be more aggressive on the matter of paint, as applied on the modern steel car.

W. O. Quest, M. C. P.,
P. & L. E. R. R. Co.,
McKees Rocks, Pa.

Painting Steel Bridges in Winter

The question of durability regarding the painting of steel bridges, is not so much a question of season as it is a question of favorable weather. So far as temperature is concerned, either extreme (hot or cold) is equally derimental to paint. Extreme heat forces paint to dry rapidly and therefore unnaturally, while extreme cold retards the drying and consequently also causes unnatural drying. Oil paint wastes much in weight and body under extreme heat, while the reverse is true in cold weather. The latter is an advantage, but is offset in many instances by the injury sustained whenever the paint becomes frosted before it is dry. When an oil paint dries naturally, it absorbs the requisite amount of oxygen, but if forced by extreme heat or by the addition of artificial dryers, its durability is correspondingly impaired. A temperature of from fifty to sixty degress, provided the atmosphere is not overladen with moisture, is far more conducive to durability than either extreme heat or cold. Water which is usually to be found in considerable quantity near or underneath most steel bridges, is a factor to be reckoned with, in bridge painting. The ascending moisture caused by the evaporation of the water is very detrimental, especially while painting, unless there is sufficient heat to dissipate it before it envelopes the steel structure. On this account much care is necessary in order to guard against painting over and sealing up in the pores of the iron, such moisture that may have been absorbed by the metal. Moisture thus absorbed will remain indefinitely, or until there has been a protracted season of dry weather of sufficient duration to dry it out. Whether the painting is done on naked metal or over old absorbent paint, it is necessary as a preliminary step to determine the presence or absence of moisture before painting. That portion of a bridge most exposed to the rays of the sun presents the greater advantage for painting in winter on account of the action of the sun in freeing the metal of moisture. It is a good plan and not impracticable in bridge painting to be governed by the position of the sun, or more correctly speaking, by the position of such structures to the sun at various seasons. As for instance, painting the sunny side of a bridge in winter when conditions require it, and those parts never reached by the sun in warmer or dryer weather. Another feature of bridge painting whether in winter or summer, that does not always receive the attention it should, is the method of cleaning and application of paint. When it becomes necessary to scrape away or sandblast the structure, thus exposing the bare surface of the metal, the cleaned surface should in no instance be left unprotected over night, or for a period sufficiently long to absorb moisture, but should be followed up immediately with the painting. Sandblasting a bridge or other structure previous to painting, has the advantage of being dried or freed of moisture at the same time to a large extent by the compressed air that operates, the sandblast, that is provided the atmosphere is not over charged with moisture, as the air taken in by the compressor is necessarily of the same humidity as that of the surrounding air. This is a common mistake in the construction of air compressors, as the air inlet should be placed in the engine room, or arrangements made to dry the air before it enters the compressor. Where this is the case, the dry air could be utilized to dry out the moisture from those parts of the bridge not exposed to the sun.

All things considered, the winter season is not altogether favorable for bridge painting. The fall season is far more advantageous than either winter or summer for painting structures whether of wood or metal.

Care of Locomotive Jackets

There is nothing that adds more to the good appearance of a locomotive than a well kept jacket. The painting may be ever so nice, but the jacket, constituting as it does such a large portion of the engine, if it shows a lack of attention, presents about the same appearance as a man with new hat and shoes and a shabby suit of clothes.

Being unprotected by paint or varnish, constant care is necessary to prevent rusting. The treatment of a jacket on the road and in the shop is or should be somewhat different. In the shop, preparatory to painting or varnishing the painted parts of an engine, the jacket should be thoroughly cleaned with benzine or gasoline, and the more stubborn parts, such as where the grease has become baked, should be removed with concentrated lye. After thorough cleaning it should be rubbed over with a piece of waste only slightly moistened in valve oil, this should be allowed to remain until the painting is completed, after which the jacket should be lightly wiped off with clean waste, leaving just a scum of oil to protect the metal, and to present a slight luster.

On the road, the jacket should never be without a slight film of oil, or in other words, it should be wiped with dry waste, but should contain just sufficient oil to clean and at the same time to leave a deposit to protect against moisture.

An excess of oil on a jacket is about as unsightly as the jacket that is never cleaned. This is not only unnecessary but is a waste of material.

The jacket that is once thoroughly cleaned, and constantly kept cleaned, can be kept clean with very little cleaning.

The Process of Gold Beating

Wonderful as machinery has been in transforming our industries, there is one department in which it has played no part, and apparently will forever remain knocking in vain at the door of the gold beater.

Gold leaf as thin and fragile as any made to-day has been found in the coffins of the Egyptian mummies, which must be at least three thousand years old, and in all that period practically no improvement has been made in the art of beating out to a thin film this most ductile of precious metals. In admiring the product of the modern gold beater one must be still more astonished at the skill which the Egyptians showed in acheiving like results in an age when civilization was supposed to be at a low ebb.

The ductility of gold may be best appreciated by poising a small cube of five-eights of an inch on the thumb, and then estimating the amount of space it will cover when hammered and expanded. Such a cube would cover the floor of a room twelve feet square, or one hundred and forty-four square feet. In the hands of the artful gold beater a piece of the metal no larger than a pin head can be flattened so that it will cover twenty-five square inches.

And the work is all done by a hammer which to the observer looks more suitable for driving heavy spikes. There are several hammers used by the different operations, the largest of which weighs eighteen pounds and the smallest seven pounds. With these apparently unweildy instruments the gold beaters produce the wonderfully filmy substance sold as pure gold leaf.

When the work is finished the small cube of gold is reduced to a thickness, or thinness, of one two hundred and eighty thousandth of an inch. The mind can scarcely grasp the full meaning of that unless comparison is made with some other material of common use. It means that it is at least one thousand times thinner than the paper on which this is printed. So thin is the gold leaf that in booking it the operators have to use slender wooden pliers to pick up the sheets.

Gold twenty-three to twenty-four carats fine is used as the standard of purity for gold beating, and goes to the operator in the form of a solid ingot one inch wide, five inches long, and three-sixteenths of an inch thick. It is first slightly heated and then passed through steel rollers which transform it into a ribbon from seven to eight yards in length and one inch wide. The steel roller is the only suggestion of a modern machine used in the whole process, and to this extent the work may differ slightly from the art as practised by the early Egyptians.

The ribbon is cut into one inch sections and placed between leaves of very tough paper. The package thus formed is called a kutch, and contains from one hundred and eighty to two hundred sheets. This kutch is placed on a solid anvil, and the operator begins hammering it with an eighteen pound hammer with a convex surface four inches in diameter. For half an hour this hammer is weilded rapidly and skilfully, until the leaves have been spread to four times their area. Then they are cut into four squares, and new books filled with them. There are seven hundred and twenty of the leaves of gold now, and they are placed between vellum instead of paper, and beaten for two hours with a hammer slightly smaller than the first.

The gold beater works like an automaton, shifting the hammer from hand to hand without once making a miss. Each blow must be carefully directed, for the gold must be hammered evenly and uniformly throughout. This book, which is called the shoder, reduces the gold leaves sixteen times thinner than the original ribbon. The original one hundred and eighty leaves are now cut into twenty-eight hundred and eighty.

The final beating is then begun. In this stage of the process the utmost skill must be displayed, for a false blow of the hammer might easily tear the leaves. Neither paper nor vellum can be used to separate the gold leaves in the last hammering and the only satisfactory substance ever found is the large intestine of the ox.

The preparation of the intestine for this work is peculiar. When stripped off in lengths of two or three feet they are freed of grease by special treatment with an alkali solution. Next they are thoroughly cleaned and doubled over so they stick and unite together. Various chemicals are then applied to increase their toughness, after which they are ready for the gold beater. Although very tough and durable, the skins can be used for only about two hundred beatings, and then new ones must be employed. The expense of the skins can readily be understood when it is stated that for one mold upward of three hundred and fifty to five hundred oxen must be slaughtered. In fact, the skins are more expensive than the gold leaves placed between them, often $45 to $50 dollars being paid for the skins for a single mold.

With the gold leaves placed between the skins, the operator beats the package for upward of four hours with a seven pound hammer, and at the end of that time the gold is of the standard thickness used for decorative purposes. The leaves are put up in books, each containing twenty-five and twenty books make a package of five hundred leaves. The original ingot of gold has thus been converted into eighty books of twenty-five leaves each.

An important consideration in gold beating is the recovery of the waste. There is a specified amount which must be recovered by each workman from the trimmings and scraps, and for all that each one returns above this he gets one dollar a pennyweight.

Gold beaters generally work with bare arms, and after their day's work wash hands and arms to recover the gold. Hair and clothes are shaken thoroughly for the same purpose. The fine particles of gold lodge everywhere, and occasionally a complete cleaning of the shop is made to secure these particles. In a shop which was recently torn down to make room for a larger building nearly $500 worth of gold was recovered from the woodwork, floors and ceilings.

There are twenty to twenty-five gold beating establishments in this country, most of which are located in New York and Philadelphia, and upward of two hundred workmen are employed in them.

Flemish Oak

Flemish oak has become, or is fast becoming the prevailing style of interior finish for residences, depots, and possibly the innovation may ere long extend to the oak finished passenger car. Although it is rather dark, it harmonizes well with the statuary bronze finish that has lately came into vogue. There are various ways of producing the Flemish oak imitation, one is to fill the wood with a filler stained with raw umber, and when dry, the wood is given a transparent flat stain of raw umber, and for the darker shades, black is added to produce the desired shade, and when varnished and rubbed down, a very pretty effect is obtained. This is really the most economical method of treating all oak finishes on account of its tendency to darken.

Turpentine from Waste

Plainly enough, the time is near at hannd, if it has not already arrived, when, in the lumber business as in the pork industry, "nothing is wasted but the squeal." Turpentine is now being extracted, by a steam process, from sawmill waste and from tree stumps. The stumps are obtained at small expense from cut-over lands, and after the turpentine is extracted, the refuse can be used as fuel in local power plants. The cost of turpentine procured in this way from sawmill waste in Paxton, Fla., is said to be less than 30 cents a gallon. The waste is first passed through a "hog," and, with the sawdust is carried on a conveyor chain through the upper part of a turpentine still, the dust being automatically dropped into open retorts. These retorts, being filled, are securely closed, and the steam is turned on, extracting the crude turpentine in about an hour. The turpentine passes into a tank with the condensed steam, the oil rising to the top and being partly cleaned during the process. It then goes through another still, and from this through a cooling apartment, which lowers its temperature and thus prevents evaporation. Passing from the cooler, it goes through a series of vats, which process thoroughly frees it from impurities. It is said that more turpentine per cord of wood is obtained by this process than by any other now in operation, while, in addition, the value of the wood for fuel is not destroyed.

This scheme for preventing loss by waste is likely to be watched with interest by lumber interests everwhere. The company which has been making the experiments is cutting about 75,000 feet of lumber per day, or about 2,000,000,000 feet per month. The product of turpentine is estimated at a gallon from the waste of 500 feet board measure of lumber output. According to figures supplied by the company, sawmill dust will yield from five to ten gallons of turpentine per cord; fat lightwood, fifteen to twenty gallons; pine stumps, twenty to thirty gallons, and fat tops thirty to thirty-five gallons. Considering the fact that the cost of stock is nothing, this method of extracting turpentine bids fair to develop into a considerable industry.

What Denaturized Alcohol Is

Denaturized alcohol is simply ordinary alcohol mixed with some substance that makes it unusable as a beverage. The bill recently passed by Congress to remove the tax on alcohol for technical uses, which is expected to prove of enormous value to almost all industries, necessitates treatment of this kind in the case of the exempted spirit. Such processes have been long in use in European countries, where alcohol used in the arts has been free from tax. In The Scientific American (New York, June 9) the following description is given of the "denaturizing" processes in use in Germany. Says the writer:

"There are two general classes or degrees of denaturizing, viz., the 'complete' and the 'incomplete,' according to the purposes for which the alcohol so denaturized is to be ultimately used.

"Complete denaturization of alcohol by the German system is accomplished by the addition to every 100 liters (26½ gallons) of spirits: (*a*) Two and one-half liters of the 'standard denaturizer,' made of 4 parts of wood alcohol, 1 part of pyridin (a nitrogenous base obtained by distilling bone-oil or coal-tar), with the addition to each liter of 50 grams of oil of lavender or rosemary; (*b*) one and one-fourth liters of the above 'standard' and 2 liters of benzol, with every 100 liters of alcohol."

Of alcohol thus completely denaturized there were used in Germany during the year 1903, we are told, 26,080,505 gallons, which were employed for heating, lighting, and various processes of manufacture. The "incomplete" type of denaturization is sufficient to prevent alcohol from being drunk, but not to disqualify it from use for various special purposes, for which the wholly denaturized spirits would be unavailable. There are several methods in which such substances as pyridin, shellac, camphor, ether, soap, or castor oil are used. The writer concludes:

"The price of denaturized alcohol varies in the different states and provinces of the empire in accordance with the yield and consequent market price of potatoes, grain, and other materials. At the present time alcohol of 95 per cent purity, which is the quality ordinarily used in Germany for burning, sells at wholesale from 28 to 29 pfennigs (6.67 to 6.9 cents) per liter (1.06 quarts), and at retail for 33 pfennigs (7.85 cents) per liter."—Literary Digest.

Knifing Paste for Locomotive Tanks

Editor Railroad Paint Shop:—

Locomotive painters who are using the A. B. C. system will find that the settled paste of the C makes a good knifing paste or plaster in filling up locomotive tanks, as it can be applied in the morning and sanded down in the afternoon and given a brush coat of C surfacer which is sanded down on the morning following and colored, with good results. This avoids sanding lead which is so injurious to the health of the painter. It cuts freely and leaves a good smooth surface on which you might finish in a pinch, but one coat or two of surfacer C applied makes a better foundation without suction, to bear up with the varnish coas.

J. H. Kahler,

Meadville, Pa. Erie R. R.

Necrological

From Secretary Dane, we learn of the death of our former secretary, Mr. Robert McKeon, who passed away on the fifth of June at his residence at Keat, Ohio. His funeral took place on the 8th at the Standing Rock Cemetery in the same city.

Bro. McKeon's health has been failing for some time, and to those who knew of his physical condition, his death was not unexpected, nevertheless his many brother members and friends of the association will learn with sorrow of his death. Although his ill health has for several years past compelled his retirement from active participation in the affairs of the association, his good works and noble character had endeared him to the hearts of his fellow members, whose love went out to him in his retirement and affliction.

A more extended notice of his death, and history of his life, will be given in the succeeding issue.

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Contents

System in the Blacksmith Shop

THE value of system in shop management was recently illustrated very clearly while visiting a blacksmith shop. Within a few minutes several men appeared from the back shop, each with a job requiring blacksmith work. As the foreman read each man's order, he very quietly and promptly announced the number of forge to which the work should be delivered. Upon investigation it was observed that each forge was stenciled plainly with a large white number.

Contrast this effective and systematic method of disposing of work with the system in vogue in a shop which is lacking in this simple arrangement. For instance a man from the round house presents an order to the foreman blacksmith and is told to take the work to a certain blacksmith, calling him by name. If the round house man is personally acquainted with all the blacksmiths and the location of their forges, this plan works very well, but with the constant change of labor going on in shops, especially those near large cities, there are a number of well founded defects in the system. The man with the order may not be acquainted with the blacksmith designated and in such an event he will have to ask where his forge is located. The foreman must stop and tell him in some more or less definite manner such as, the fifth forge from the office, or the second forge from the face plate. This takes a needless amount of both the foreman's and the man's time which is not productive of results. Often times the instructions are not given in a manner which enables the man to go directly to the forge in question and more or less time is further wasted in making the necessary inquiries of workmen. The man is really given a license to become a disturbing factor and interrupt the routine of shop work. Effective organization is based primarily on a careful arrangement of details and a simple change in method such as described, frequently is productive of far reaching results.

When Tonnage Does Not Pay

RECENTLY a heavy freight locomotive was started on a turn around trip on its second day out of the shop. On its first trip over a district of fifty miles, this engine handled a work train during a part of the trip and made the rest of the run light. At the district terminal the engineer found that a drag had been made up for his engine with full tonnage of 1900 tons. He objected to this on the ground that he had had a hot driving journal while handling the work train but had been standing for such a length of time that the journal had cooled and did not then feel hot when touched by the hand. Telegraphic instructions were sent the round house foreman to inspect the engine and report if it was in condition to take full tonnage. He replied that the engine was capable of taking two-thirds tonnage.

From this report the dispatcher naturally came to the conclusion that the foreman and engineer had conspired together to keep him from giving the engine a full train. He reasoned that if a journal would run hot on a light train it was hardly probable that a drag would cause the journal to run any hotter. The weight on each driving wheel being the same regardless of the tonnage behind the engine it was natural to suppose that a journal was less likely to heat while revolving slowly than when revolving at high speed. With a drag which is necessarily a slow speed train the temperature of the bearing should therefore not be increased.

While this may be considered a rather unusual line of reasoning and not justified by practical experience, this view is upheld by some mechanical officers, who require an engine to go into freight service immediately upon leaving the shop. Full tonnage is assigned the engine, which is not expected to exceed 10 miles per hour. A reduction of tonnage would not be considered on account of hot journals and the engineer is expected to take the train over the division without damage to the engine.

In contrast to this practice the opinion generally prevails that new driving box brasses are not in proper condition for a tonnage train until they have "come down" to an even bearing, which is usually obtained by running the engine light or with light trains for a few hundred miles after coming from the shop. Proper care of a driving box at the start even though the engine does not go into regular service for several days after leaving the shop, is economical practice. It will prevent many delays from hot journals and result in a material saving of oil. An engine with a set of driving boxes that will not run cool under the most severe road conditions is an asset of doubtful value and a most unsatisfactory possession.

One of the inconsistencies of an organization which is perhaps altogether too common, is to demand the utmost care in fitting driving box brasses in the shop and then allowing the bearings to be almost ruined by failure to have a reliable system of breaking them in for service. This is a self evident waste of economy and not in accord with good practice.

The earning capacity of a new engine should not be considered until it has been put in condition for service. The cost of a proper "break in" will be more than compensated by the returns which are received from the performance of the engine. This is about the only time when full tonnage does not pay.

Status of the Special Apprentice

THE special apprenticeship course was instituted primarily to draw more technical men into railroad work. As generally planned, the course was a readjustment of the ordinary apprenticeship system which would offer more attractions to the technical man and more nearly correspond with his previous training. Instead of spending four years in the machine and erecting shops, the special apprentice was given a few months experience in each of the different departments and at a slight increase in pay over that allowed the ordinary apprentice. As a result, a considerable number of technical men have entered railroad service.

After several years experience with the system, the true status of the special apprentice is worthy of consideration, as it indicates the efficiency of the present method of preparing this class of men for active railroad service. The technical graduate with his scientific training is obviously needed on every progressive railroad and that there is a distinct field in railroad work for this class of men is generally acknowledged. From a study of conditions surrounding the special apprentice it would seem however that a wide variation exists in regard to just what this field of usefulness is.

There is a general tendency to keep the special apprentice along experimental and theoretical lines of work such as testing, drafting, inspecting, etc., after the apprenticeship is completed and recently a superintendent of motive power of a large road with a number of special apprentices, gave instructions to the effect that shop and round house foremen were to be promoted from the ranks as far as possible, making it plain that the special apprentice was not to be considered for these positions. If a special apprentice of average capacity who has served his time in the shop and on the road is not eligible to become a shop foreman, what is the reason? Obviously, the fault must either lie with the man or his training. In the case mentioned, the lack of capable men could not be offered as a logical reason, for among the number of apprentices on the road were the usual ratio of bright, ambitious fellows.

An investigation of the training received by the special apprentices on the road in question, reveals the reason for the stand taken by the superintendent of motive power. Four years was the time allotted to the special apprenticeship course, which was divided up into periods such as 6 months in round house, 6 months in machine shop, 4 months in drafting room, 5 months firing on the road, with proportionate time allowances for all the various departments. Although the number of apprentices exceeded twenty, not one of them had served his apprenticeship according to the schedule, and in a few cases, four year men had spent from two to three years in the drafting room and the remainder of the time on the road following up experimental data. Very few of the men had received the full time in the round house and erecting shop.

It is reasonably certain that these men were not eligible to foremanships in the round house or machine shop, as their training had been neglected along those lines, but does this not emphasize the need of a readjustment of the special apprenticeship system, so that this class of men are trained to become foremen in all of the various departments? This is needed from the standpoint of both parties concerned. The railroads need thoroughly trained technical men for responsible positions and on the other hand it is manifestly unfair to the technical man to hire him as an apprentice at a few cents an hour with the prospect of self improvement and then use him in some department where his four years college training makes him skillful and worth many times the pay he receives.

While the facts quoted are not typical of all roads and there are instances where special apprentices have received thorough training and advanced to high positions, the general status of these men, more nearly agrees with the experience previously given. It is evident that the system now in vogue is not productive of the best results. Instead of a few months spent in a number of departments where only a smattering knowledge is received of each, let the special apprentice enter the shops as an ordinary apprentice and serve the specified time on the machines, erecting floor and in the round house. Include the grease, dirt and hard work that goes with the course and let the man forget the word "special." Arrange the pay on the basis that a man from college is usually hard up and has to live. Although this may seem relatively high for the amount of work done at first, it should be remembered that the man has brought a technical training (worth a good salary to any manufacturing concern) with him, which may in later years be combined with the experience gained in the shop in such a way, that no adequate return could be paid for it. As lack of practical experience is now the principal defect in the training of the special apprentice let him start in at the beginning and become proficient with tools, the methods of doing work and all the details of the trade. He will not only become familiar with shop methods and organization but also gain an intimate knowledge of human nature, which is an absolute necessity to the leader of men.

Freight Car Repair Shop at McKees Rocks

Pittsburgh and Lake Erie Railroad

THE Pittsburgh and Lake Erie Railroad and leased lines, operate 15617 freight cars of which 53 per cent is steel equipment. The main freight car repair shop of the road is located at McKees Rocks, Pa., where most of the repairs are made to both steel and wooden cars.

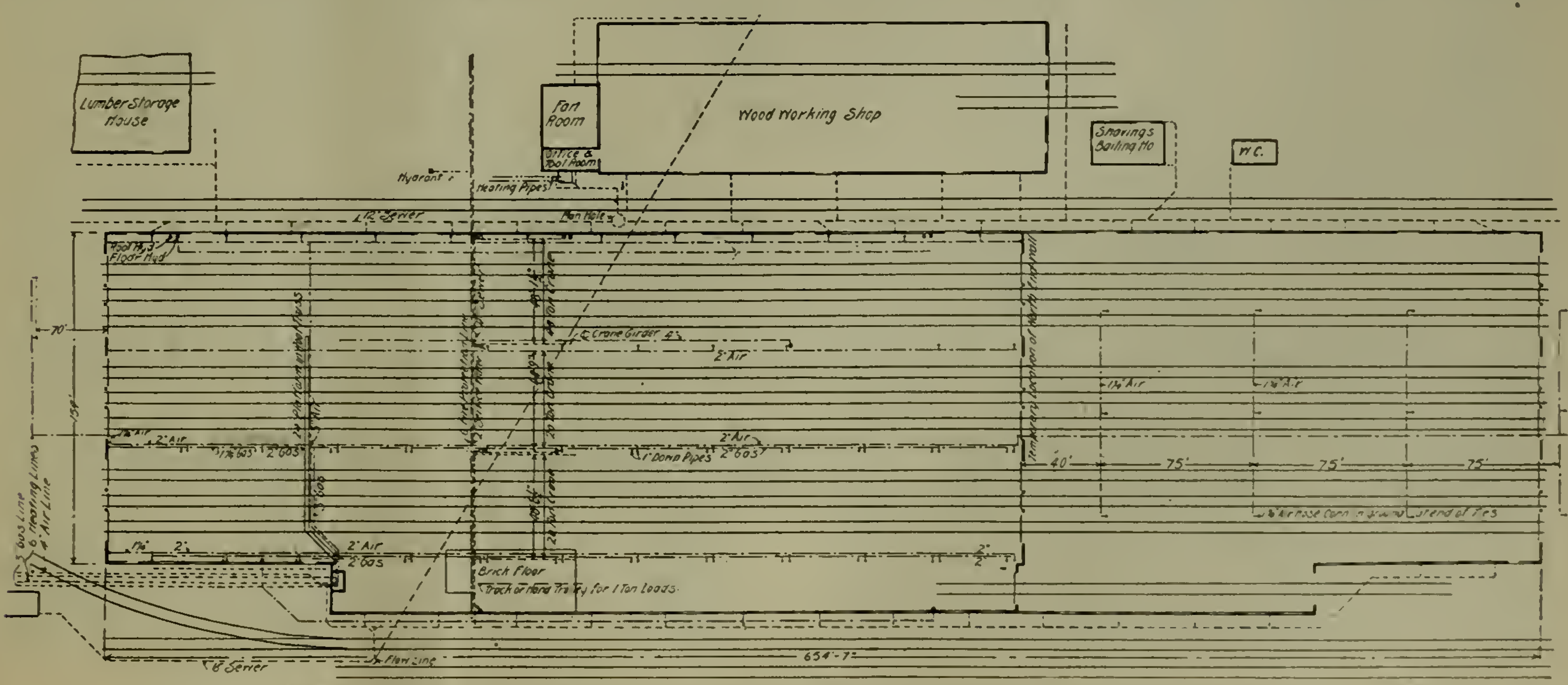
The repair shop at McKees Rocks is a brick and steel structure 654 feet 7 inches long by 154 feet wide arranged in three longitudinal bays. An extension on the east side of the shop, 23 feet wide by 450 feet long provides a convenient location for the furnaces, straightening presses, storage rooms, and machine shop.

The walls are of brick with steel framing conforming to the uniform design of the other shop buildings. The roof is of saw tooth construction with transverse arrangement of skylights, and is supported by steel trusses resting upon steel columns. The windows in the skylights are vertical and face toward the north so that an abundance of diffused light is admitted to the shop from above. Large windows in the side an end walls also contribute materially to the natural lighting.

The hot air system of heating is installed, with overhead supply pipes and down drop outlets. The shop is piped with both air and natural gas, for the operation of tools and heaters.

The shop is divided into three longitudinal bays, two of which are devoted to the repair of wooden cars, while the third or east bay is given over entirely to steel car work. In each bay are two longitudinal working tracks on 24 foot centers, with a standard gauge industrial track located centrally between them. The centers of the two outer tracks are 14 feet 3 inches from the crane columns and the center of the inner tracks 12 feet from the main columns, allowing ample space for carrying on repairs simultaneously on all tracks without confusion and interference. The span of the outside bays are the same, 53 feet and that of the center bay 48 feet, with a clear height from floor to roof truss of 30 feet. Each bay is served by a Shaw over head electric crane operating the full length of the shop, the crane in the west bay being of 40 tons and those in the other bays, 20 tons capacity.

The wood working shop and lumber storage house are located adjacent to the main shop, on the west and are arranged for direct handling of material. A system of standard gauge industrial tracks provides a convenient method for distribution of material from one building to another. The store room although located a greater distance away than the mill, is of easy access and in connection with the system of industrial tracks is provided with a ready means of communication with all departments. The scrap platform and bins are located beyond the store



PLAN OF FREIGHT CAR REPAIR SHOP, McKEES ROCKS, PITTSBURGH AND LAKE ERIE R. R.

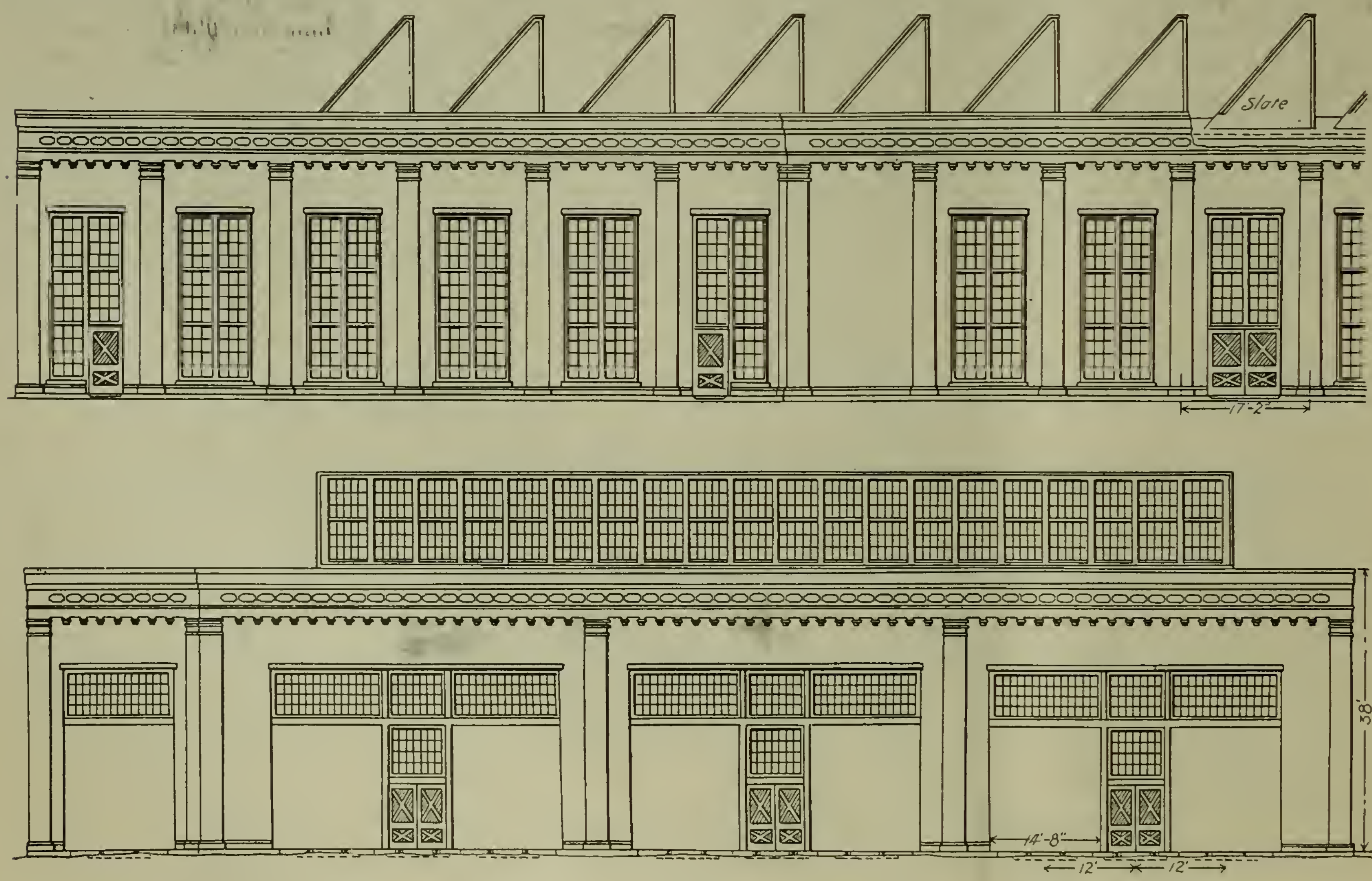
NORTH END OF FREIGHT CAR REPAIR SHOP, MC KEES ROCKS—PITTSBURGH AND LAKE ERIE R. R.—BAD ORDER CARS ENTER THE SHOP FROM THIS END.

SOUTH END OF FREIGHT CAR REPAIR SHOP, MC KEES ROCKS—PITTSBURGH AND LAKE ERIE R. R. FINISHED CARS LEAVE THIS END.

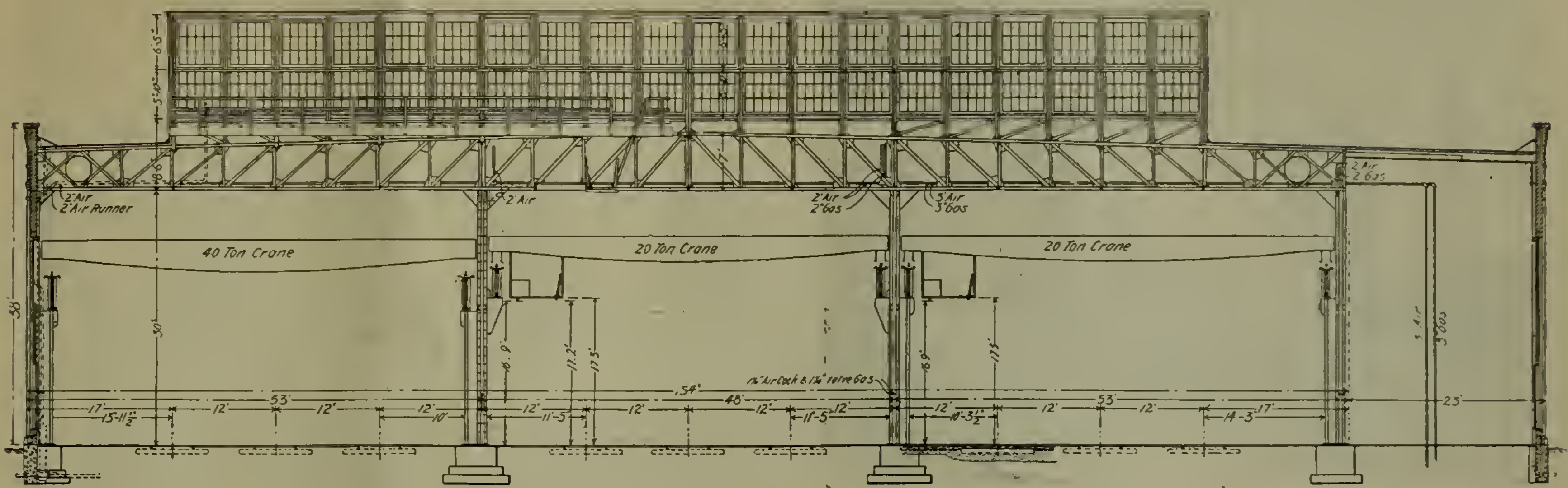
house. The platforms are level with a car floor for convenience in loading and unloading scrap, while an industrial track is extended the length of the platform for handling the scrap from the shop.

As would be expected in a longitudinal shop, the cars advance progressively under repairs; in this case the bad order cars enter the north end of the shop and as repairs progress, are moved along, leaving the south end in a finished condition. In the matter of organization, the shop is not divided up into gangs of specialists who only handle certain classes of work, but into gangs of all round car men, who are capable of making any kind of repairs. Thus a gang is assigned to a car entering the shop and is held responsible for all the repairs marked up against the car. This method was found preferable to the special gang system as with the comparatively cheap class of help employed, it lessened the chances for slighting work and gave a better opportunity of checking up the work done. The air brake work, packing journal boxes and a few other special jobs, are handled by regular men who do nothing else as experience has shown that satisfactory results can not be obtained in any other way. Practically all repair work is conducted on the piece work basis. There is nothing distinctive in the system followed in repairng wooden cars, although up to date methods and practice are used, but as greater provisions has been made for handling steel equipment than on most roads, this department, will be considered in more detail.

As stated above, the east bay is devoted to the repairs of steel cars exclusively. There is room under cover for 30 cars assigning 15 cars to each working track and approximately 43 feet space is allowed to each car. The machine shop extension practically constitutes another bay adjacent to the east bay, so that direct access is afforded to all machines, furnaces, etc. By referring to the illustrations, the arrangement of the machine and storage rooms will be seen. At the south end is located a large oil furnace for heating quantities of bent parts. When a certain amount of these parts have been accumulated they are heated in the furnace and straightened on the table

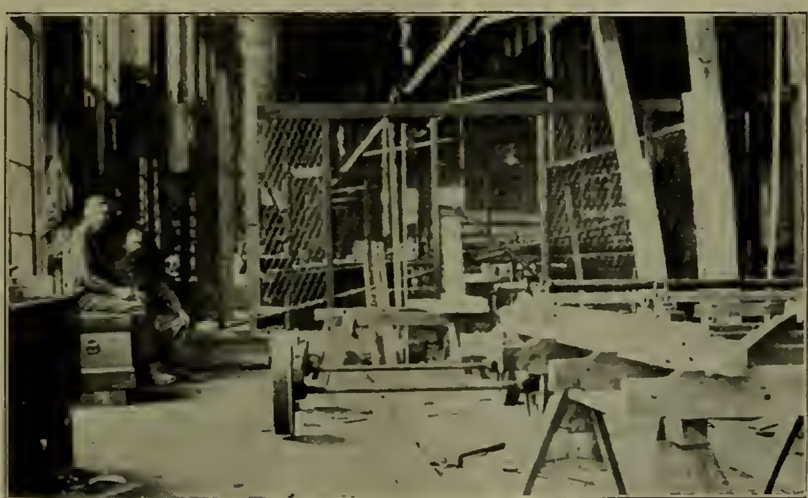


END AND PARTIAL SIDE ELEVATION OF FREIGHT CAR REPAIR SHOP—MC KEES ROCKS, PITTSBURGH AND LAKE ERIE R. R.



CROSS SECTION OF FREIGHT CAR REPAIR SHOP, SHOWING CONSTRUCTION AND ARRANGEMENT. STEEL CAR BAY ON RIGHT—FREIGHT CAR REPAIR SHOP, MC KEES ROCKS, PITTSBURGH AND LAKE ERIE R. R.

or by the presses provided. Near the furnace a coke fire is placed for heating the rush parts which are necessary to prevent delay to movement of cars. A large pneumatic press is located within convenient reach of the furnace for straightening purposes and a number of dies are furnished which fit all the regular repair parts. For straightening angles, beams, side stokes, etc., a large



CARPENTER SHOP AT NORTH END OF MACHINE BAY.—FREIGHT CAR REPAIR SHOP. MC KEES ROCKS, PITTSBURGH AND LAKE ERIE R. R.

pneumatic press is also provided. Adjacent to this press a horizontal pneumatic riveter, motor driven, is placed for riveting all parts which can be conviently handled. Beyond the riveter the storage rooms are located where a stock of end sills, extension center sills, side stakes, buffer plates, center pockets, structural iron, etc., are maintained.

partitioned off and equipped with the necessary tools. An over head electric trolley crane and 2 hand cranes operate the full length of the machine shop and storage room, on a line of 10 inch I beams, suspended about 12 feet above the floor. This provides an easy method of handling material undergoing repairs and also for the delivery of heavy parts in stock. This bay has a floor of plank con-

STORAGE ROOM FOR STEEL REPAIR PARTS, OVERHEAD TROLLEY CRANE IS SHOWN AND TRUCK FOR HANDLING PARTS.—FREIGHT CAR REPAIR SHOP, MC KEES ROCKS, PITTSBURGH AND LAKE ERIE R. R.

At the north end of this bay a carpenter and pipe shop are struction in common with the rest of the shop and is well lighted by large windows.

Following the system common to the shop, each gang of men is responsible for repairs to certain cars. Instead

VIEW IN MACHINE SHOP ADJACENT TO STEEL CAR BAY. RIVETER AND ANGLE PRESS IN FOREGROUND WITH STRAIGHTENING TABLE AND FURNACE BEYOND.—FREIGHT CAR REPAIR SHOP, MC KEES ROCKS, PITTSBURGH AND LAKE ERIE R. R.

ILLUSTRATING THE CLASS OF REPAIRS MADE TO STEEL CARS. NATURAL GAS BURNER BEING USED TO STRAIGHTEN SIDE ANGLES.—FREIGHT CAR REPAIR SHOP, MC KEES ROCKS, PITTSBURGH AND LAKE ERIE R. R.

VIEW DOWN SERVICE TRACK IN STEEL CAR BAY.—FREIGHT CAR REPAIR SHOP, MC KEES ROCKS, PITTSBURGH AND LAKE ERIE R. R.

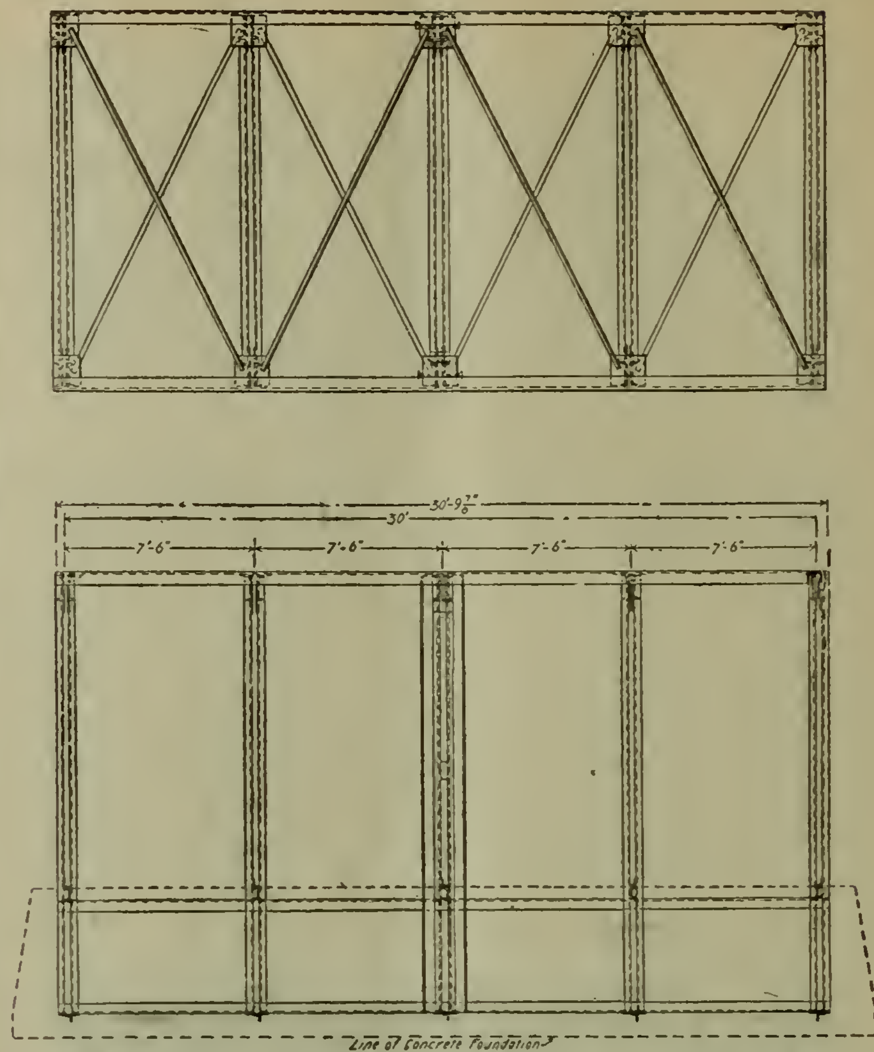
of assigning a rivet heater to each gang, three boys are detailed for the work. Three coke heating furnaces are located alongside the industrial track at regular intervals and each boy tending to one furnace, supplies 4 gangs with rivets.

The ordinary service of a car in the ore and iron trade in the Pittsburgh district is much shorter than in other localities and the severe handling which cars are subject to, makes it necessary to give heavy repairs to a large proportion of those going to the shops. One of the common causes for shopping steel cars comes from derailments, cornering, etc., which distort or twist the body of the car. To repair a car in this condition formerly, was a big job and necessarily slow and expensive, but by the installation of a steel car repair jack frame, this class of repairs is accomplished in a relatively short time. This jack frame constitutes one of the novel features of the shop and the original nature of its design will be seen by referring to the accompanying illustration.

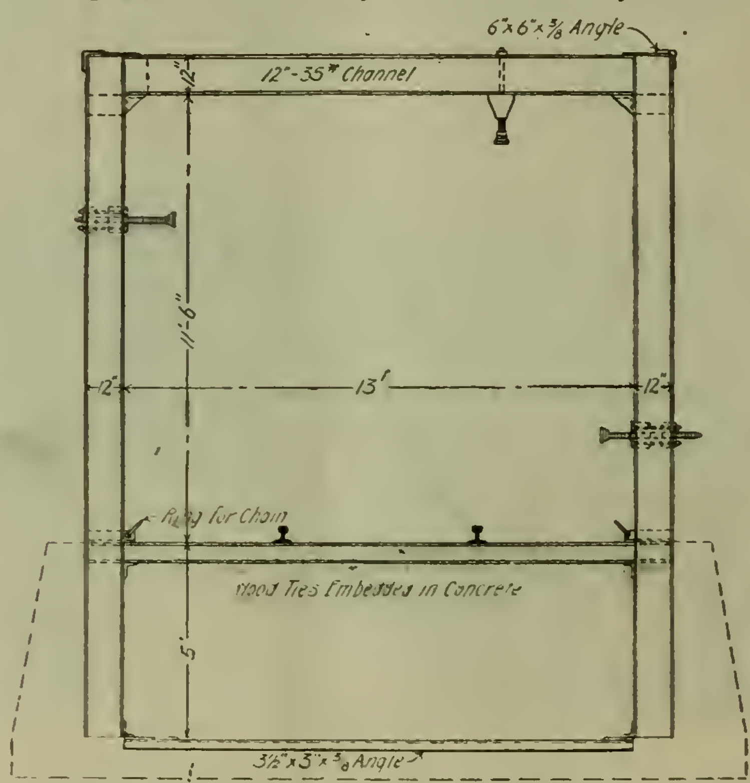
In brief, the jack frame consists of a steel frame work, built over the east working track. A car with twisted body, is placed within the jack frame and by means of a

VIEW OF STEEL CAR REPAIR JACK FOR STRAIGHTENING UP STEEL CAR BODIES—FREIGHT CAR REPAIR SHOP, MC KEES ROCKS, PITTSBURGH AND LAKE ERIE R. R.

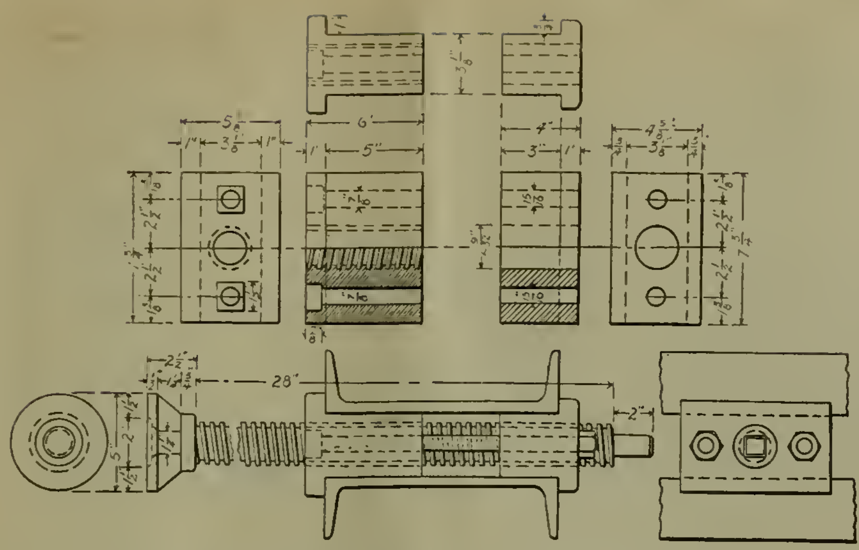
INDUSTRIAL TRACK THROUGH CENTER OF STEEL CAR BAY. RIVET FURNACE ON RIGHT, STEEL CAR JACK ON LEFT—FREIGHT CAR REPAIR SHOP, MC KEES ROCKS, PITTSBURGH AND LAKE ERIE R. R.



PLAN AND SIDE ELEVATION OF STEEL CAR JACK—FREIGHT CAR REPAIR SHOP, MC KEES ROCKS, PITTSBURGH AND LAKE ERIE R. R.



END ELEVATION OF STEEL CAR JACK—FREIGHT CAR REPAIR SHOP, MC KEES ROCKS, PITTSBURGH AND LAKE ERIE R. R.



SIDE AND END ELEVATIONS OF SCREW JACK USED IN STEEL CAR JACK—FREIGHT CAR REPAIR SHOP, MC KEES ROCKS, PITTSBURGH AND LAKE ERIE R. R.

number of movable jacks mounted upon the frame work, the car is pressed back into shape without even removing the trucks. As shown by the illustrations the jack frame is built up of 12 inch channels arranged in 5 pairs forming a skeleton steel box. Horizontal braces of 12 inch channels riveted to the tops of the vertical members bind them firmly together. Diagonal braces of 3 by 2 inch angles and longitudinal braces of 6 by 6 inch angles, connect the 5 sections of the frame together. A system of braces at the lower end of the vertical members similar to that employed at the upper ends completes the structure, which as observed, is a frame work having a width inside of 13 feet, height of 11 feet 6 inches and a total length of 30 feet 9⅞ inches. The vertical and cross channel members are arranged in pairs 3¼ inches apart and form the supports for screw jacks of special construction which may be adjusted at any place and clamped in position. By setting these jacks in the proper place, the car can be readily pressed back into shape. In practice it has been found that a saving of about 400 hours per car is effected by the use of the jack frame against the old method of straightening, which clearly illustrates the efficiency of the appliance.

With a road having the large percentage of steel cars as the Pittsburgh and Lake Erie, the necessity for ample facilities for the repair of this class of equipment has been realized and met in the shops at McKees Rocks. The average output has been 167 heavy repair cars per month. We are indebted to Mr. L. H. Turner, Superintendent of Motive Power, G. E. Carson, Master Car Builder and Mr. J. A. Atwood, Chief Engineer, for the illustrations presented.

Mallet Compound Locomotive for Freight Service

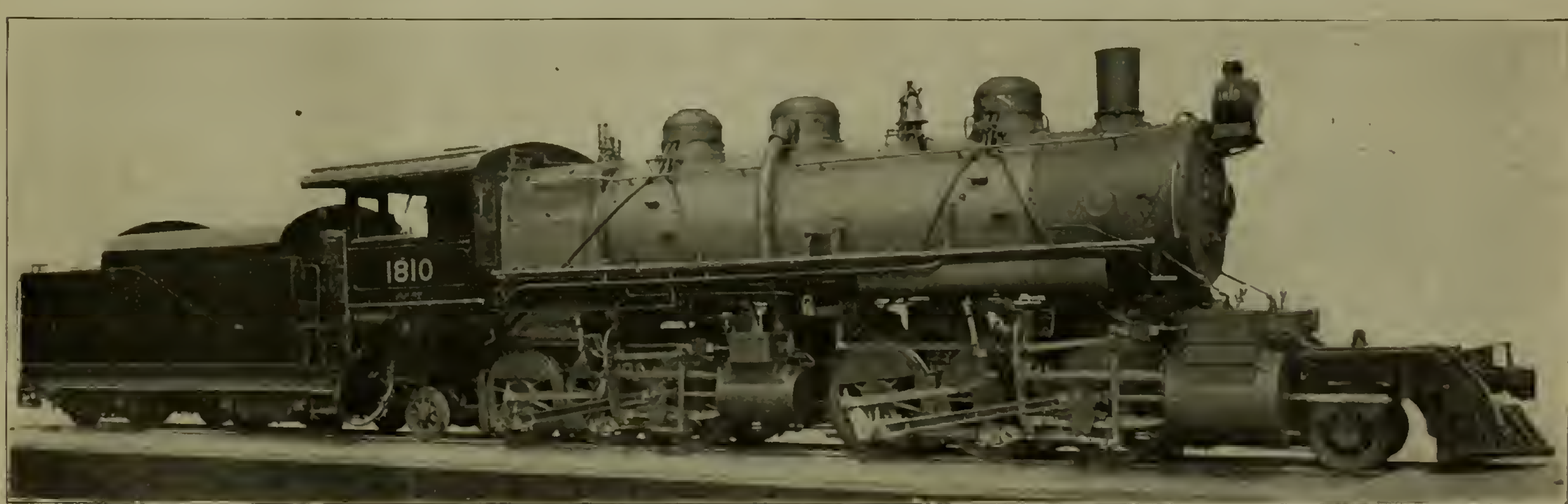
Great Northern Railway

THE Baldwin Locomotive Works have recently delivered to the Great Northern Railway, twenty-five Mallet compound locomotives, which are of special interest as they represent the first effort made in this country to adapt this type to road service. These engines are similar in many respects to the mountain pushers built at these works for the same road in 1906. The wheel arrangements are alike, there being three pairs of driving wheels in each group with a two-wheeled radial truck front and back. The calculated tractive force of the new locomotives is 61,000 pounds working compound.

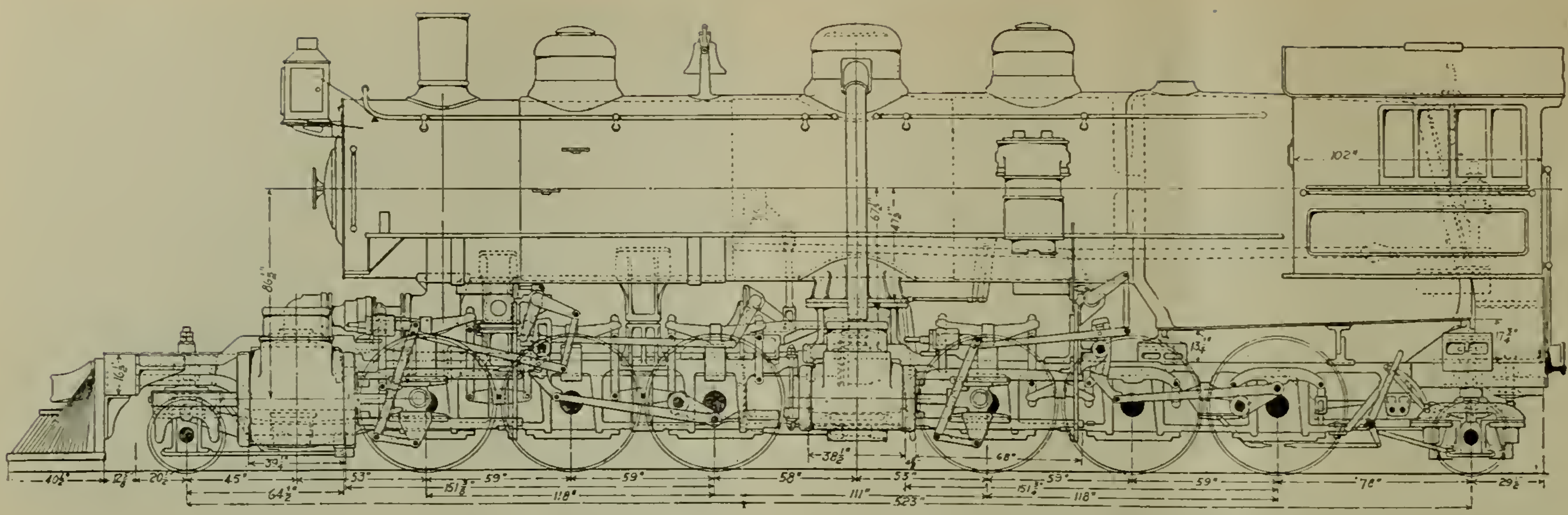
The boilers of these engines are of the same general dimensions are those used on the Pacific type locomotives, built for this road in 1906 by the Baldwin Locomotive Works. The firebox has been modified in that it has a sloping instead of a straight back head, while the dome, throttle and steam pipes have been necessarily changed. The dome is of cast steel, and is made in one piece with two short connections which join the throttle valve box with the outside steam pipes. The throttle valve is of the Rushton balanced type, delivering steam on both sides. The boiler is of the Belpaire type with wide water legs, and tubes 21 feet long.

The firebox is supported on the rear frames, by means of sliding shoes front and back. The waist is carried by the high pressure cylinder saddle, and by a sliding support placed over the front frames. A centering device, placed under the smoke box, is provided with coiled springs, which assist in bringing the forward group of wheels into line after rounding a curve.

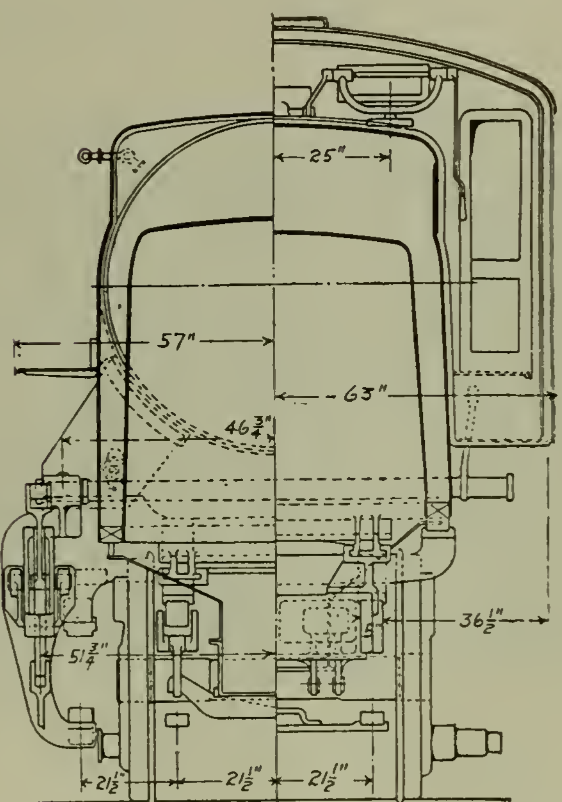
The dome is placed immediately above the high pressure cylinders, which receive steam through heavily lagged external pipes. Each high pressure cylinder is cast separately from the saddle, and is bolted to the rear



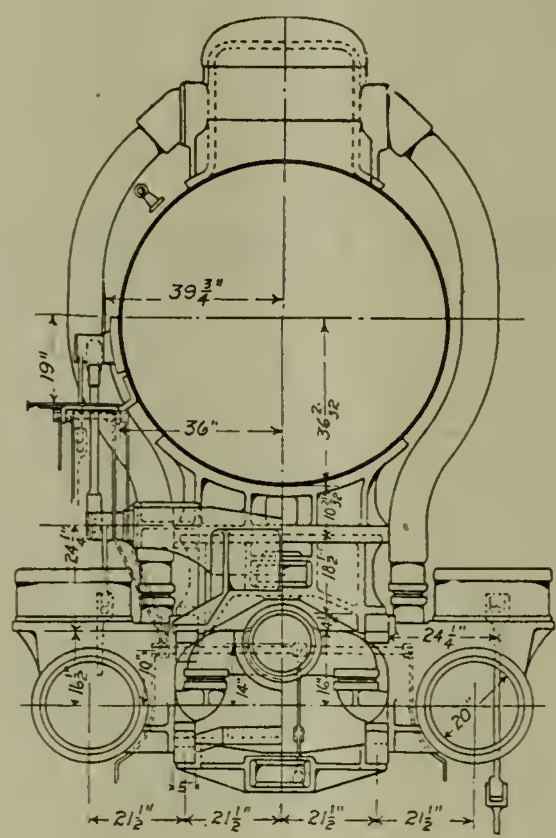
MALLET FOUR CYLINDER COMPOUND FOR FREIGHT SERVICE—GREAT NORTHERN RY.



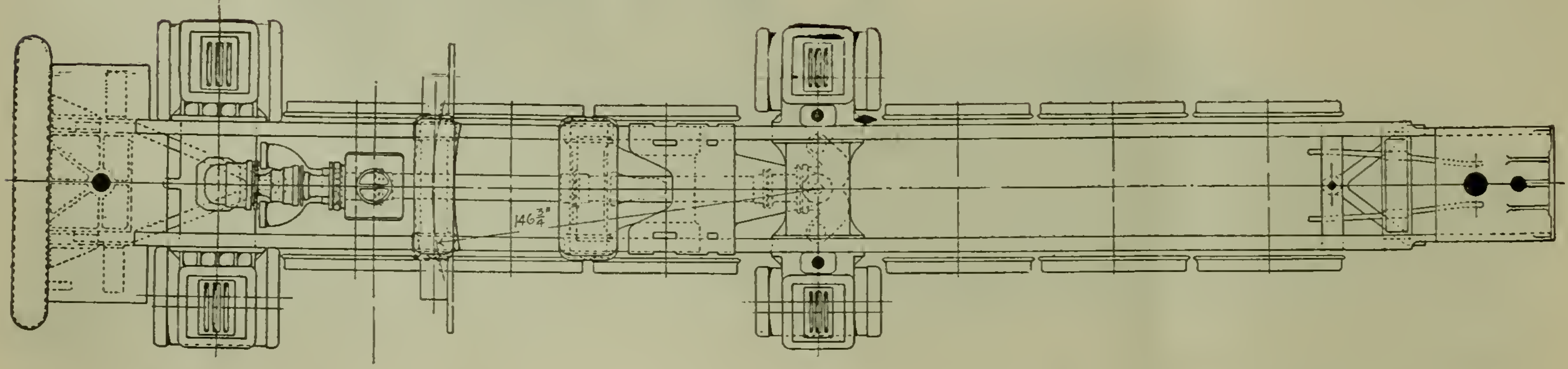
SIDE ELEVATION OF MALLET COMPOUND LOCOMOTIVE FOR FREIGHT SERVICE—GREAT NORTHERN RY.



CROSS SECTION THROUGH FIREBOX-MALLET COMPOUND FOR FREIGHT SERVICE—GREAT NORTHERN RY.



CROSS SECTION THROUGH BOILER-MALLET COMPOUND FOR FREIGHT SERVICE—GREAT NORTHERN RY.



PLAN OF LOCOMOTIVE SHOWING ARRANGEMENT OF CYLINDERS, FRAMES AND ARTICULATED FEATURE—MALLET COMPOUND FOR FREIGHT SERVICE—GREAT NORTHERN RY.

frames. The saddle, which is composed of two pieces, one placed above the other, supports the boiler shell and carries the upper one of two fulcrum pins, about which as a centre the front frames swing when curving. The lower fulcrum pin is supported by a cast steel crosstie.

The high pressure cylinders exhaust into a flexible receiver pipe, which is provided with a ball joint at the rear end. The centre line of the ball joint coincides with the fulcrum pin centre line, so that there is no variation in the length of the receiver pipe while the engine is curving. A slip joint with a packed gland is placed in this pipe, to avoid strains due to expansion and contraction.

The low pressure cylinders are bolted between the front frame rails. The cylinder castings meet on the centre line of the engine, but as they are placed in advance of the smoke box, they are not secured to the boiler shell in any way. Exhaust steam from the low pressure cylinders is conveyed to the smokebox through a flexible pipe having a ball joint at each end and a slip joint in the middle.

All the cylinders are equipped with balanced slide valves actuated by the Walschaert valve gear. The reversing connection between the high and low pressure gears, is effected by a link suspended from a bell crank which is fulcrumed to the boiler shell immediately ahead of the articulated frame connection. With this arrangement the side swing of the link, when the engine is curving, is reduced to a minimum, and the distorting effect on the low pressure gears is practically negligible.

The engine is reversed by means of the McCarroll reversing mechanism, consisting of a rotary air engine which actuates the reach rod through suitable gearing. The reversing connections are plainly shown on the erecting card. No automatic starting device is employed in this design. If, however, increased tractive power is required, live steam may be admitted to the receiver through a 1¼ inch pipe which is connected to a valve in the cab.

The flexibility of the wheelbase is a prominent feature of the design. Each engine truck is equipped with a radius bar, and is equalized with the adjacent group of driving wheels. The front truck is centre bearing, while the rear truck is side bearing. The three point suspension system is thus practically retained. In order to better distribute the weight between the two groups of wheels, the upper rails of the front frames, and the lower rails of the rear frames are tied together by long bolts which are provided with ball jointed washers, thus permitting the frames to have a relative lateral movement.

The tender is equipped with a water bottom tank which is carried on a steel channel frame. The side walls of the fuel space curve inward toward the top, and high fuel boards are provided front and back.

This design is interesting as representing an articulated locomotive for heavy road service, and the satisfactory performance of the first Mallet engines built for this road, indicates that these locomotives will prove successful.

The principal dimensions and specifications are as follows:

Type of engine	Articulated Four-cylinder Compound
Service	Freight
Fuel	Bit. Coal
Tractive force (compound)	61,000 lbs.
Gauge	4 ft. 8½ ins.
Cylinders,	H. P. 20 x 31 ins. L. P. 30x31 ins.
Valve gear, type	Walschaert
Valves, kind	Balanced slide
RATIOS.	
Weight on drivers ÷ tractive force	4.55
Tractive force × diameter drivers ÷ heating surface	820.0
Fire box heating surface ÷ total heating surface	.051
Total heating surface ÷ grate area	73.0
Weight on drivers ÷ total heating surface	67.5
Volume of equivalent simple cylinders, cu. ft	17.1
Total heating surface ÷ volume of cylinders	229.0
Grate area ÷ volume of cylinders	3.1
BOILER.	
Type	Belpaire
Working pressure	210 lbs.
Diameter first ring	72 ins.
Staying	Vertical
FIRE BOX.	
Length	116⅛ ins.
Width	66¼ ins.
Depth, front	72 ins.
Back	64¼ ins.
Thickness of sheets, sides, back, crown	⅜ ins.
Tube	½ in.
Water space	Front 5 in., sides 5 in., back 5 in.
TUBES.	
Material	Steel
Wire gauge	No. 11
Number	301
Diameter	2¼ ins.
Length	21 ft. 0 in.
HEATING SURFACE.	
Fire box	198 sq. ft.
Tubes	3708 sq. ft.
Total	3906 sq. ft.
Grate area	53.4 sq. ft.
DRIVING WHEELS.	
Diameter, over tires	55 ins.
Diameter, wheel centers	48 ins.
Journals, diameter and length	9½x12 ins.
ENGINE TRUCK WHEELS.	
Diameter, engine truck	30 ins.
Journals, engine truck, diameter, and length	6x12 ins.
Diameter, trailing truck	30 ins.
Journals, trailing truck, diameter and length	6x12 ins.
WHEEL BASE.	
Driving, each group	9 ft. 10 in.
Rigid	9 ft. 10 in.
Total engine	43 ft. 7 in.
Total engine and tender	72 ft. .0¼ in.
WEIGHT.	
On driving wheels	263,350 lbs.
On engine truck	17,900 lbs.
On trailing truck	21,400 lbs.
Total engine	302,650 lbs.
Total engine and tender about	450,000 lbs.
TENDER.	
Wheels, diameter	36 in.
Journals, diameter and length	5½x10 in.
Water, capacity	8,000 gals.
Coal, capacity	13 tons.

All Steel Passenger Cars

Pennsylvania Railroad

First Installment

THE Pennsylvania Railroad has ordered the construction this year of 200 all-steel cars for its passenger equipment. The company has gone further in the direction of the use of steel than has hitherto been attempted, and the order now placed is also the largest yet given for this class of equipment. The Pennsylvania's policy in this respect is the result of a long period of inquiry and experiment, in which the late President Cassatt took an active part. After several cars had been built the president appointed a committee of motive power officials to make a thorough report on the design to be adopted and the orders just placed are in accordance with the recommendations of that committee.

The demand for passenger cars which would be stronger and better able to meet the severe conditions of service, has led to the consideration of other materials than wood for their construction.

Growing scarcity of suitable timber and its rapidly increasing price have played an important part in the development, for wooden cars will soon cost as much as those of non-combustible materials.

For several years passenger cars have been continually made stronger and heavier, with a view of decreasing the cost of maintenance and of rendering them less subject to damage in event of accident. This increase in strength was finally obtained largely by means of steel reinforcement at the platforms and in those parts affected by the pulling and buffing strains.

The next stage in the natural development was in the use of an underframe built entirely of steel. Freight car construction had passed through the same stage only a few years before, and experience derived from this source was available for use in designing passenger equipment.

In selecting the materials for a non-inflammable car there is not a long list to choose from. For the frame, structural portions, and outside sheathing, steel is the only suitable material.

For the inner lining, with which the passengers come into contact, steel possesses the necessary mechanical strength and can be worked up into the innumerable forms required. It does not, however, lend itself easily to artistic decorations, as in the case with wood. Sheets of composite material made by compressing vegetable pulp or asbestos are excellent non-conductors of heat and sound, but some kinds are not fireproof and none possesses sufficient mechanical strength to warrant its general use as a material for bulkheads and inside lining. For head lining these materials have been found very satisfactory, as they are not subjected to great wear or mechanical injury. Sheet steel with a fibre or asbestos board cemented to its unexposed surface has been adopted for inside lining, as this combination possesses most of the necessary properties.

Coverings used in upholstery as well as carpets for the floors may be treated chemically to render them non-inflammable.

For the floor, corrugated sheet steel plates, covered with any one of several cement mixtures, have given very satisfactory results.

Paints used in interior decorations are of a composition which will not produce smoke, or noxious fumes if subjected to heat.

As a structural material, steel possesses distinct advantage over wood. Wood must be used with reference to the direction of its grain, and at joints as well as in tension elements, steel reinforcement is nearly always necessary. Steel on the contrary can be flanged, shaped, or jointed to meet almost any condition. The art of steel car construction is a new and developing one, and designs made in Altoona were not obtained by laboriously substituting a metal part for each piece of a wooden car. Conditions were accurately analyzed and structures designed to meet them, regardless of whether the result had the same general form as the wooden parts which it superseded.

In the development of steel passenger cars the Pennsylvania Railroad has from the first played an important part. When steel cars were proposed for use in the New York Subway, none of the car builders in the country was in a position to furnish them, so it came about that the first motor car was built at Altoona in 1902.

In 1904 designs were made for a 58-foot passenger coach, which had a steel underframe and a steel outside sheathing up to the roof. The interior finish was largely of composite board and the roof was of wood covered with copper. One car of this type was built, but as it contained about 1,500 pounds of wood further development of the designs was considered necessary.

The next was a 60-foot baggage car, completed in November, 1906, and closely followed by a 70-foot mail car turned out in February, 1907. In the two latter cars an infinitesimal amount of wood was used.

Designs are now prepared for a 70-foot dining car, also for a 70-foot passenger coach. The latter car contains but 300 lbs. of wood (used for brake rod guards, window sash, and arm rests for the seats). The interior finish is of steel except the headlining, which is of composite board. Designs are being completed for a Suburban type car, 54 feet 4 inches long.

After carefully considering the problem from all sides, the Pennsylvania Railroad Company has decided to adopt two types of steel passenger equipment:

(*A*) For through trains; drawn by a steam or electric locomotive, and comprised of mail, baggage, sleeping, dining or day coaches; a long car of heavy construction suited to withstand the strain incident to pulling, coupling, or buffing long trains.

(*B*) For suburban trains; drawn by a locomotive or propelled by motors upon the truck axles; a short car of lighter construction well suited to operation in frequent short trains to accommodate the traffic.

The general dimensions of the equipment is given in the following table:

Passenger Coach—Length, 70 ft. 5¾ in.; weight, 113,500 lbs.; capacity, 88 persons; trucks, 4 wheel.

Mail Car—Length, 71 ft. 4⅜ in.; weight, 128,000 lbs.; trucks, 6 wheel.

Baggage and Express Car—Length, 60 ft. 10⅜ in.; weight, 91,000 lbs.; capacity, 40,000 lbs.; trucks, 4 wheel.

Special Express Car—Length, 70 ft.; weight, 120,000 lbs.; capacity, 60,000 lbs.; trucks, 6 wheel.

Passenger-Baggage—Length, 71 ft. 1 in.; weight, 130,000 lbs.; trucks, 6 wheel.

Dining Car—Length, 71 ft. 11¾ in.; weight, 140,000 lbs.; capacity, 30 people; trucks, 6 wheel.

Suburban Car—Length, 54 ft. 4 in.; weight, 75,000 lbs.; capacity, 70 people; trucks, 4 wheel.

Comb. Suburban Car—Length, 54 ft. 4 in.; weight, 75,000 lbs.; trucks, 4 wheel.

DESIGN AND CONSTRUCTION.

In preparing the designs for heavy type equipment great care has been exercised to provide ample strength to resist end shock of buffing or collision. Standard steel freight cars are designed to resist an end shock equivalent to 300,000 pounds compression. Experience with freight cars during the last five years indicated that this is not excessively high. An experimental determination of this figure was made by allowing a dynamometer car, weighing 51,000 pounds, to bump a number of loaded freight cars standing upon the track. The dynamometer registered 607,000 pounds. Another experiment was made by allowing a loaded steel freight car and the dynamometer car, weighing together 181,400 pounds, to bump a loaded freight car standing on the track. The dynamometer recoreded 400,000 pounds. Impact, of course, cannot be measured in pounds, but the results give a general idea of the conditions of actual service. In collision between passenger and freight cars it is desirable that the passenger car should be the stronger in order to escape with as little injury as possible.

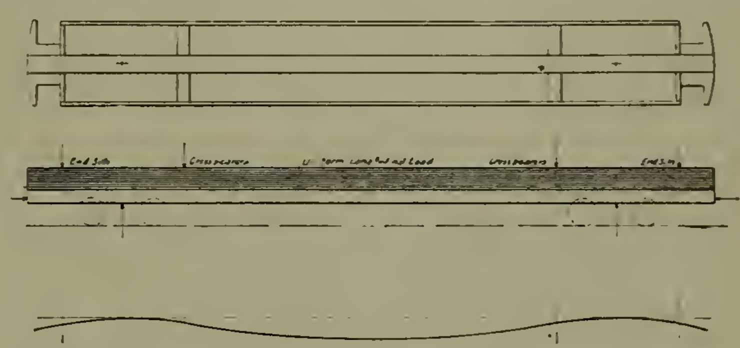
In computing loads upon the various members of the frame, it has been decided that a compression load of 250,000 pounds between buffers, also 150,000 pounds between draft gear, is to be added to the normal loads due to the weight of the car and lading. Under these conditions the combined fibre stress is limited to 12,500 pounds per square inch for cars in through train service and 20,000 pounds per square inch for cars in suburban service. In determining these stresses none of the material above the belt rail is included. The sides of the cars beneath the window sills form girders about three feet deep, for which the belt rail acts as the top flange and the outside sill, the bottom flange. Owing to their great length, the thinness of the web, and the comparative shallowness of the flanges, these girders would probably collapse if subjected to end thrust. In calculations, therefore, the web and upper flange are not considered as resisting any of the 400,000 pounds load assumed to represent the effect of buffing.

The superstructure of cars is made strong enough so that they can roll completely over without danger of collapse. Posts, carlines and other parts are proportioned under this assumption.

Ends of cars are framed with the idea of preventing one car from sweeping off the superstructure of the next one, when the under frame of one rises above the floor of the other in a collision. Deck or I-beams forming a frame about the end door, and securely fastened to both underframe and roof are proportioned with this idea in view.

In the design of framing for steel cars two general types have been developed. One, in which the center sill is made strong enough to resist the end loads developed by pulling and buffing, in addition to the transverse loads due to the weight of underframe, superstructure and lading. The other type, in which the plate girders formed by the sides of the car beneath the windows, are relied upon to carry the transverse load due to the weight of the underframe, superstructure and lading.

The center sill in the latter type is usually rather light.



CAR LOAD DIAGRAM—ALL STEEL PASSENGER CARS—PENNSYLVANIA R. R.

being designed to resist the end loads developed by ordinary pulling and light buffing. This type of framing follows the general form used in wooden cars where the transverse loads are carried by wooden trusses within the sides of the car reinforced by truss rods beneath the side sills.

By careful calculation it has been found that when the loads due to pulling and buffing are less than 100,000 pounds, the weight and cost of a car frame of either type will be practically the same. Where loads due to pulling and buffing exceed 100,000 pounds, the framing for the type, where the sides carry the load, increases considerably in weight. While for the center sill type, the loads due to pulling and buffing may equal the assumed value of 400,000 pounds without a material increase in weight.

For through train service subjected to heavy buffing and pulling, the center sill type of frame has been selected. It has also been used in designs for suburban type equipment, as it has been found that, with a modified form of center sill, sufficient room for motors can be provided between the under frame and truck.

The height from the track to the center of coupler is determined by law and the height to the top of the floor is practically regulated by custom. The center of the drawbar is therefore fixed at about 17 inches below the floor.

In wooden car construction the center sills are usually rather shallow and the coupler is supported below them. Loads upon the underframe, brought about by buffing, tend to bend down the ends of the car due to the fact that the center sills are not symmetrically loaded. In the steel car of the through train type, the center sill is made deep enough to bring the line of the coupler within its section.

With the heavy center sill frame, body bolsters used in wooden car construction are unnecessary, for the major part of the transverse load it delivered directly to the center sill which transmits it to the trucks through center plates carried on its under surface. The transverse loads which come upon the sides of the car and which must be transferred to the center girder are delivered at four points to equalize the loading. Referring to the accompanying illustration the center sill is a continuous girder, supported at two points and loaded with a practically uniform longitudinal load, which it carries directly, together with four transverse loads delivered to it from the sides of the car through cross bearers and body ends. The points of application of the concentrated loads are so selected, that the two loads at each end are about equidistant from the center plate. Under this condition it has been possible to obtain in the center sill practically equal fibre stress at the middle and over the center plates, thereby securing great economy in metal and avoiding the use of a center sill of deeper cross section at the middle than over the trucks. Symmetrical loading of the center sill gives a deflection under load indicated by line. Each of the four points is deflected practically the same amount. They therefore are always in line with one another and no load is placed upon the superstructure of the car by the deflection of the center sill. With the comparatively thin sheet metal used in sheathing the sides and roof it is of great importance to avoid unnecessary loading, as it is likely to cause loosening of the joints and working of the rivets in their holes. With this form of construction the side girders can be made comparatively light as they sustain little transverse load and are supported at four points. Side doors required by mail, express, or baggage cars can be located where most convenient without requiring any material strengthening in the side truss.

The following table gives the comparative strength and weight of steel and wooden cars:

	Standard Wooden Passenger Coach 53 ft. long	Heavy type Steel Passenger Coach 70 ft. long	Suburban Steel Passenger Coach 54 ft. long
Number of passengers.........	62	88	72
Car weight, pounds............	91,000	*113,500	*75,000
Car weight, per passenger, lbs.	1,470	1,290	1,042
Area centre sill at middle of car, square inches...........	152	50	24.32
Area centre sill at centre plate of car, square inches........	152	50	33.32
Stress in centre sills due to 150.000 lbs. compression on draft gear and 250,000 on buffer; lbs. per square in....	10,850	11,000	18,500
Comparative values of centre sills, per cent...............	25	100	60

* Estimated weight.

In the next issue, the details of design and construction of the various types of cars will be considered.

Tractive Force of the Mallet Compound Locomotive

By. T. F. Crawford, Engineer of Tests, Great Northern Ry.

TRACTIVE force, as an expression of the power which should be developed by a locomotive in hauling trains, is one of the most important items in locomotive operation. It is the fundamental basis for all locomotive comparison and tonnage rating, as it represents the actual work locomotives should perform.

Practical formulas for tractive force have been reduced and readjusted until we have an extremely accurate means for telling just what draw bar performance may be expected from a locomotive of any given size on any grade and under all conditions. This applies to simple engines and compounds of all types, except the Mallet articulated compound. The Mallet engine has not been extensively used in this country; and so far but few practical demonstrations have been made of its pulling power and consequently there still remains some question as to the proper formula to use in calculating the tractive force.

A compound of the Mallet type in which the steam is used to operate two independent engines under the same boiler, is somewhat similar to the cross-compound, considering each side independent. In the cross-compound however, it is essential that the work done by each cylinder be the same, owing to the fact that they each operate on the same pair of drivers. With the Mallet engines this feature is not absolutely necessary, for the power can be designed to suit the weight on drivers both front and back. In the existing types however, the work done by each engine is supposed to be equal. There is also the consideration of a long receiver and the fact that two high pressure cylinders exhaust into, and two low pressure cylinders receive their steam from the same pipe. Actual tests made with the two cylinder compound cannot be thoretically applied to the Mallet type of engine, although it is fair to assume that the results should not differ to any great extent.

The Baldwin Locomotive Works gives the formula for the tractive force of two cylinder compound, assuming that cylinder ratio is correct for an equal distribution of work:

$$\text{T. F.} = \frac{C^2 \times S \times 2\,3\ P}{D}$$

Where C=Diameter high pressure cylinder.
" S=Length of stroke.
" P=Boiler pressure.
" D=Diameter of drivers.

For the Mallet compounds they simply double this and write,

$$\text{(a)}\quad \text{T. F.} = \frac{C^2 \times S \times 4\,3\ P}{D}$$

Other formulas for two cylinder compound considering the low pressure cylinders and the proper ratio, give

$$\text{T. F.} = \frac{.85\ P\ C^2\ S}{(R + 1)\ D}$$

and
$$\text{T. F.} = \frac{.8\ P\ C^2\ S}{(R + 1)\ D}$$

Where D=Diameter of drivers.
" C=Diameter of low pressure cylinder.
" P=Boiler pressure.
" S=Length of stroke.
" R=Cylinder ratio.

Applying these formulas to the Mallet compound, with equally distributed work would give:

$$\text{(b)}\quad \text{T. F.} = \frac{1.7\ P\ C^2\ S}{(R + 1)\ D}$$
and
$$\text{(c)}\quad \text{T. F.} = \frac{1.6\ P\ C^2\ S}{(R + 1)\ D}$$

Taking the Great Northern Mallet engine for example and substituting its dimensions in the various formula we have the following:

$$\text{(a)}\quad \text{T. F.} = \frac{C^2\ S\ 4.3\ P}{D} = \frac{(21\ 1/2)^2 \times 32 \times 4.3\ (200)}{55} = 71540 \text{ lbs.}$$

$$\text{(b)}\quad \text{T. F.} = \frac{1.7\ P\ C^2\ S}{(R + 1)\ D} = \frac{1.7\ (200) \times (33)^2 \times 32}{(2.35 + 1)\ 55} = 64304 \text{ lbs.}$$

$$\text{(c)}\quad \text{T. F.} = \frac{1.6\ P\ c^2\ S}{(R + 1)\ D} = \frac{1.6\ (200) \times (33)^2 \times 32}{(2.35 + 1)\ 55} = 60522 \text{ lbs.}$$

From actual service and work performed by this engine, and also from indicator diagrams it would appear that the results required by the Baldwin formula cannot be obtained in practice. Formula (b) appears to be more correct and seems to indicate about the general result of the power developed by that engine. A mean effective pressure of fifty pounds was the maximum amount obtained in the low pressure cylinders of the Mallet engine on the Great Northern and from the cylinder ratio we have:

$$P = \frac{X\ P}{R + 1}$$

Where P=Boiler pressure.
" R=Cylinder ratio.
" P=Pressure in low pressure cylinders.
" X=Unknown coefficient.

Substituting values:

$$50 = \frac{X\ 200}{2.35 + 1} \text{ or } X = .837$$

This coefficient when doubled for both sides (1.674) is quite close to the factor (1.7) used in formula (b).

Considered on the basis of the high pressure cylinders alone the following formula could be used:

$$\text{T. F.} = \frac{C^2\ S \times 6.5\ P}{D}$$

Figures based on the above are low when considering the formula used by the Baltimore and Ohio Railroad. With their Mallet engine in service since 1904, a tractive force figured from the following, is claimed:

$$\text{T. F.} = \frac{C^2\ S\ 3/4\ P}{D} + \frac{C^2\ S\ 1/4\ P}{D}$$

Where C=Diameter high pressure cylinders.
" c=Diameter low pressure cylinders.
" P=Boiler pressure.
" D=Diameter of drivers.

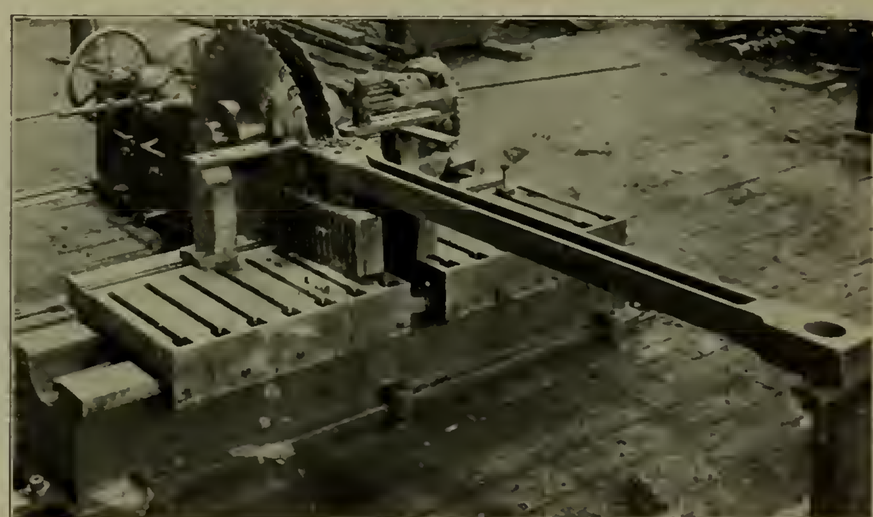
This is supposed to be developed at a speed in miles per hour equal to the diameter of the drivers in feet.

Applied to the Mallet engine on the Great Northern this would give a tractive force of the high pressure cylinders of 40,320 lbs. and 31,680 lbs. in the low pressure cylinders, a sum total of 72,000 lbs. Although this is practically the same as that obtained when using the Baldwin formula, it is clear that this inequality of work should not exist. Future experiments may show that all the formula here given are incorrect, but at the present time formula (b) is without a doubt a conservative estimate, of what the Mallet engine will do.

Performance of the Cold Saw Cutting-Off Machine

THE results of experience with the cold saw cutting off machine warrant its more extended use in railroad shops, as it has proved to be the most economical and satisfactory machine for doing certain classes of work. With saws of large diameter carrying inserted high speed steel cutters, little difficulty is experienced in machining steel castings which would be impossible in an ordinary machine with tempered tools. The heavy construction parts, strong rigid bed, large bearing surfaces and direct application of the cutters to the work, combine in forming an ideal heavy duty machine, capable of doing the maximum amount of work under the most severe conditions.

By the use of special tool inserts in the saw, cutters are provided which will give from 35 to 100 hours' service in all classes of steel castings, without regrinding. A fair idea of the results accomplished by a machine of this type may be gained by referring to the accompanying illustration, which shows a Newton machine with two 48 inch saws, operated by a 15 H. P. motor, cutting out the stock of a solid end main rod. Speed of the cutters, 40 feet per minute, making a cut 11⅜ inches deep through steel 5 inches thick, in 17 minutes. This performance, considering the amount of metal removed is very good and considerably better than could be obtained



COLD SAW CUTTING OFF MACHINE, MAKING CUT 11⅜ INCHES DEEP THROUGH STEEL 5 INCHES THICK, IN 17 MINUTES.

on any other type of machine with the ordinary tools.

In connection with the operation of the cold saw cutting off machine, the question of cutting speed should receive consideration, as recent experience has shown that feeds twice as coarse are obtained by reducing the periphery speed of blade to 40 or 60 feet per minute from the former practice of 100 to 200 feet per minute.

The efficiency of this type of machine in handling a difficult class of work is shown by the following data, obtained from a number of different shops.

A. 110 carbon steel castings, well annealed, 16 inches in diameter. Speed of cutters 35 feet per minute, feed ⅜ inch per minute, 12 H. P. motor used. Cutters ground every 40 or 50 hours.

B. Steel ingots, 85 carbon, 12 inch in diameter. Speed of cutters 30 feet per minute, feed ½ inch per minute, 10 H. P. motor used. Cutters ground every 35 or 40 hours. Carbon or tempered saws would not touch this material.

C. Steel rails, 100 pound, 60 to 85 carbon. Speed of cutters 50 feet per minute, feed ½ to 1 inch per minute. 5 to 6 minutes for each rail which took carbon saw 15 to 18 minutes. Cutters ground every 40 to 60 hours.

From the above performance records, the capacity of the cold saw cutting off machine for heavy difficult work will be readily apparent.

DeGlehn Four Cylinder Compound Locomotive

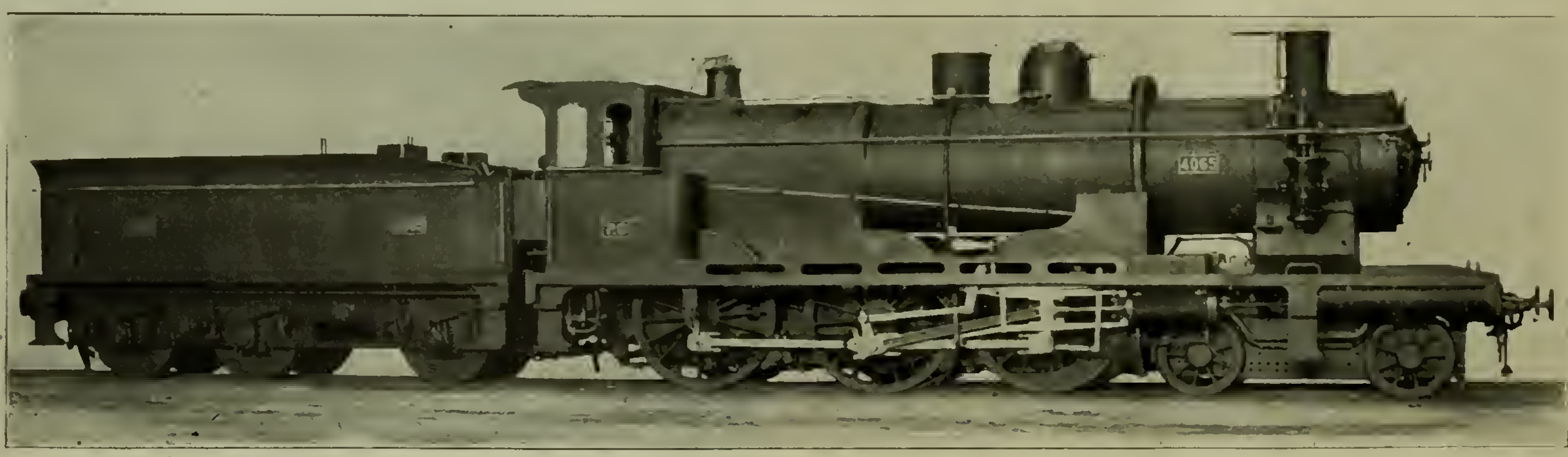
Paris-Orleans Railway

THE Baldwin Locomotive Works has recently built twenty ten-wheel locomotives for the Paris-Orleans Railway of France. These engines are compounded on the DeGlehn system, and were built to drawings furnished by the railway company. All measurements in their construction were made on the metric system, necessitating the introduction by the builders, of many new standards and gauges.

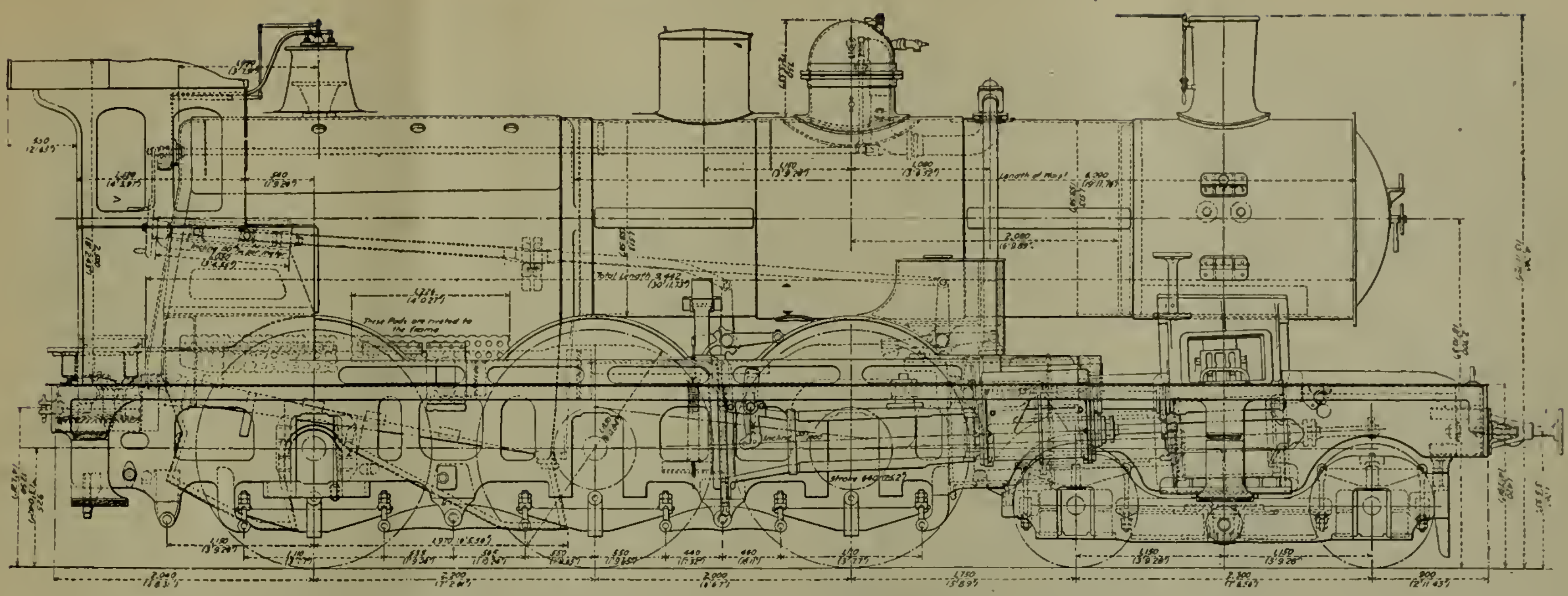
The DeGlehn type of locomotive is characterized by an arrangement of cylinders which divides the application of the power between two driving axles, and provides a separate valve gear for each cylinder, so that the high and low pressure cut-offs can be independently varied. The high pressure cylinders are placed outside, while the low pressure are inside between the frames. The Walschaert valve motion is used throughout. The gears for the inside cylinders are driven from eccentrics placed on the first driving axles, while those for the outside cylinders are driven from the second pair of driving wheels by return cranks placed on the crank pins.

The outside, or high pressure cylinders, are connected to the second pair of driving wheels, while the inside, or low pressure, are connected to the first pair, which has a cranked axle. In order to keep the main rods of as nearly the same length and weight as possible, the high pressure cylinders are set some distance in the rear of the low pressure cylinders. This arrangement of cylinders is facilitated by the use of plate frames to which the cylinder castings are conveniently bolted. In the locomotive mentioned, the high pressure cylinders are located immediately in front of the leading pair of driving wheels. The slide valves are balanced, and are of bronze. The low pressure valves are also of bronze, but unbalanced; they have inclined seats, and their steam chests are formed within the cylinder casting. All the cylinders are set on an inclination of 3½ per cent. to provide clearance for the engine truck under the low pressure cylinders. Steam is conveyed to the high pressure cylinders through external pipes, and is passed on to the low pressure cylinders through special valves which are operated by air pressure controlled from the cab.

The centre lines of the high pressure steam chests are placed outside the cylinder centre lines, all parts of the valve motion are located in the same plane. With the low pressure cylinders, such an arrangement is impossible, as the valves are driven by eccentrics which are placed on the first axle between the inside crank cheeks. The links are mounted on rock shafts, which serve to transfer the motion from one plane to the other. Independent reverse shafts are provided for the high and low pressure



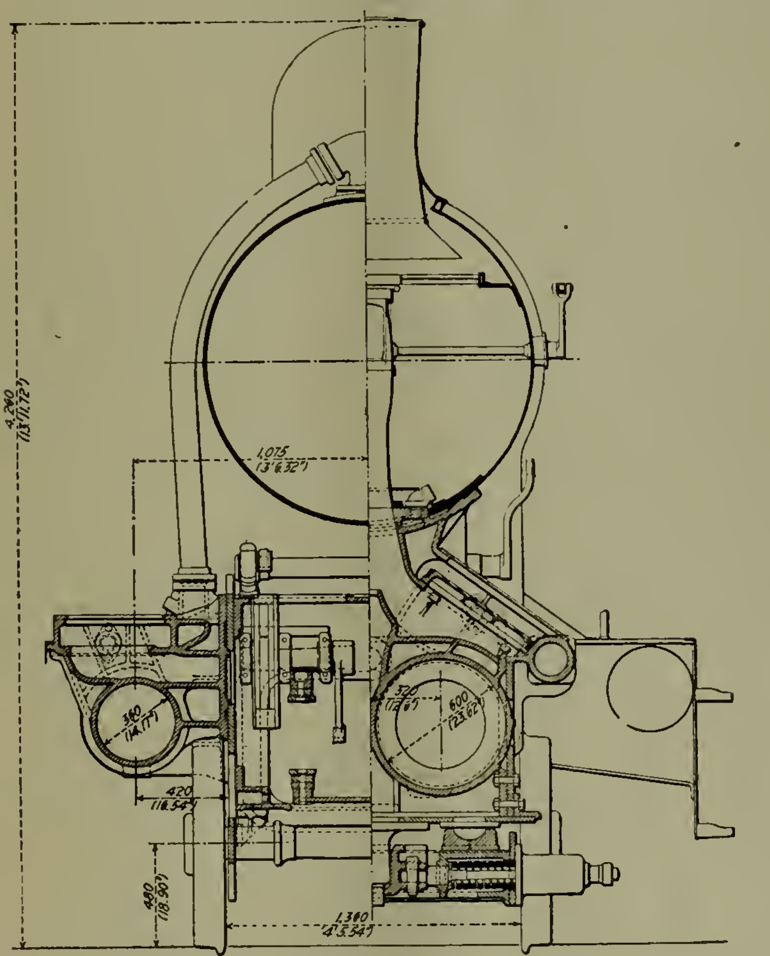
DE GLEHN FOUR CYLINDER COMPOUND LOCOMOTIVE—PARIS-ORLEANS RY.



SIDE ELEVATION OF DE GLEHN FOUR CYLINDER LOCOMOTIVE—PARIS-ORLEANS RY.

valve gears, which may be operated together or separately by means of an ingeniously arranged screw reverse mechanism placed in the cab.

The boiler is of the Belpaire type, built of steel with



CROSS SECTION THROUGH BOILER HIGH AND LOW PRESSURE CYLINDERS, DE GLEHN FOUR CYLINDER COMPOUND—PARIS-ORLEANS RY.

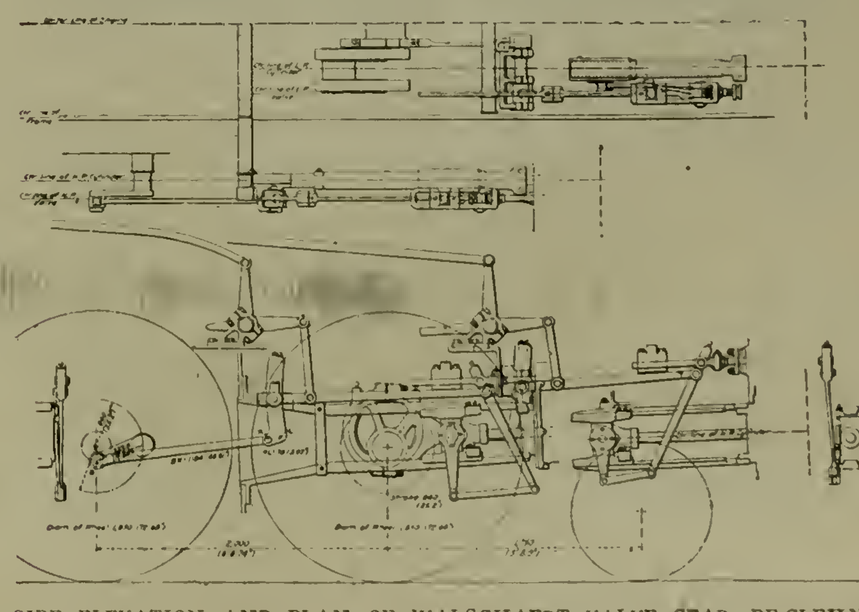
the exception of the inside fire box, which is of copper. The grate is placed between the frames and is inclined toward the front at a sharp angle, thus giving an exceptionally deep throat. The stay bolts in the water legs are of maganese bronze. Each bolt is drilled throughout its entire length with a hole ¼ of an inch in diameter. These holes are closed up at their inner ends by riveting the bolts over after they have been screwed into the sheets. The firebox is provided with a brick arch which is supported on copper strips, secured to the side sheets by copper studs. The grate is of the rocking type. The tubes are soft steel, of the "Serve" pattern, with internal ribs.

The boiler shell is built with longitudinal butt joints having double covering strips, while the circumferential seams are double riveted with lap joints. The throat sheet completely encircles the barrel. The cab is built of steel plate, and has narrow side windows. Access to the running boards may be had by climbing around outside of the cab, and for this purpose suitable hand rails are provided. An interesting part of the equipment is the Haesler Chronotachymetre, which keeps a complete record of the speed throughout the run, and also shows the engine men the rates of speed at any instant. The motion for this device is derived from a stud which is screwed into the rear right hand crank pin, and works in a slotted arm on a gear shaft located under the running board.

The tender is carried on six wheels, the two rear pairs of which are equalized. The frames are of the plate form, placed outside the wheels.

The principal dimensions and specifications are as follows:

Type of engine	10-wheel De Glehn Compound
Service	Passenger
Fuel	Bit. Coal
Tractive force	21,466 lbs.
Gauge	4 ft. 9 ins.
Cylinders	H. P. 14 3-16 in. x 25 3-16 L. P. 23⅝ in. x 25 3-16 in.
Valve gear, type	Walschaert



SIDE ELEVATION AND PLAN OF WALSCHAERT VALVE GEAR, DE GLEHN FOUR CYLINDER COMPOUND—PARIS-ORLEANS RY.

RATIOS.

Weight on drivers ÷ tractive force	5.12
Tractive force × diameter drivers ÷ heating surface	606.9
Firebox heating surface ÷ total heating surface	.067
Total heating surface ÷ grate area	77.2
Weight on drivers ÷ total heating surface	42.7
Volume of H. P. cylinders, cu. ft	4.6
Total heating surface ÷ volume of H. P. cylinders	560
Grate area ÷ volume of H. P. cylinders	7.7

BOILER.

Type	Belpaire
Working pressure	227 lbs.
Diameter first ring	59⅝ in.
Material	Steel

FIRE BOX.

Material	Copper
Length	119 13-16 ins.
Width	39⅜ ins.
Depth, front	82 11-16 ins.
Back	57 15-16 ins.
Thickness of sheets, sides, back, crown, tube	⅝ ins.
Water space	Front 3¾ ins., sides 2⅞ ins., back 3¾ ins.

TUBES.

Material and kind	Serve ribbed steel

AN IMPROVED BLACKSMITH FORGE, DESIGNED BY A. W. MC CASLIN, MASTER BLACKSMITH, PITTSBURGH AND LAKE ERIE R. R.

Number	139
Diameter	2¾ ins.
Length	14 ft. 7⅜ ins.

HEATING SURFACE.

Fire box	174 sq. ft.
Tubes	2402 sq. ft.
Total	2576 sq. ft.
Grate area	35.4 sq. ft.

DRIVING WHEELS.

Diameter over tires	72 13-16 ins.
Journals, diameter and length	8 9-16 ins. x 9⅛ ins.

ENGINE TRUCK WHEELS.

Diameter, engine truck	37¾ ins.
Journals, engine truck, diameter and length	5 5-16 ins. x 9⅞ ins.

WHEEL BASE.

Driving	13 ft. 9⅜ ins.
Total engine	27 ft. 0 13-16 in.
Total engine and tender	48 ft. 8 1-16 ins.

WEIGHT.

On driving wheels	110,000 lbs.
On engine truck	42,900 lbs.
Total engine	152,900 lbs.
Total engine and tender	195,000 lbs.

TENDER.

Style	Six wheel
Wheels, diameter	48¾ ins.
Journals, diameter and length	5½ ins. x 9¾ ins.
Water, capacity	1,580 gals.
Coal, capacity	7 tons.

An Improved Blacksmith Forge

IN the development of railroad shops and facilities, the blacksmith shop has generally been the last to receive its share of attention and improvement. The old style forge with its inefficient draft arrangement was continued in use so long that smoke, gas and grimy walls became a recognized feature of this shop. Although this condition exists today to some extent, there are examples of modern construction with installations of improved appliances, which illustrate clearly the advantages to be gained in development along these lines.

The blacksmith shop of the Pittsburg and Lake Erie railroad at McKees Rocks with its white walls and clear atmosphere is a good example of modern construction and up to date practice. The remarkable ventilation of the shop, noticeable in the entire absence of smoke and gas, is accompanied by the use of the improved forge designed by Mr. A. W. McCaslin, master blacksmith of the road. The principle feature of this forge will be seen by referring to the accompanying illustration. Simplicity of construction, compactness of design and a correct application of principles are the main features of this forge. They are made of cast iron, 42 inches wide, 54 inches long and 24 inches high. Above the fire pot a large hood is arranged in connection with a stack of ample area, to carry away the gases and smoke by natural draft. No special contrivances are used to increase the draft as the large open discharge areas have proved more than sufficient for the purpose. A cellar 12 inches deep extends under the forge where about two days' supply of coal can be kept in addition to a compartment which is arranged for storing both hard and soft coke. The ash box is 5 inches deep and located back of the forge so that all unsightly coal and ash boxes are done away with. The outer end of the top, or hearth of the forge, is partitioned off to hold the good slack while the old fire is being torn down, as the old slack is used again in building a new fire. In the space, 2 feet wide, between the double forges are located the blast valves and shelves for holding the small tools. The success of this forge has led to its adoption by other roads and a number of shops are now equipped with them.

Concerning Shops

A STUDY of American railroad shops of today reflects the fact that each railroad contemplating the construction of a new shop or preparing new plans for an old one, will find it necessary to work out its own salvation according to its own requirements and governing conditions. Present railroad shops embody many features worthy of being emulated and in many instances there are a number of details in the shop of one railroad which may be used to advantage in the shop of another. However an attempt to plan a shop under the mere specification that it shall provide for a given number of locomotives, without a thorough investigation and study of all the governing conditions, will hardly result in success. The same may be said of the lay out and construction of one shop as an identical counterpart of another on a foreign road, for the reason that governing conditions would hardly be alike and these conditions would necessarily modify the shop design.

The preparation of plans for a new shop are universally preceded by a comprehensive study of the most successful shops in operation both old and new However, the progress of shop construction has not adhered to such lines that a precedent can be established or any rules formulated by which shops can be prepared to meet all conditions.

Comparative data is apt to be misleading on account of the difference in demand upon the shops of various systems consequent upon conditions affecting locomotive repairs. The character of traffic, grade, ballast, curvature, water supply, type and size of locomotives, etc., varies for each locality and affects the demands upon the shop. Each shop therefore is designed and equipped according to the dictates of local surrounding conditions and influenced by the personal preference of those supervising the design.

It may be said that the general lay out of a shop is not always representative of an arrangement considered the most satisfactory for the work to be accomplished, but rather the most practical under the circumstances governing at the time the shop was built.

Its location is dependent upon the convenience provided for the accommodation of the system, or portion of the system which it serves; convenience with respect to centers of supply of labor and material and advantages with respect to cost of land, buildings, taxes, etc.

Plans have been influenced by shape and size of available land, by location of property with relation to direction of main line, by provision for construction of new shops or remodeling of old, by character and quantity of work to be done, whether for manufacture as well as repair, and whether for maintenance of cars, locomotives or both, by the demand to be made on the shop by departments other than the mechanical and by prevalent ideas of economy.

In earlier shops the use of the transfer table was the principal factor in determining the most practical lay out in providing communication among the buildings. The introduction of the powerful overhead traveling crane, capable of lifting the heaviest locomotives, is shown to have modified the arrangement and concentration of buildings. This is especially noticable in the locomotive department though the variation is noticeable in the trend of repair and building plants as a whole. In the small plant built to meet the demand of railway equipments in its early stages of development it is apparent that the effort was to so locate buildings containing machinery that power could be delivered by line shafts driven from one engine and it was thought that the rope drive would facilitate such an arrangement. Later developements include the delivery of steam from one boiler house to two or more engines located at different points about the plant and for driving line shafts. It is generally conceded that the distribution of electrical power from one central power plant provides the most satisfactory method of power transmission and permits the most flexible arrangement of buildings and equipment. Practically all recent designs of new railroad shops are observed to include a power house centrally located or nearly so—and containing all apparatus for power and light, and frequently the principal heating apparatus. Many of the older shops have been extended and electrical apparatus is being installed liberally in them also.

It may be said then that the introduction of electrical apparatus and traveling cranes, together with the use of air driven small tools and appliances, have been the prominent features in the evolution of the railway shop to meet the demand of the constantly growing motive power and rolling equipment.

The railroads of the country are found to have shops varying in degree of development. Some of them were built about forty years ago, for the repairs of about twenty-five engines and they are still in operation. The fact that most of the large roads of today represent the growth and absorption of the small roads of the past, is largely responsible for the "back number" shops found at division points of so many systems which in a general sense are considered up-to-date. Some railroad companies, noticeably the New York Central and the Baltimore & Ohio, are providing small repair plants standard to their respective systems, for light repairs and remote round houses and these are found to be of material assistance in relieving the principal shops.

Railroad managements are awakening to the necessity of good terminal facilities for maintaining running repairs on the heavier equipment of today and for quickly turning the power in minimum time consistent with its condition upon arrival at the terminal. This is reflected particularly by the terminal plants at Elkart on the L. S. & M. S and at East Altoona on the Pennsylvania.

The tendency in recent years has been to build a principal or main shop at some central point on a system where the greatest number of locomotives will be accessible for repairs and at which the principal freight traffic centers. Such a point is not usually found to be the geographical center, but rather the business center of the system.

There is evidence of but little marked improvement in the way of new shops at division points and the tendency seems to be to concentrate the heavy repairs at the main shops and maintain the light and running repairs at the outside points.

This would seem to be conceded by the following from the report of the committee on shop lay outs at the 1905 convention of the American Railway Master Mechancs' Association:—

"No matter how large and complete the main shop may be, the outlying points can advantageously and profitably use a moderate tool equipment for taking care of running and light accidental repairs, leaving heavy repairs and manufacturing to be done at the main shops. With such an equipment and organization, we believe that relatively small shops are undesirable, expensive and unprofitable, and that the larger, completely equipped main shops will handle the repairs in the most satisfactory manner."

Granting then that the railroad main shops have received the most marked attention in improvement and provision for modern facilities, it is natural to turn to these as representative of the trend in shop progress.

Shop kinks and devices for saving time and labor have been developed by individuals, to meet the requirements of conditions surrounding their work. Such kinks often have been found worthy of imitation, sometimes with greater or less modification to meet conditions in other surroundings.

New shops have felt the need of jigs, templates and methods and have been known to progress but slowly until such devices and systems from old shop routine had been installed. The significance of such items in the organization of old shops had hardly been appreciated until their want was felt in putting some new shops into commission. Hence, characteristics of older shop organizations, where found indicative of efficient operation, should be given careful attention in preparing to put a new plant into commission.

Ten-Wheel Freight Locomotive

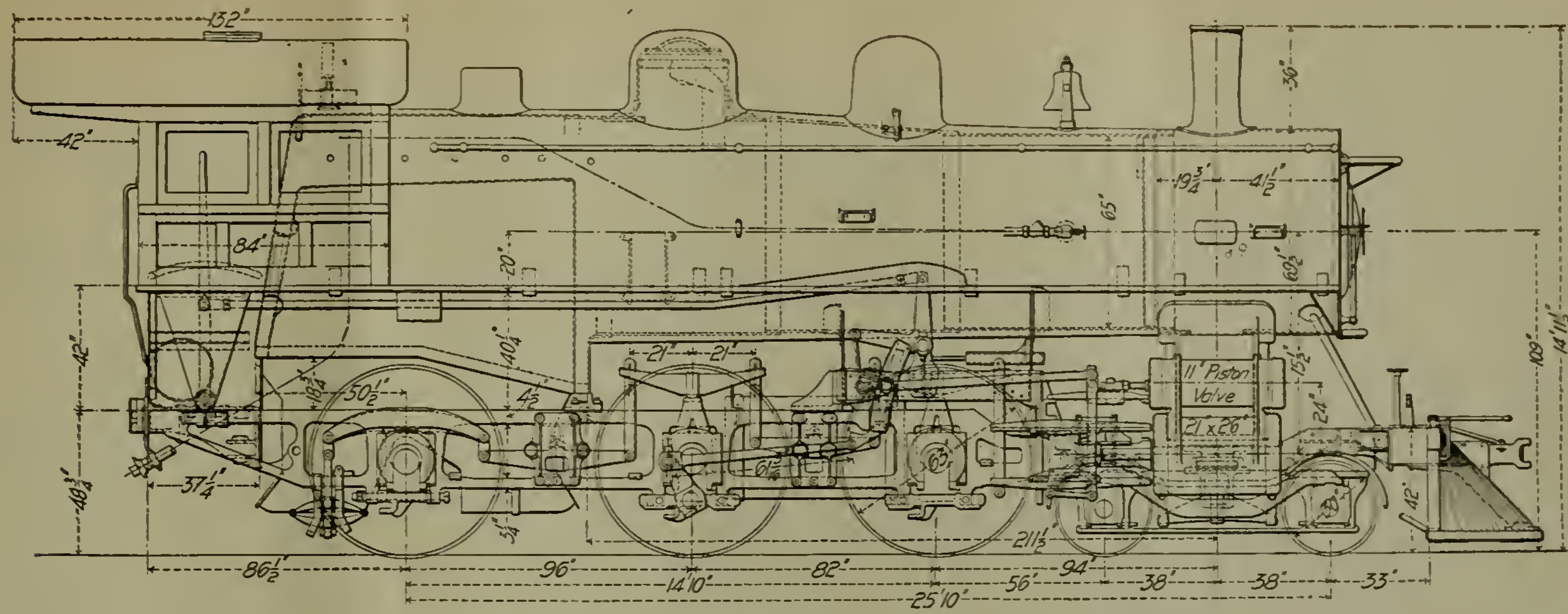
Chicago and Northwestern Railway

THE Schenectady works of the American Locomotive Company have recently delivered an order of 30, ten wheel engines to the Chicago and Northwestern Railway. These engines are for all around freight service and except the five equipped with the Walschaert valve gear, are of the same specifications as the class R-1 engines of that road, which for several years have been the standard engine for freight service.

The five engines equipped with the Walschaert valve gear are the first on the Chicago and Northwestern to be supplied with this gear, and the design differs from any arrangement used on previous locomotives constructed by the builders. By referring to the illustrations it will be observed that the link is supported in a steel casting bolted to the end of the cross-tie or yoke located between the front and middle pair of driving wheels and extending beyond the driving-wheels. Connecting this cross-tie and the guide yoke and outside of the driving-wheels is a steel plate 1¼ inches thick to 10 inches deep. The reverse shaft bearing is bolted to the top of this plate just back of the center of the forward driving-wheels, and the backward extending arm of the reverse shaft is connected to the radius bar by means of a lifting link.

An interesting feature of the design is the use of corrugated fire-box side sheets, which are quite a departure from regular practice. As shown by the accompanying illustration the sheets are provided with a series of vertical corrugations throughout the length of the sheet to within the last three rows of stay bolts at the front and back ends. At each row of staybolts the sheet is depressed ¾ of an inch, which is the amount of corrugation. This not only strengthens the sheet but provides more elasticity for distributing the strains of expansion and contraction, preventing cracks, etc. The heating surface of the side sheets is increased about 15 per cent by the corrugations and as the head of the staybolts are located in the depressions of the sheet they are better protected from the fire and consequently not so liable to burn off

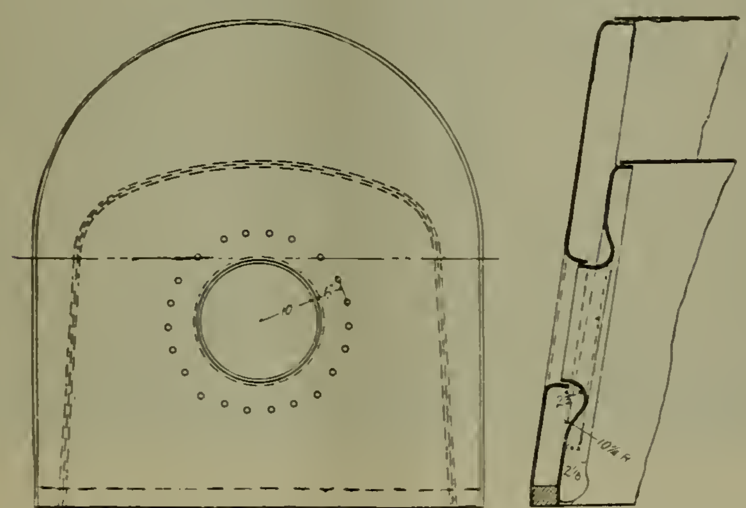
SIMPLE TEN WHEEL FREIGHT LOCOMOTIVE—CHICAGO AND NORTHWESTERN RY.



SIDE ELEVATION OF TEN WHEEL FREIGHT LOCOMOTIVE—CHICAGO AND NORTHWESTERN RY.

and leak. The Cour-Castle firebox of which the corrugated side sheet is a part, has been used on the Chicago and Northwestern since 1903 and at the present time about 300 engines are equipped.

Another feature of firebox construction worthy of mention, is the O'Connor door sheet which has been used on the Chicago and Northwestern for a number of years with excellent results. As shown by the illustration the sheet is not changed in construction from the ordinary design, except the flange at the door is made of a much larger radius than customary, which increases the flexibility of the sheet and distributes the stresses which concentrate at the flange. Increased water space around



SECTION AND END ELEVATION OF FIRE BOX, SHOWING APPLICATION OF O'CONNOR DOOR SHEET—TEN WHEEL FREIGHT LOCOMOTIVE—CHICAGO AND NORTHWESTERN RY.

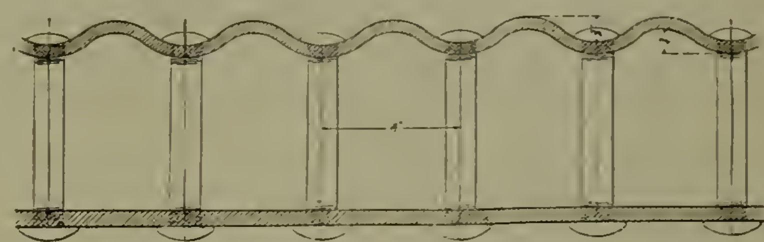
the door provides better circulation, preventing the accumulation scale and increasing the life of the sheet. That the design of the flange is based on practical experience has been proved by the service obtained from fireboxes on which it has applied.

The general features embodied in the design of the engines are shown by the illustrations and the leading specifications and dimensions are as follows:

Type of engine	10 wheel, simple
Service	Freight
Fuel	Bit. coal
Tractive force	30,900 lbs.
Gauge	4 ft. 8½ in.
Cylinders	21 by 26 in.
Valve gear, type	25 Stevenson, 5 Walschaert
Valves, size and kind	11 inch piston
Valves, steam lap	1 in.
Exhaust lap	1-16 in.
Valve travel, in full gear	5¾ in.

RATIOS.

Weight on drivers ÷ tractive force	4.37
Tractive force × diameter drivers ÷ heating surface	660.0
Firebox heating surface ÷ total heating surface	.053
Total heating surface ÷ grate area	64.0
Weight on drivers ÷ total heating surface	46.0
Volume of cylinders cu. ft.	10.4



SECTION OF FOUR-CASTLE SIDE SHEET SHOWING DESIGN OF CORRUGATIONS—TEN WHEEL LOCOMOTIVE—CHICAGO AND NORTHWESTERN RY.

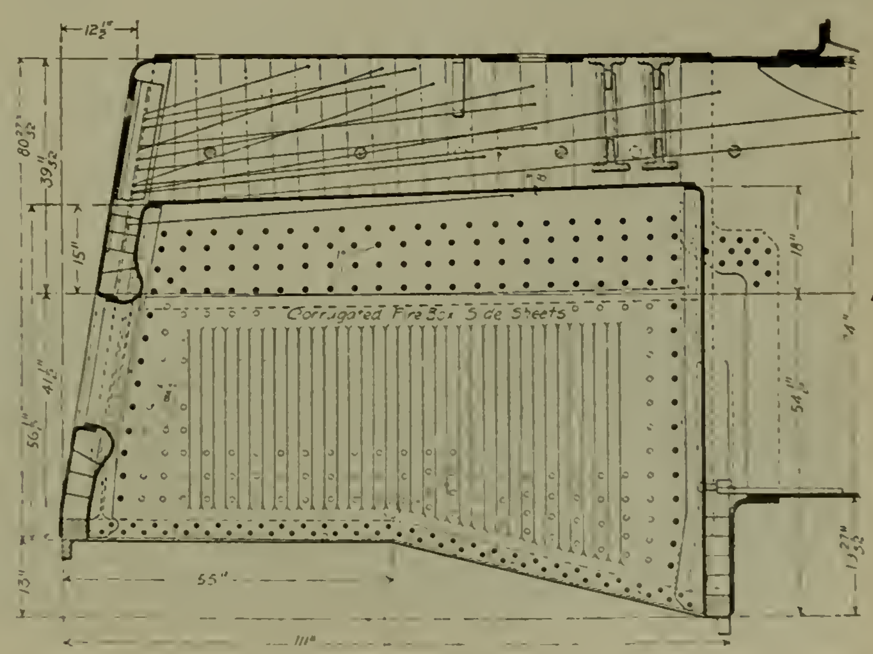
Total heating surface ÷ volume of cylinders	285.0
Grate area ÷ volume of cylinders	4.5

BOILER.

Type	Extended wagon top
Working pressure	200 lbs.
Diameter first ring	63⅜ in.

FIRE BOX.

Material	Steel
Length	102⅛ ins., width. 65¼ ins.



SECTION OF FIREBOX SHOWING CORRUGATED SIDES SHEETS—TEN WHEEL LOCOMOTIVE—CHICAGO AND NORTHWESTERN RY.

Thickness of sheets, sides, crown	3/8 in. back, 3/8 in.
Thickness of sheets, tube	1/2 in.
Water space, front	4 in., back, 4 in.
TUBES.	
Number	337
Diameter	2 in.
Length	16 ft. 0 in.
HEATING SURFACE.	
Fire box	150.8 sq. ft.
Tubes	2808.4 sq. ft.
Total	2959.2 sq. ft.
Grate area	46.3 sq. ft.
DRIVING WHEELS.	
Diameter, over tires	63 ins.
Journals, main, diameter and length	9 in. x 12 1/2 in.
Journals, others, diameter and length	8 1/2 in. x 12 1/2
ENGINE TRUCK WHEELS.	
Diameter, engine truck	30 ins.
Journals, engine truck, diameter, and length	6 in. x 10 in.
WHEEL BASE.	
Driving	14 ft. 10 in.
Total engine	25 ft. 10 in.
Total engine and tender	57 ft. 9 in.
WEIGHT.	
On driving wheels	135,500 lbs.
On engine truck	44,000 lbs.
Total engine	179,500 lbs.
Total engine and tender	319,000 lbs.
TENDER.	
Style	Water bottom
Wheels, diameter	33 in
Journals, diameter and length	5 1/2 in. x 10 in.
Water, capacity	7,500 gals.
Coal, capacity	10 tons

All Steel Postal Car

Harriman Lines

FROM the present indications the steel passenger car is to have a permanent place in the equipment of a modern railroad, on both steam and electric lines. A number of railroads have already built experimental all-steel cars, and the various car builders throughout the country, have, to a greater or less extent, built experimental cars, and in other ways, have been preparing for the work. Several large orders for all-steel cars for electric and interurban service, have been filled during the past two years, notably, cars for the Brooklyn Rapid Transit, New York Subway, and the New York Central Railroad, but as yet, no orders for steel passenger cars for trunk line service have been filled by any of the car building companies.

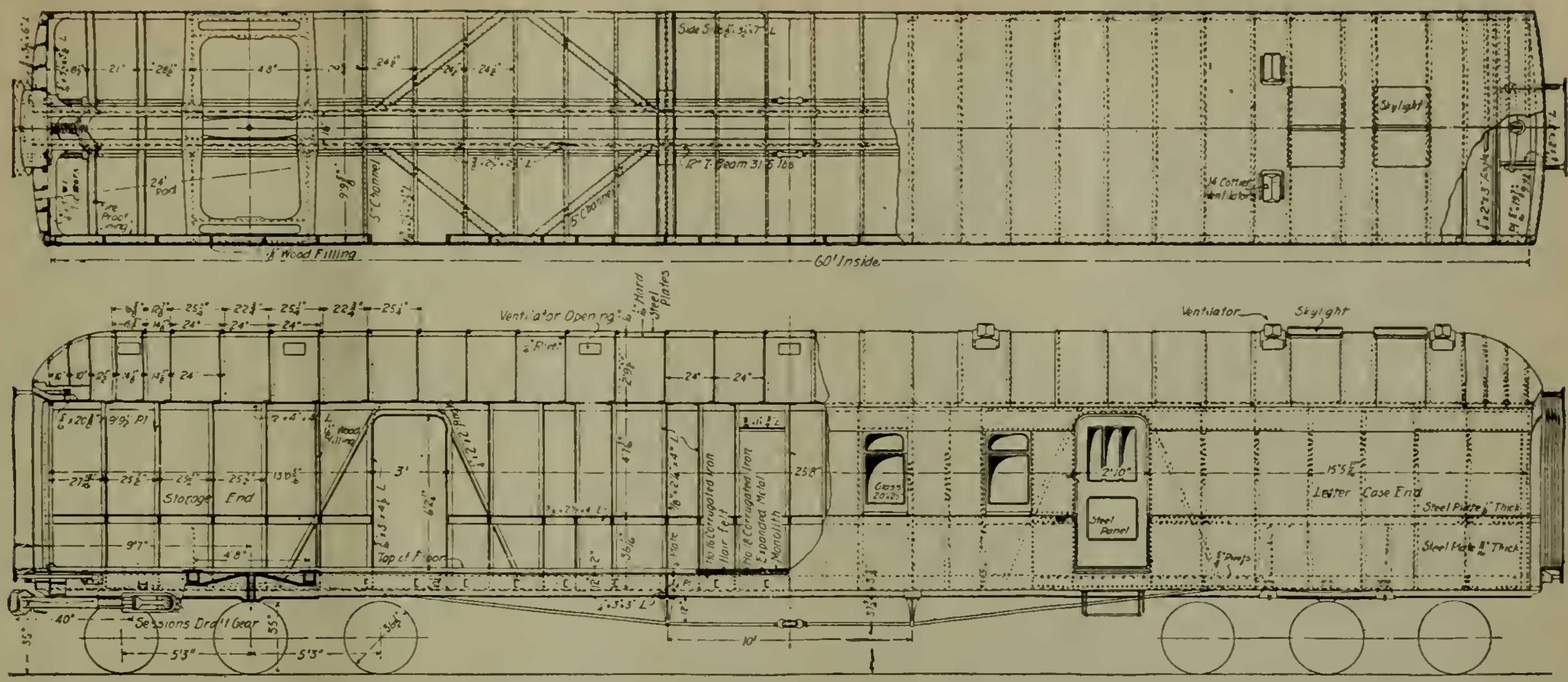
Realizing these demands, the Harriman line officers have decided to put some all-steel equipment on their lines, and with this end in view, designs have been worked up for an all-steel postal car. The first of these cars have recently been turned out at the Union Pacific Railroad Shops at Omaha and the Southern Pacific shops at Sacramento, Cal. The latter car was briefly described in the June issue of the RAILWAY MASTER MECHANIC. The postal authorities have very favorably commented upon it, and finally approved it for service on the western lines. It is to be followed by thirty-four additional cars, contracts for which are being let.

The car, as to general dimensions is essentially the same as the old designs of Harriman line wooden postal cars, the inside length being 60 feet, and the width, 9 feet 0 5/8 inches. The car is carried on six-wheel trucks, 36 1/2 inch wheels, truck-frame consisting of one large steel casting, making a truck which is practically indestructible. The car body is formed of I-beams, channels and angles; center sills, two 12 inch I-beams, side sills, 1/2x3 1/2x7 in. angles. Body bolsters are of the double cast steel design, from the Commonwealth Steel Company. The end sills are of cast iron. The underframe composed of I-beam

INTERIOR OF ALL STEEL POSTAL CAR, HARRIMAN LINES.

center sills and heavy side sills, in which the cast steel body bolster is built, is additionally braced by cross bridging, and diagonal braces of 5 inch channels; there are also two needle beams built up of heavy plate and angles.

ALL STEEL POSTAL CAR BUILT AT OMAHA SHOPS OF UNION PACIFIC RY.—STANDARD FOR HARRIMAN LINES.

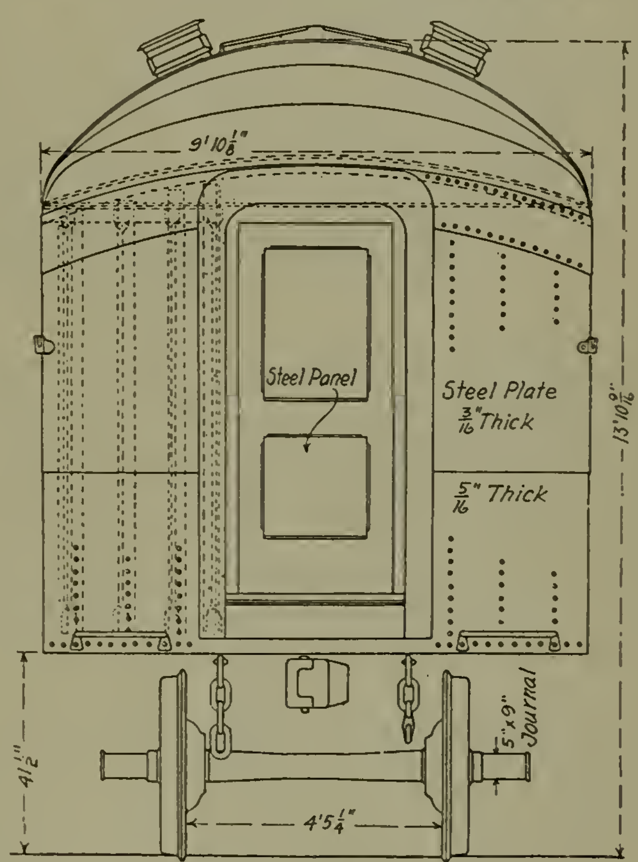


PLAN, ELEVATIONS AND SECTIONS SHOWING DETAILED CONSTRUCTION OF CAR—ALL STEEL POSTAL CAR, HARRIMAN LINES.

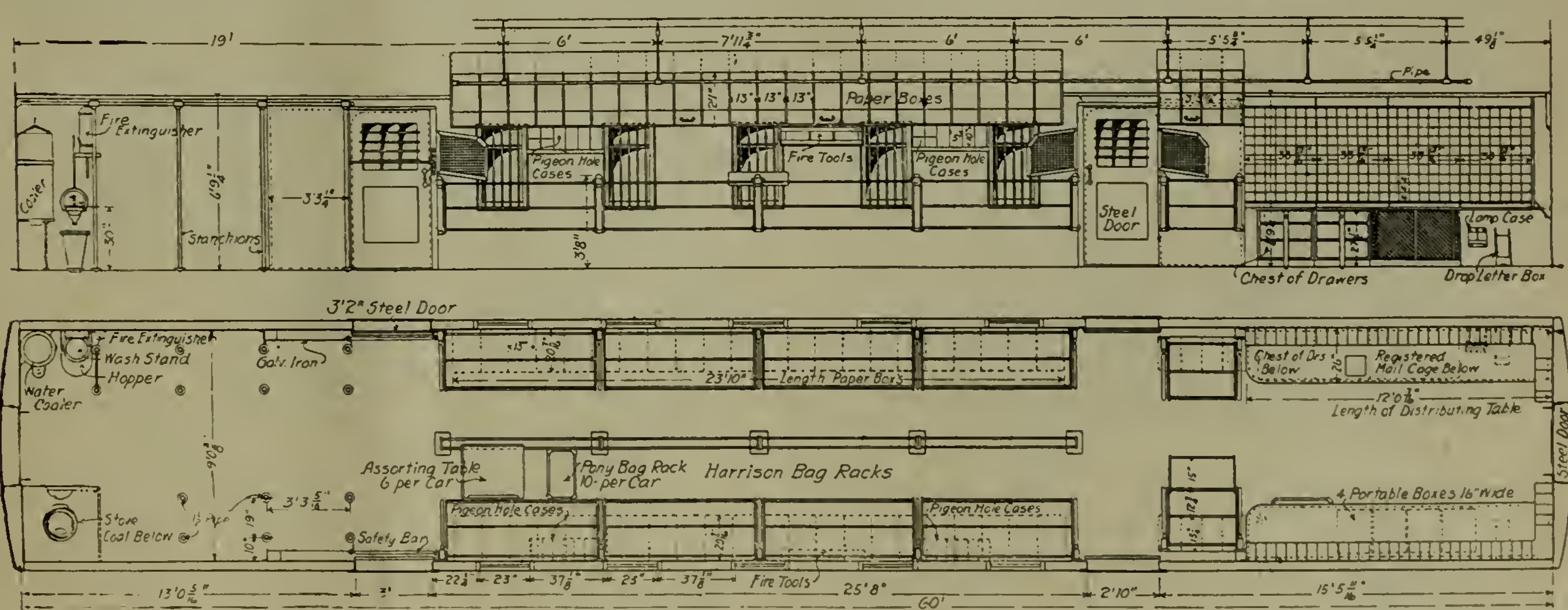
Posts are 2¼x4 in. angles, to which the side plate is riveted, the car-line being in one piece, riveted to the side plates.

The equipment is essentially the same as in the recent wooden cars, but everything is of metal and fireproof material, the letter-cases, distributing tables, paper boxes, etc., all being made of sheet steel and galvanized iron. The floor is made up of corrugated sheet steel, wire matting, and monolith, and the interior finish is in transite, ¼ inch thick.

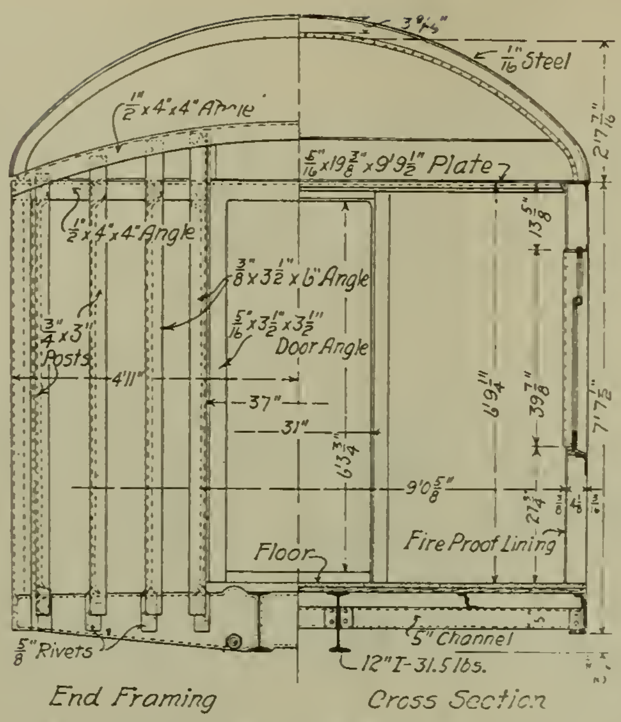
A special feature in this car, is its curved roof and ventilating system, the clear story and deck sash having been done away with, making a plain curved roof on which are placed suction ventilators which exhaust the foul air from the roof of the car. The construction of the roof is a very economical feature, and the carline is in one piece of ¼x2x4 inch angle, bent over former, on which is riveted a covering of 1/16 inch galvanized iron, which makes the roof almost semi-circular in appearance, and perfectly plain. The ceiling is also made of 1/16 inch galvanized iron, flanged and riveted in between the car-lines, making the roof construction very efficient, practi-



END VIEW SHOWING EXTERNAL CONSTRUCTION—ALL STEEL POSTAL CAR, HARRIMAN LINES.



PLAN AND SECTION OF CAR SHOWING INTERIOR CONSTRUCTION AND ARRANGEMENT OF MAIL FACILITIES—ALL STEEL POSTAL CAR, HARRIMAN LINES.



CROSS-SECTION SHOWING END FRAMING AND CONSTRUCTION—ALL STEEL POSTAL CAR, HARRIMAN LINES.

cally being riveted and soldered into two continuous sheets of steel.

The lighting system is the Axle Electric Light, of the Adams & Westlake Company, and the lights are distributed down each side of the car over the paper boxes. No oil or gas tanks are carried, arrangements being made for candle lighting, in possible case of necessity. The heating system is the vapor steam heat.

The car has been placed in regular service between Omaha and Denver, and is giving evidence of being entirely satisfactory in every respect.

The leading dimensions and specifications are as follows:

Length over end sills	60 ft. 1½ in.
Length over buffers	63 ft. 3½ in.
Length inside	60 ft. 0 in.
Width inside	9 ft. 0 in.
Height inside	9 ft. 4$\frac{11}{16}$ in.
Height, rail to top of roof	14 ft. 0⅛ in.
Width over side sills	9 ft. 9⅝ in.
Width over eaves	9 ft. 10 in.
Distance, center to center bolsters	44 ft. 1½ in.
Truck wheel base	10 ft. 6 in.
Rail to center of coupler	35 in.
Heating system	Vapor
Lighting	Electric
Interior finish	Fireproof Transite
Light weight of each six wheel cast steel truck	18,600 lbs.
Light weight of car complete	116,900 lbs.

A Few Specialties of the Elkhart Shops

Lake Shore and Michigan Southern Ry.

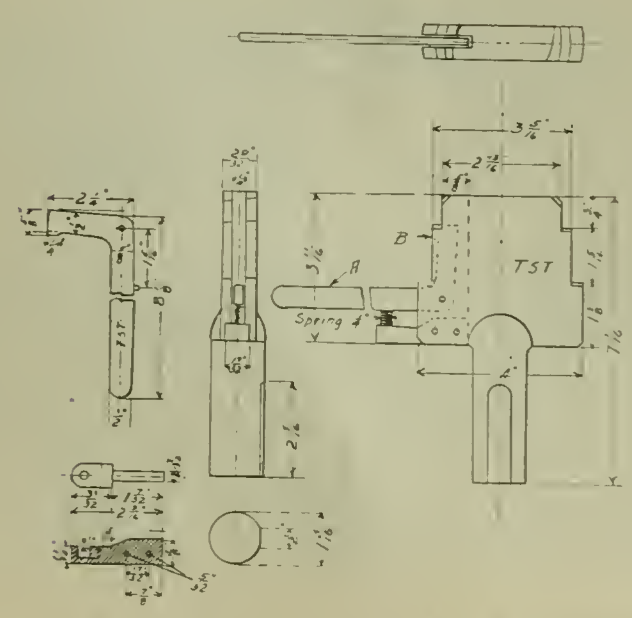
Last Installment

A special boring tool has been devised for finishing 3½ inch tank hose nuts, and is illustrated in the drawing. It was designed for use in a turret lathe and by referring to the illustration it will be noticed that a shank with key way is provided for holding it in the tool post. The body of the tool is made of tool steel 29/32 of an inch thick and provided with cutting edges which will furnish the nut to the sizes required. The handle marked "A" is pivoted in the body of the cutter and has a cutting edge at "B" for the purpose of relieving the metal back of the threads of the nut.

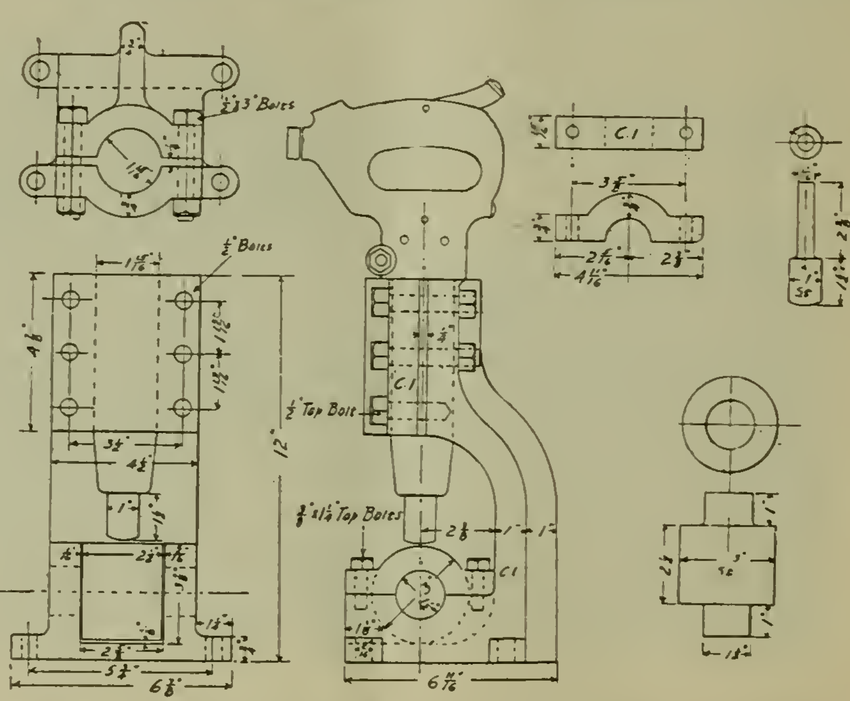
By pressing down on the handle the cutting edge is thrown out against the inner face at the shoulder of the nut and a groove ¼ inch wide cut below the depth of the thread. A coiled spring returns the cutter to a point which will clear the nut so the tool can be withdrawn. The nut is then threaded in the usual manner.

A pneumatic swager for iron flue ferrules is next shown, which has been found to be a convenient and practical machine for this purpose. An air hammer is mounted in a vertical position on a casting 12 inches high as shown in the drawing. The anvil is a 3 inch roller supported by two journal boxes cast in the base of the casting. The hammer tool is 1 inch round steel with end slightly convex and is permanently attached to the plunger of the machine, so that the tool operates directly against the anvil.

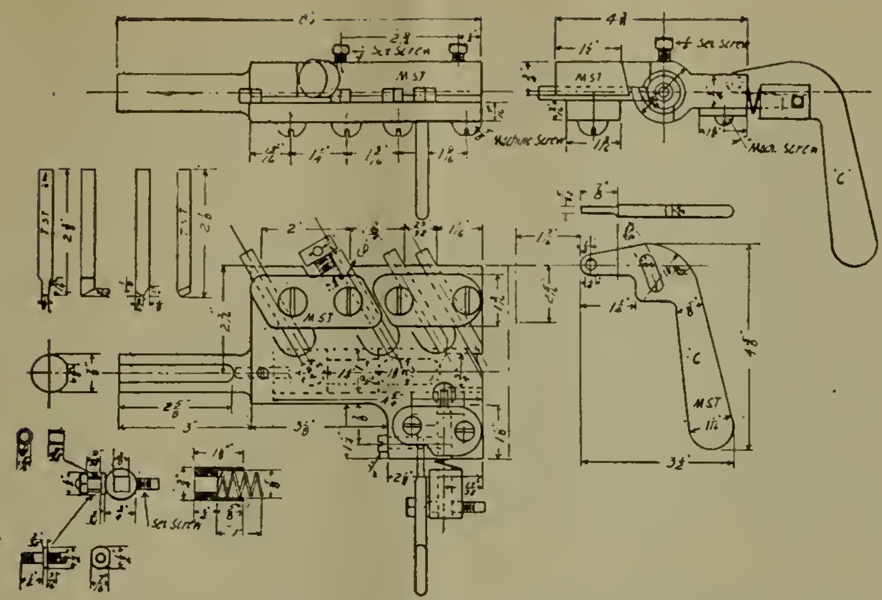
In operating the swager, sheet iron having one di-



SPECIAL BORING TOOL FOR TANK HOSE NUTS—ELKHART SHOPS, LAKE SHORE AND MICHIGAN SOUTHERN RY.



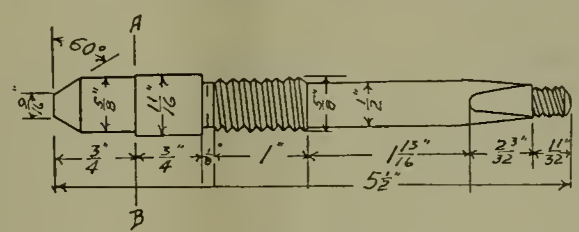
PNEUMATIC SWAGER FOR IRON FLUE FERRULES—ELKHART SHOPS, LAKE SHORE AND MICHIGAN SOUTHERN RY.



SPECIAL TOOL FOR FINISHING GAUGE COCK VALVE STEMS—ELKHART SHOPS, LAKE SHORE AND MICHIGAN SOUTHERN RY.

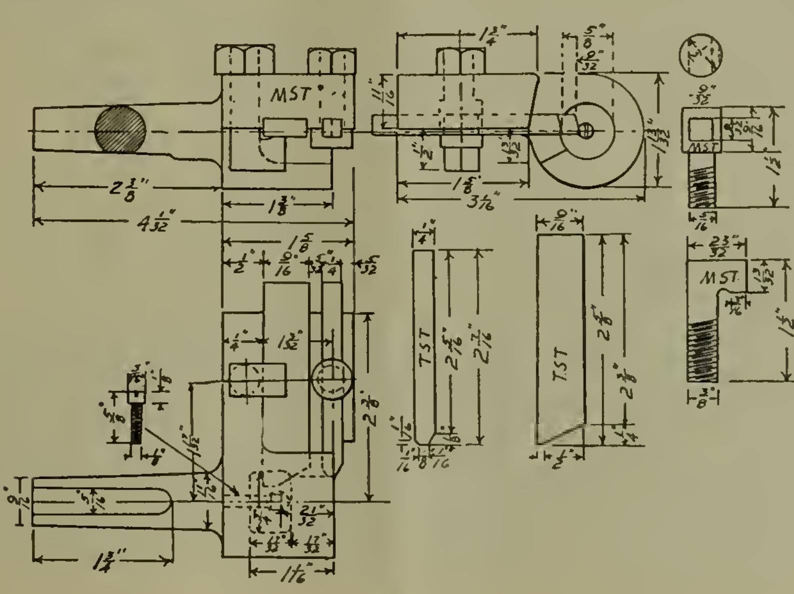
mension the same as the desired length of the ferrules is passed under the hammer and the edges swedged down. The sheet is then cut up into ferrules of the proper width by tin shears and rolled to fit the flue. This has proved to be a very handy and satisfactory appliance for doing the work it was designed for.

By means of the two special tools shown, gauge cock valves and valve stems are turned up and finished automatically with the exception of threading. The fin-

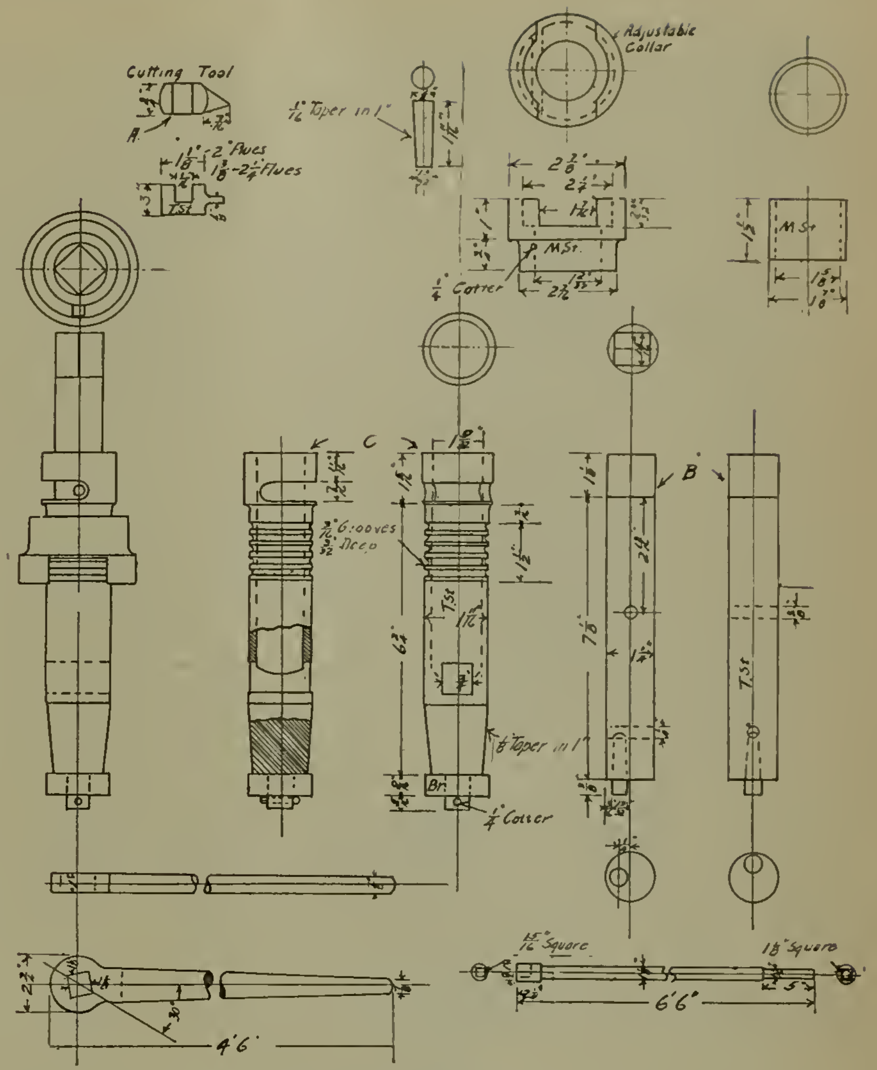


GAUGE COCK VALVE AND STEM AS FINISHED BY THE SPECIAL TOOLS SHOWN.

ished product is also shown the line A B marking the different portions of the work performed by the two tools. The stem as shown to the right of the line A B is finished by the first tool illustrated which will be readily understood from the drawing. The cutting tools are arranged as shown and set to finish the various parts of the stem as it is fed in by the operator. By operating the handle "C" which is attached to a movable cutting off tool a groove ⅛ of an inch wide and 1/16 of an



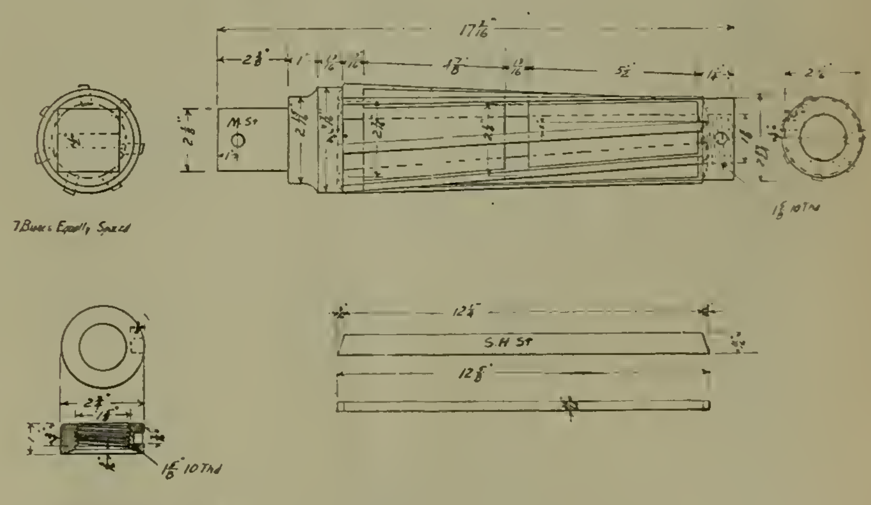
SPECIAL TOOL FOR FINISHING THE GAUGE COCK VALVE SEAT—ELKHART SHOPS, LAKE SHORE AND MICHIGAN SOUTHERN RY.



HAND FLUE CUTTER FOR ROUND HOUSE WORK—ELKHART SHOPS, LAKE SHORE AND MICHIGAN SOUTHERN RY.

inch deep is cut in the stem for relieving the thread. A coiled spring returns this tool to a position which clears the stem so that it may be withdrawn from the device.

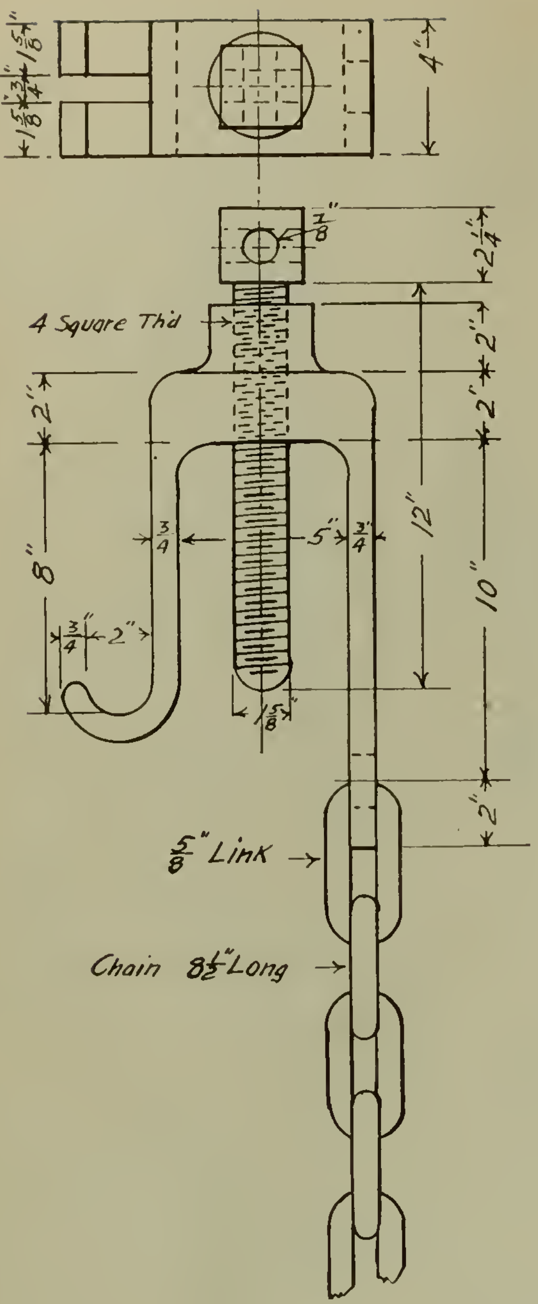
The valve seat proper and that portion to the left of the line A B is finished by the second tool shown which is an arrangement similar to that for finishing the other end of the stem. Two special cutting tools are



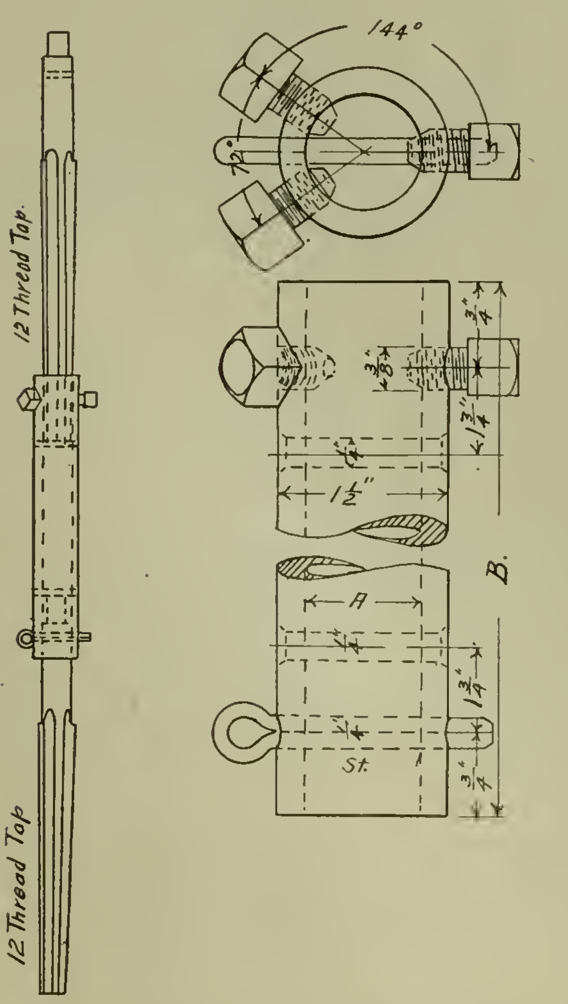
CROSSHEAD REAMER WITH STEEL INSERTS—ELKHART SHOPS, LAKE SHORE AND MICHIGAN SOUTHERN RY.

arranged and adjusted so that both the valve and the seat are finished in one operation. By using these special tools gauge cock and other valves can be quickly turned up and with the accuracy of automatic machinery.

When a small number of flues are to be removed, where a pneumatic cutter is not accessable or would not pay to rig up in position, a hand cutter has been designed for this purpose. Although there are a number of parts to the appliance, its construction is simple, as



APPLIANCE FOR COMPRESSING LOCOMOTIVE DRIVING SPRINGS—ELKHART SHOPS, LAKE SHORE AND MICHIGAN SOUTHERN RY.

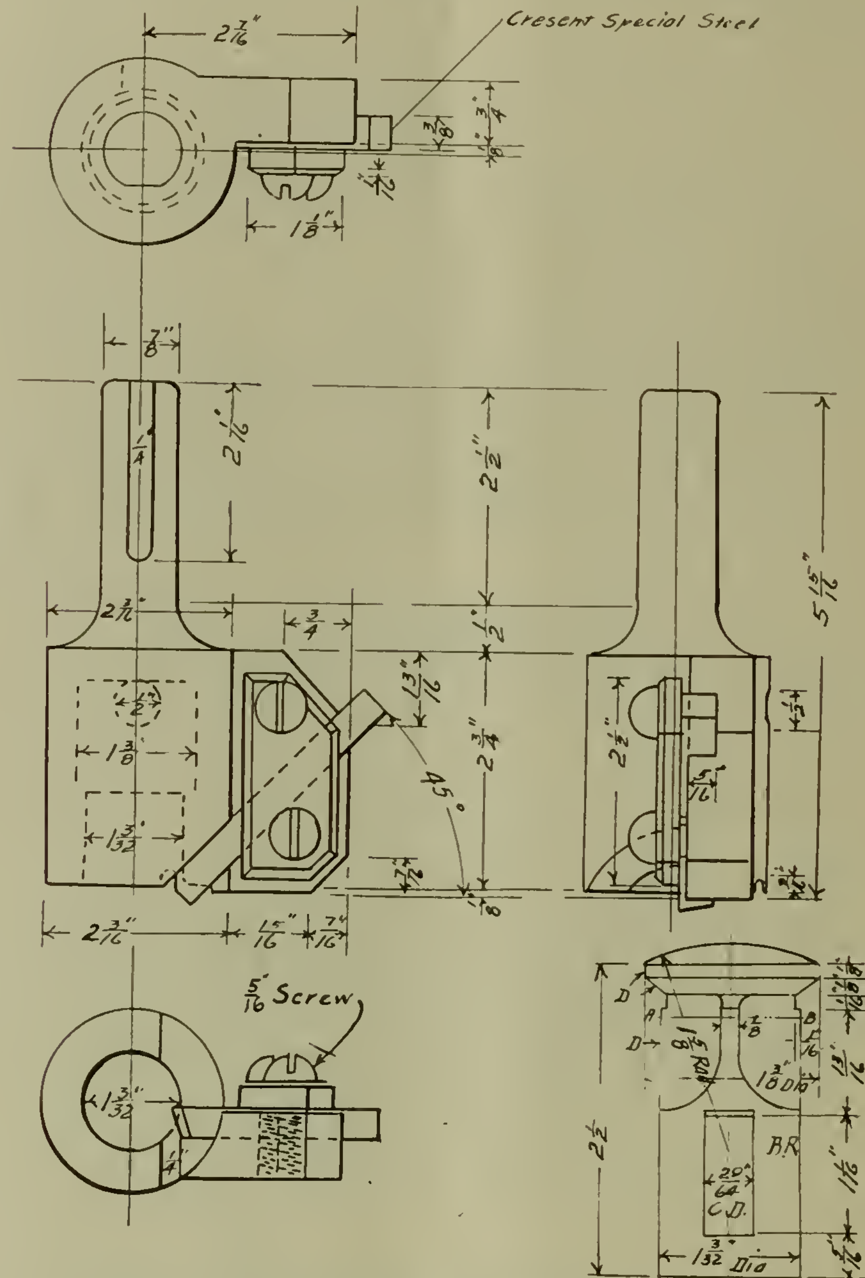


A	B
15/16"	9 3/8"
15/16"	10 3/4"
15/16"	12 3/4"
15/16"	13 3/4"
1"	9 3/8"
1"	10 3/4"
1"	12 3/4"
1"	13 3/4"
1 1/16"	9 3/8"
1 1/16"	10 3/4"
1 1/16"	12 3/4"
1 1/16"	13 3/4"
1 1/8"	9 3/8"
1 1/8"	10 3/4"
1 1/8"	12 3/4"
1 1/8"	13 3/4"

EXTENSION SLEEVE FOR BOILER TAPS—ELKHART SHOPS, LAKE SHORE AND MICHIGAN SOUTHERN RY.

shown by the illustration. The flue is cut in two, close to the flue sheet by the cutting tool "A" which is rotated against the inner surface of the fire by means of the rod "B" which this operated by a wrench. The rod "B" works in the thimble "C" the cutting tool projecting through the square opening shown.

By means of the dowel pin fitted in the end of the rod "B" the cutting tool "A" can be adjusted in various positions for taking a large or small cut. The appliance is held in position while making the cut by an adjustable collar on the thimble which fits against the flue sheet. A 1/4 inch cotter pin in the collar, fits in the grooves on the thimble and provides for various adjustments of the



SPECIAL TOOL FOR FINISHING THE CYLINDER COCK VALVE SHOWN—ELKHART SHOPS, LAKE SHORE AND MICHIGAN SOUTHERN RY.

cutting tool, so the flue can be cut at the desired distance from the flue sheet. The flue cutter has proved to be a very desirable tool for roundhouse work and has superceded the tools formerly used for this purpose.

A built up reamer with 7 inserts of self hardening steel for reaming the wrist pin fit in crossheads is shown in the accompanying illustration. The inserts are made of self hardening steel 23/64 of an inch thick and 12 5/8 inches long, set in the body of the reamer at an angle to improve their cutting power. A round nut on the small end of the reamer keeps the blades in place. There are 6 different sizes of the reamer made and while there is nothing particularly new in the design, it illustrates what can be done in providing tools of this description at a cost much below the manufactured article, in addition to the advantage of having a tool that can always be made new by the addition of new inserts.

Among the variety of appliances arranged for compressing locomotive driving springs, the device illustrated although not an original product of the Elkhart shop has been found to be one of the best under all conditions. The chain is made of ⅝ inch links and can be passed through the small spaces between frames and driving wheels with much more facility than usual arrangement of rods, etc. It possesses the additional advantage of being flexible which permits all slack to be taken up, before compression of the spring is begun which represents a considerable saving in time. The adaptibility of this appliance and the rapid results obtained from it, should lead to its more general adoption in roundhouse work.

The next illustration shows an extension sleeve for use in connection with boiler taps which obviates the necessity of carrying a large stock of long taps for radial stays. The arrangement makes it possible to use any combination of the usual 12 thread boiler taps, for tapping the two sheets for crown and radial stay work, without resorting to the use of the long expensive taps of regular design. In using the appliance the first tap is started through the crown sheet by a man in the firebox with an air machine; the sleeve which is connected with the second tap is then applied to the end of the first tap and the second tap started through the roof sheet, the machine then driving the whole as one tap. The results obtained from the use of this sleeve have been very satisfactory and equal to that of the special taps. In roundhouse and small shops where the number of tools are limited the sleeve could be employed with advantage.

The special tool has been arranged for finishing cylinder cocks valves at one operation. The wings and seat are finished by the tool shown which has two cutting edges. The tool holder is made for use in a Fox lathe and its construction is manifest from the drawing, which gives an idea of the amount of work done by the appliance.

The output of the Elkhart shops will bear comparison with many of the modern plants notwithstanding its equipment of old machine tools, due to the utilization of shop kinks and methods.

We are under obligation to Mr. M. J. McCarthy, Master Mechanic, for the illustrations presented.

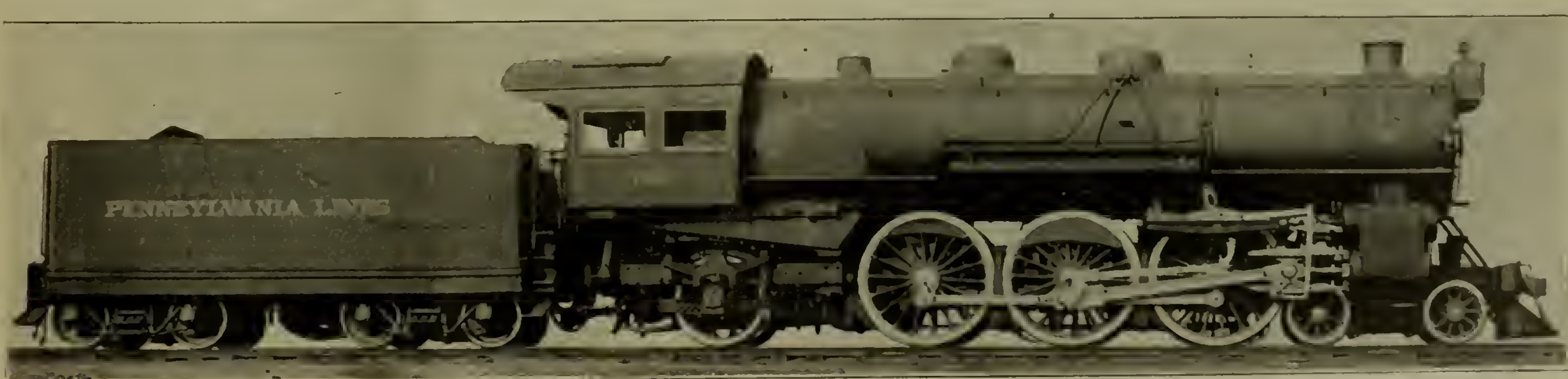
The Heaviest Passenger Locomotive

Pennsylvania Railroad

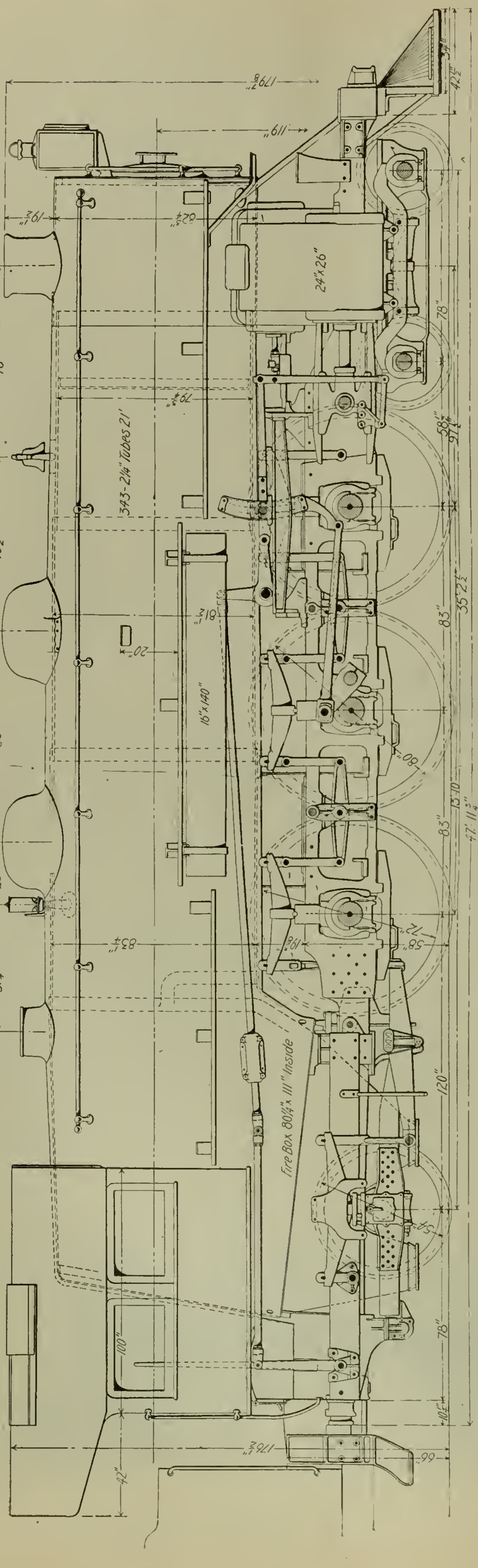
THE Pacific type locomotive recently completed by the American Locomotive Company at the Pittsburgh works for the Pennsylvania Railroad is the largest and heaviest passenger locomotive ever built. The principal passenger locomotives now in use on the Pennsylvania Railroad for handling the through trains are of the Atlantic type, the largest designated as class E 3d. These engines will develop a tractive force of 27,500 pounds and have 22 by 26 inch cylinders, 80 inch drivers and carry 205 pounds boiler pressure. Although highly successful in handling 8 car trains on fast schedules, the Atlantic type engines have been unequal to the task of taking 10 to 12 car trains over divisions with heavy grades on schedule time, as the load was beyond their capacity. An Atlantic type engine designed to meet these conditions would necessitate increasing the load on drivers to an extent which was deemed impractical, consequently the Pacific type was adopted as the design upon which an engine of the required capacity could be built. Although only one locomotive has been constructed it is not an experimental machine in point of design, but the conservative plan of thoroughly testing the performance of the locomotive on a particular division of the road has been followed, before more of the same design are ordered.

The locomotive will develop a tractive force of 32,700 pounds which is 22 per cent higher than that of the Atlantic type locomotives now in use on the Pennsylvania. The drivers are 80 inches in diameter. Cylinders 24 by 26 inches, steam pressure 205 pounds. The weight of the locomotive is 269,200 pounds, of which 173,550 pounds is on the drivers. The general features of design are shown by the accompanying illustrations and the leading dimensions and specifications are given in the following table:

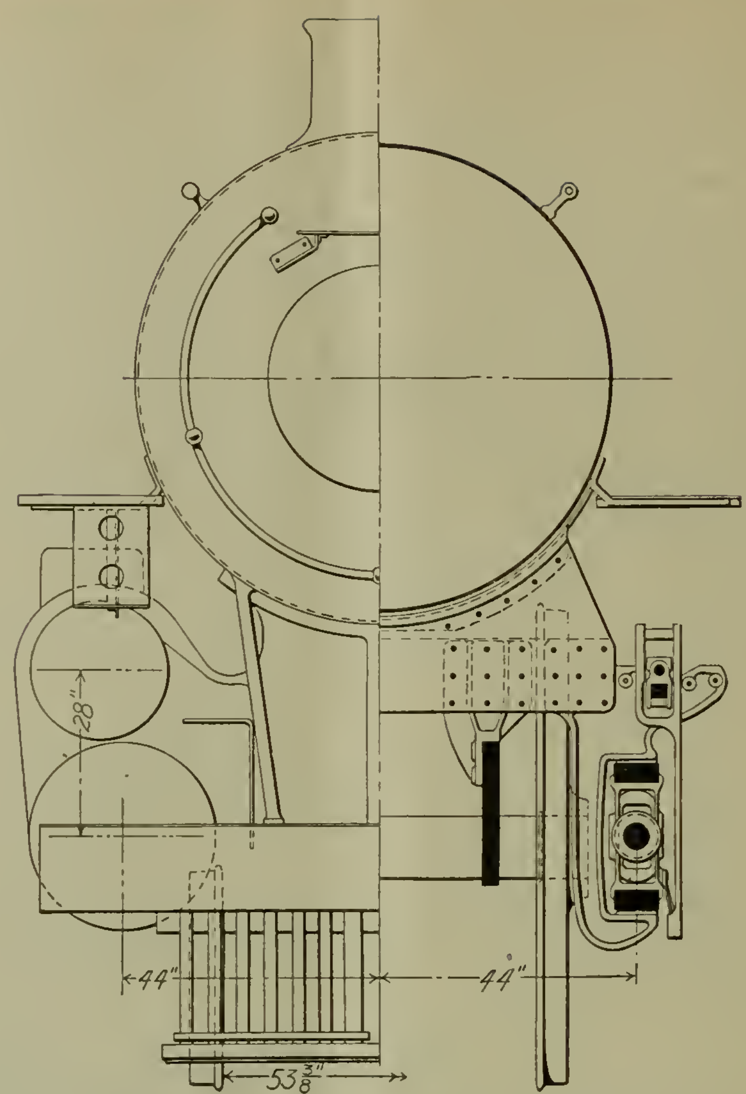
Type of engine	Pacific-simple
Service	Passenger
Fuel	Bit. Coal



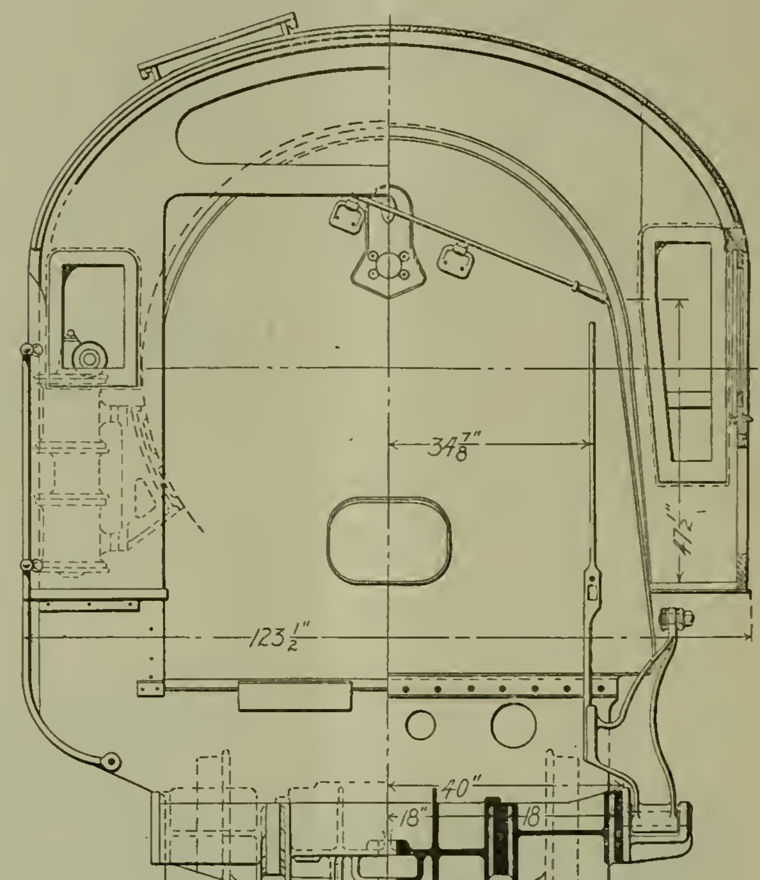
HEAVIEST PASSENGER LOCOMOTIVE EVER BUILT—PENNSYLVANIA RAILROAD.



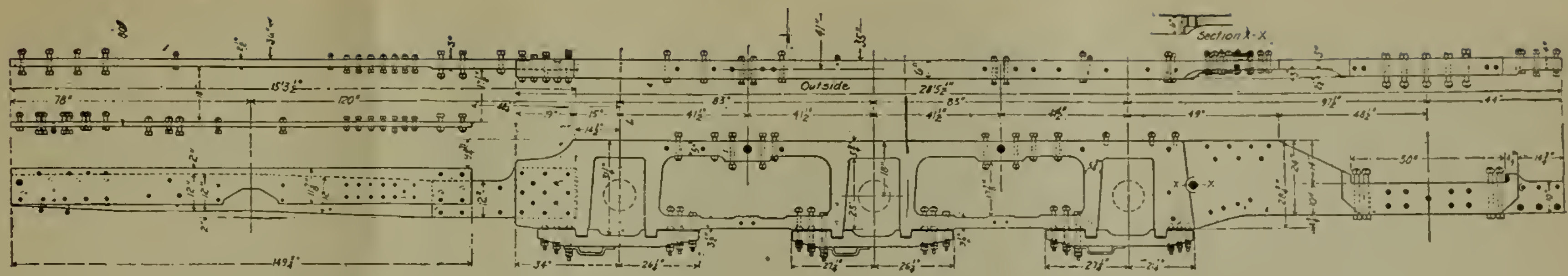
SIDE ELEVATION OF HEAVIEST PASSENGER LOCOMOTIVE EVER BUILT—PENNSYLVANIA RAILROAD.



FRONT ELEVATION AND SECTION OF HEAVIEST PASSENGER LOCOMOTIVE —PENNSYLVANIA RAILROAD.



REAR ELEVATION AND SECTION OF HEAVIEST PASSENGER LOCOMOTIVE —PENNSYLVANIA RAILROAD.



PLAN AND ELEVATION OF MAIN FRAMES FOR HEAVIEST PASSENGER LOCOMOTIVE—PENNSYLVANIA RAILROAD.

Tractive force	32,700 lbs.
Gauge	4 ft., 8½ ins.
Cylinders	24 in. by 26 in.
Valve Gear, type	Walschaert
Valves, size and kind	Piston, 16 in. diam.
Valve travel, in full gear	7 in.
RATIOS.	
Weight on drivers ÷ tractive force	5.3
Tractive force × diameter drivers ÷ heating surface	590.0
Firebox heating surface ÷ total heating surface	.046
Total heating surface ÷ grate area	72.0
Weight on drivers ÷ total heating surface	39.2
Volume of cylinders cu. ft.	13.6
Total heating surface ÷ volume of cylinders	326.0
Grate area ÷ volume of cylinders	4.5
BOILER.	
Type	Straight
Working pressure	205 lbs.
Diameter first ring	79¾ in.
Staying	Radial
FIRE BOX.	
Material	Steel
Length	111 ins., width, 80¼ ins.
Thickness of sheets, sides	⅜ in., back, ⅜ in.
Thickness of sheets, crown	⅜ in., tube, 9/16 in.
Water space, front	4½ in., sides 4½ in., back 4½ in.
TUBES.	
Number	343
Diameter	2¼ in.
Length	21 ft. 0 in.
HEATING SURFACE.	
Fire box	205 sq. ft.
Tubes	4,222 sq. ft.
Total	4,427 sq. ft.
Grate area	61.8 sq. ft.
DRIVING WHEELS.	
Diameter, over tires	80 ins.
Diameter, wheel centers	72 ins.
Journals, main, diameter and length	10½ in. x 14 in.
Journals, others, diameter and length	10 in. x 14 in.
ENGINE TRUCK WHEELS.	
Diameter, engine truck	36 ins.
Journals, engine truck, diameter and length	6½ in. x 12 in.
Diameter, trailing truck	54 ins.
Journals, trailing truck, diameter and length	8 in. x 14 in.
WHEEL BASE.	
Driving	13 ft. 10 in.
Total engine	35 ft. 2½ in.
Total engine and tender	67 ft. 0¾ in.
WEIGHTS.	
On driving wheels	173,550 lbs.
On engine truck	46,175 lbs.
On trailing truck	49,475 lbs.
Total engine	269,200 lbs.
Total engine and tender	409,200 lbs.
DIMENSIONS.	
Distance from rail to top of stack	14 ft. 11⅞ in.
Distance from rail to center of boiler	9 ft. 11 in.
TENDER.	
Wheels, diameter	36 in.
Journals, diameter and length	5½ in. x 10 in.
Water, capacity	7,000 gals.
Coal, capacity	11 tons

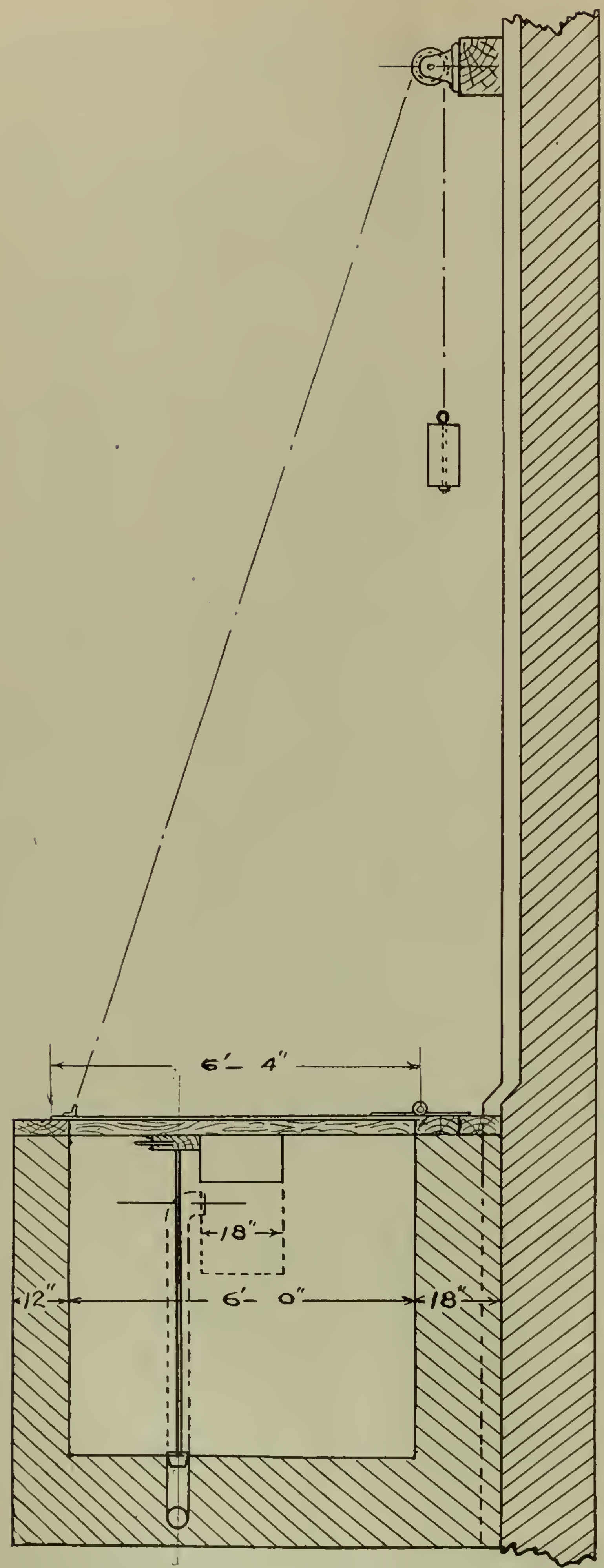
Cleaning Locomotive Machinery

CONSIDERING the number of locomotive repair shops that are lacking in facilities for cleaning machinery and parts removed from locomotives brought into the shop for repairs, it would seem of interest to note the methods in vogue at those plants in which careful provision has been made for this class of work.

The most systematic method of removing grease and dirt from locomotive parts is by means of the lye vat. In general this process consists of submerging the articles to be cleaned in a solution of lye and water and heating the solution to a high temperature by means of steam coils. It is unusually necessary to leave the parts in the boiling solution for several hours to cleanse them properly. The articles to be cleaned are placed in large cages which are handled by cranes serving the vats. When the grease and dirt have been thoroughly soaked, the cages are raised by means of the crane, are set out by the side of the vat and the articles are rinsed off with water or steam.

The design of the vat is chiefly a mechanical matter. The shape is of no importance so far as the cleaning is concerned, and affects only the convenience of manipulation. Naturally the cages for holding the articles to be cleaned will be made to suit the cranes and other details of the shop in which they are used, and the vats will be made to suit the cages. This is entirely a question of convenient handling.

LYE VAT AT SAYRE SHOPS—LEHIGH VALLEY R. R.



CROSS-SECTION OF LYE VAT FOR CLEANING LOCOMOTIVE MACHINERY AT THE ANGUS SHOPS OF THE CANADIAN PACIFIC RY.

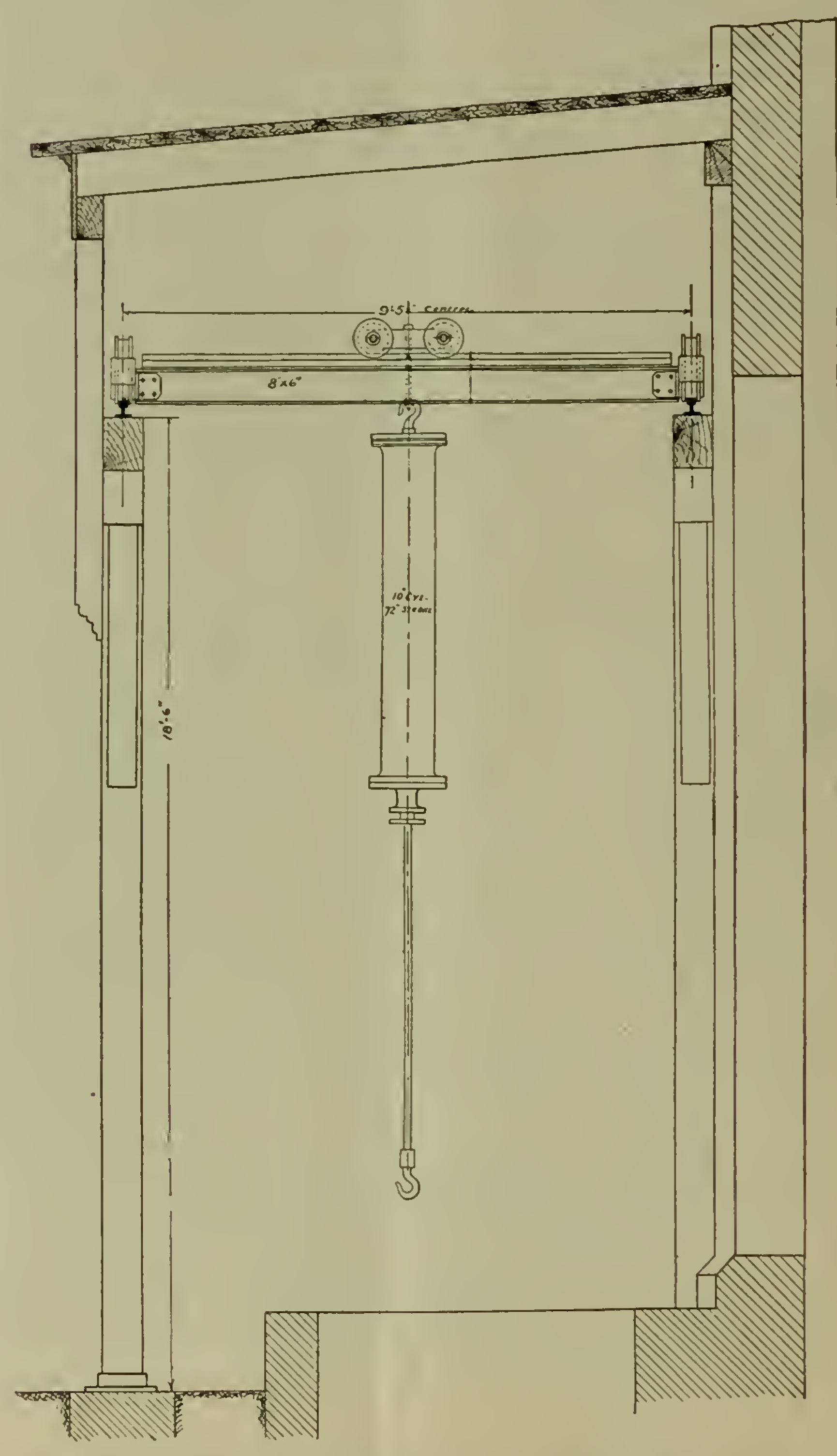
The methods of handling the parts to and from the vat; the types of vat and cradle used for this work, and the location of the vat with regard to the locomotive shop vary materially and it is interesting to observe the arrangements at several shops. Some of these reflect careful provision for the lye vat in the original layout; others have added the vat as circumstances seemed to require; while still others soak only their air brake apparatus, lubricators, etc., in solutions of lye, and clean the other parts with oil, waste, and sawdust.

The Sayre locomotive shop of the Lehigh Valley Railroad is arranged much as two erecting floors with machine floors between them. The bays between the erecting and machine floors are referred to as covered yards, though actually they are crane served portions of the shop and used largely for the storage of wheels, repairs to trucks, etc.

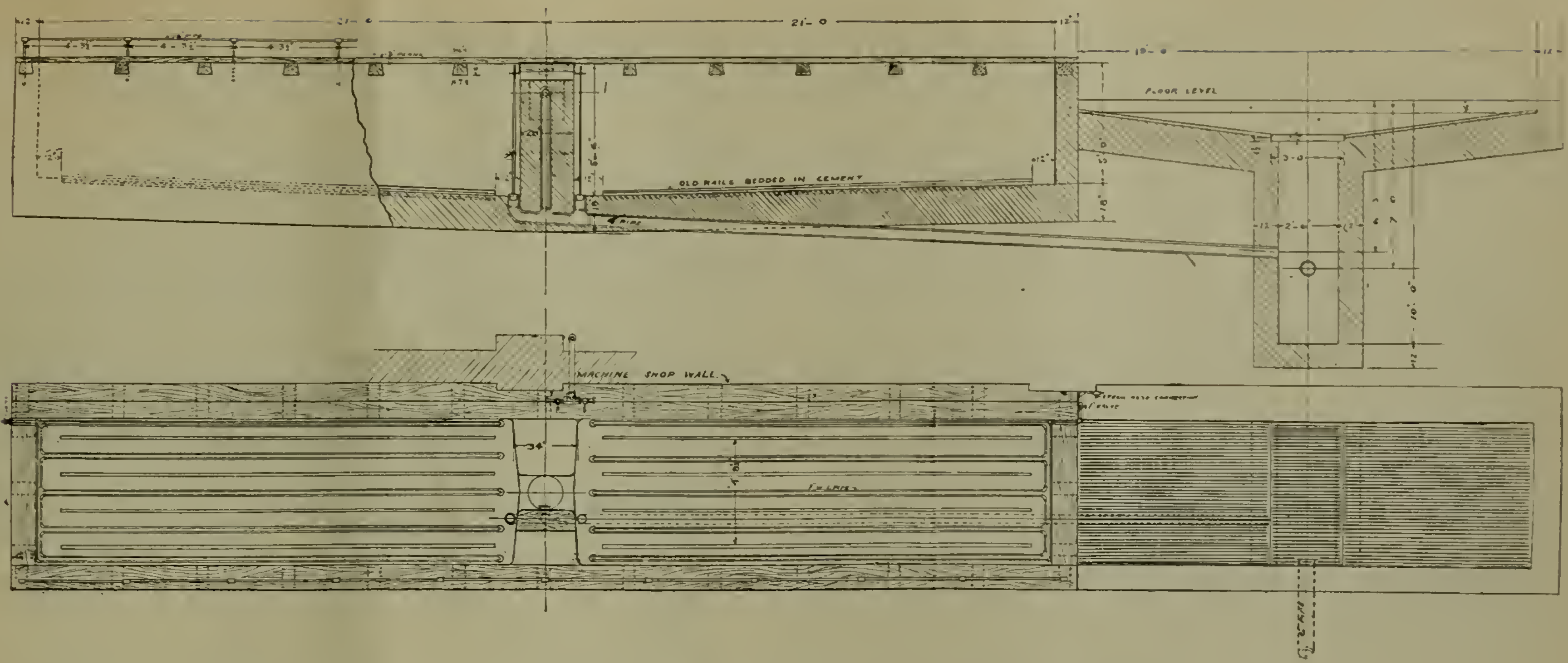
In each covered yard is a large lye vat located near the track on which locomotives enter the shop and near the pit on which they are stripped. A gang of laborers handle the parts that have been removed, places them in the vat and after they have been taken out, clean and distribute them to the several departments and machines.

During the process of cleaning, the parts are held in suitable cradles, or cages, which are handled by the overhead traveling cranes serving the covered yards.

In the locomotive department of the Angus shops of the Canadian Pacific Railway the cleaning room is situated in a "lean to," or wing, adjacent to the machine bay. There are two cleaning tanks in this room, each 19 feet. 10 inches long by 6 feet wide and 5 feet 6 inches deep at the point of greatest depth. These tanks are arranged



CRANE SERVING LYE VAT FOR CLEANING LOCOMOTIVE MACHINERY AT THE ANGUS SHOPS OF THE CANADIAN PACIFIC RY.



PLAN AND SECTION OF LYE VAT FOR CLEANING LOCOMOTIVE MACHINERY AT THE ANGUS SHOPS OF THE CANADIAN PACIFIC RY.

end to end with a distance of 28 inches between them.

Beyond the end of one tank is a cleaning floor 19 feet by 6 feet. This floor is arranged to drain toward its center and is covered with a wrought-iron grate of slats 3/8 inch by 1 inch, with a space of 3/8 inch between slats, except over the drain under the center of the floor, where the slats are 1/2 inch by 2 1/2 inches and spaced 3/8 inches apart.

The two cleaning tanks are separated by a 28 inch wall. Through this wall is a connecting channel 18 inches wide, to provide for the overflow of either tank. At the center of this channel is a sump hole 18 inches in diameter to which the overflow pipe is connected, leading to the drain.

The tanks are filled by hose attached to 1 inch cocks connected with 1 1/2 inch pipe to the water main.

Drainage is provided for by a 4 inch pipe which leads from the lowest point in the bottom of each tank to the drain under the cleaning floor. The outlet is controlled by a brass plug in the opening, operated by a wrought-iron handle of such length as to be easy of access from above the tank. The end of the pipe into which the plug fits is reamed to suit the plug.

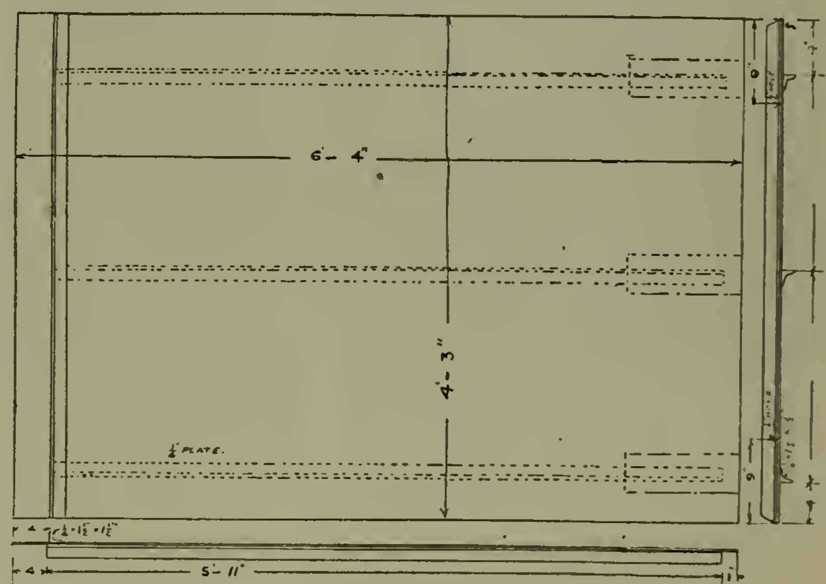
In the bottom of each tank old rails are imbedded in cement so that material placed in the cleaning solution rests on the rails and the heating pipes are so protected.

The cleaning solution is heated by a system of 1 inch steam pipes in the bottom of each tank. The last length of pipe in each tank is perforated with 1/8 inch holes at about 3 inch pitch and there is a 1/2 inch opening in the end of the pipe.

While in service the tanks are closed with covers of 1/4 inch plate of the design shown in the accompanying line drawing. Each cover is 4 feet 3 inches wide and swings on three hinges. It is balanced by two cast-iron weights suspended by a 1/4 inch chain passing over a sheave attached to the wall.

After parts to be cleaned have remained in the cleaning solution a sufficient length of time to loosen the dirt and grease, they are lifted from the tanks and placed on the cleaning floors, where the remaining dirt is blown off by steam.

A steam hose for this purpose is connected with a pipe leading to the line supplying steam to the heating coils.



COVER USED IN CONNECTION WITH LYE VAT FOR CLEANING LOCOMOTIVE MACHINERY AT THE ANGUS SHOPS OF THE CANADIAN PACIFIC RY.

Steam is controlled by a 1 inch valve conveniently located.

The cleaning room is served by a hand operated overhead traveling crane carrying an air hoist. The crane spans a distance of 9 feet 5 1/4 inches between centers of rails. The hoist has a stroke of 72 inches and is operated by a cylinder 10 inches in diameter.

Railroad Blacksmiths' Convention

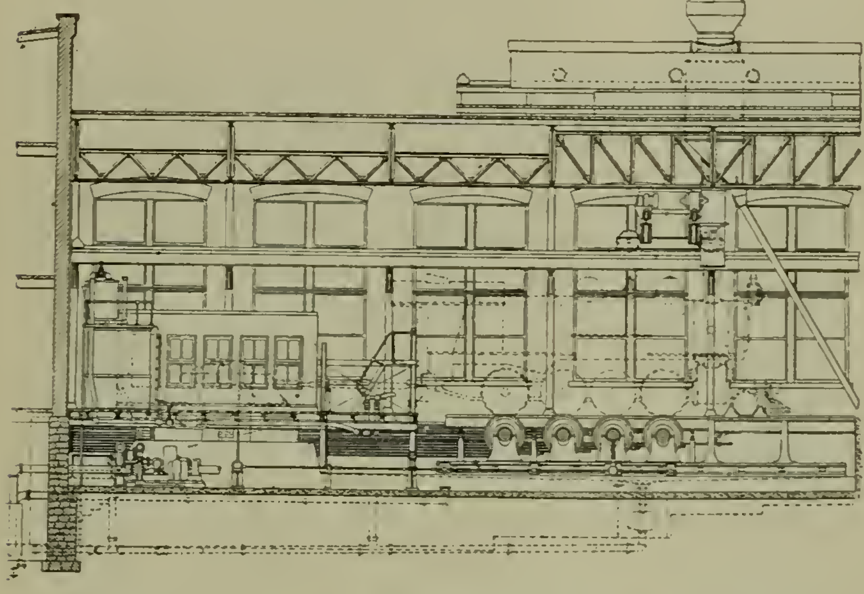
The fifteenth annual convention of the International Railroad Blacksmiths' Association will be held at Montreal, Canada, August 20, 21 and 22nd. The Bath hotel has been selected as convention headquarters. The important subjects to be discussed and the interesting convention city will probably draw a large attendance.

Locomotive Testing Plant at Altoona

Pennsylvania Railroad

SINCE November 19, 1906, the locomotive testing plant at Altoona has been in continuous operation, and the force of sixteen men have made on an average of about three complete tests each week. Certain portions of the apparatus were temporarily installed at the Louisiana Purchase Exposition, and experience gained through operation there has been embodied in the plant at Altoona.

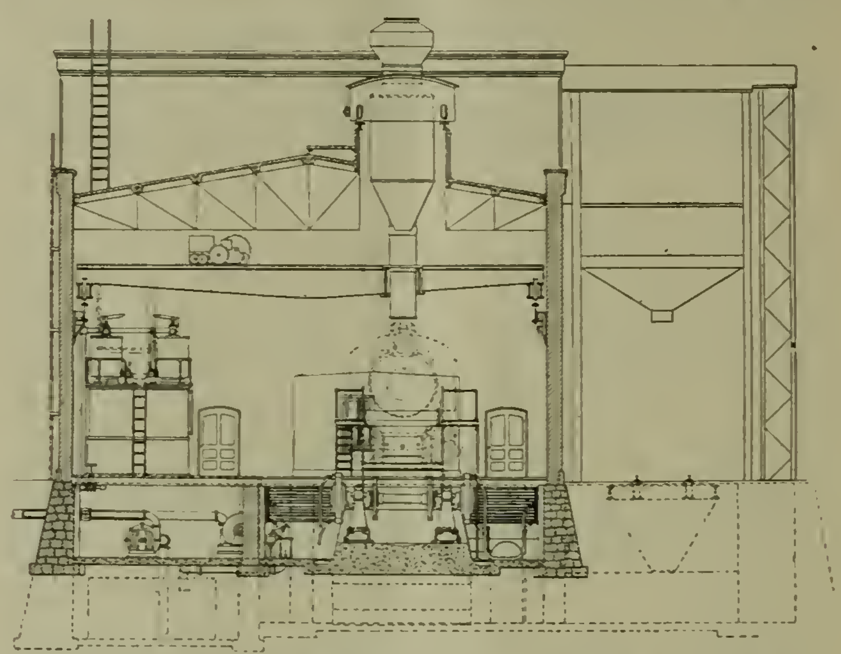
A separate building of steel and brick has been erected for housing the apparatus. The general appearance of the building is shown by the photograph, which also indicates clearly the coal handling arrangement outside of it, with the bin for ashes directly over the track used for bringing in coal.



LONGITUDINAL SECTION OF LOCOMOTIVE TESTING PLANT AT ALTOONA—PENNSYLVANIA R. R.

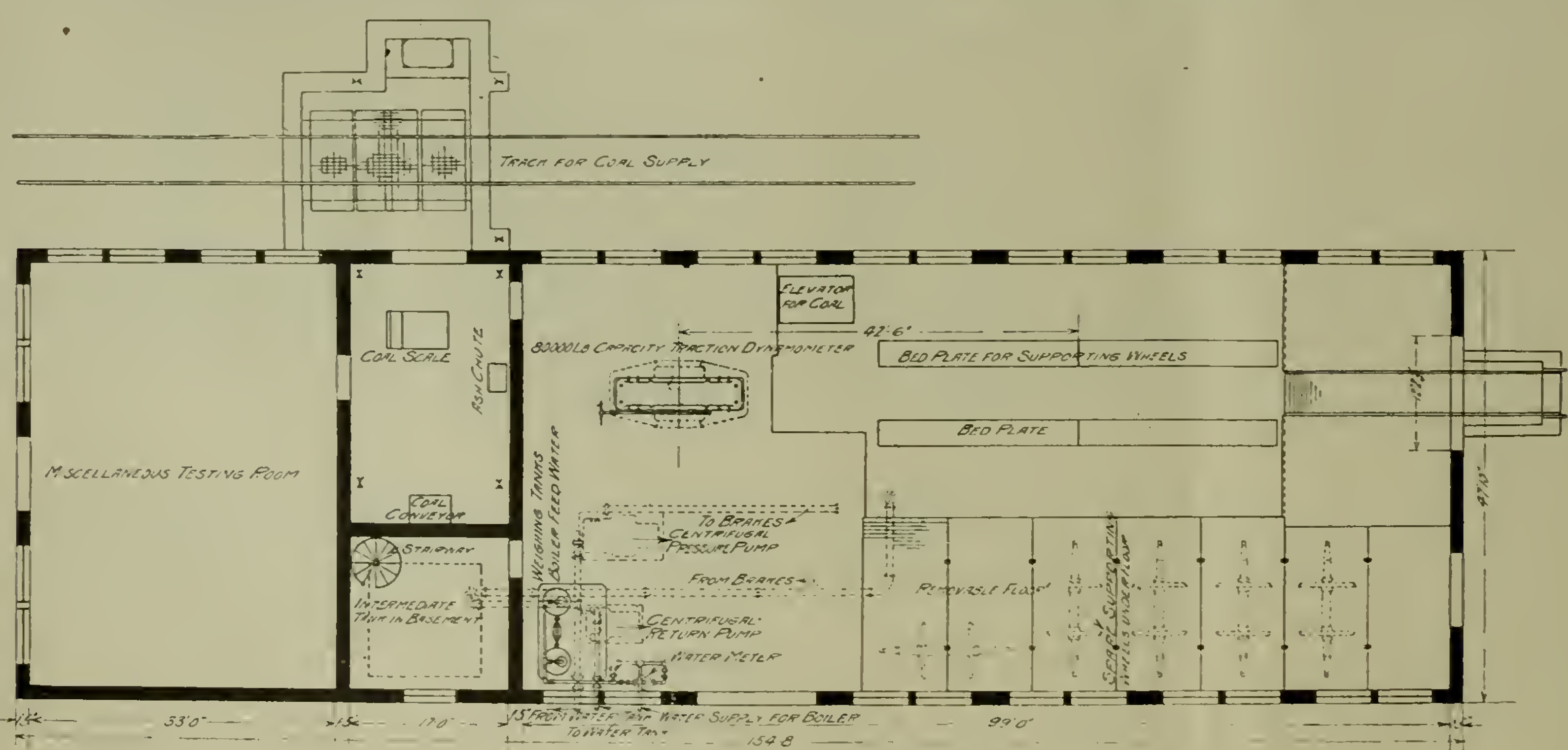
The floor of the laboratory is on the track level and is made in sections which can be removed by the traveling crane. The space between the removable floor is used for storing absorption brakes, supporting wheels and other parts when not in use. On the same level as the storage space and below the main floor is all the apparatus for water supply used in controling the brakes.

The driving wheels of the locomotive under test rest upon supporting wheels with rims shaped to correspond with the head of the rail. The axles of these supporting wheels are extended and carry absorption brakes. The turning of the driving wheels causes the supporting wheels to revolve, but these are retarded to any extent

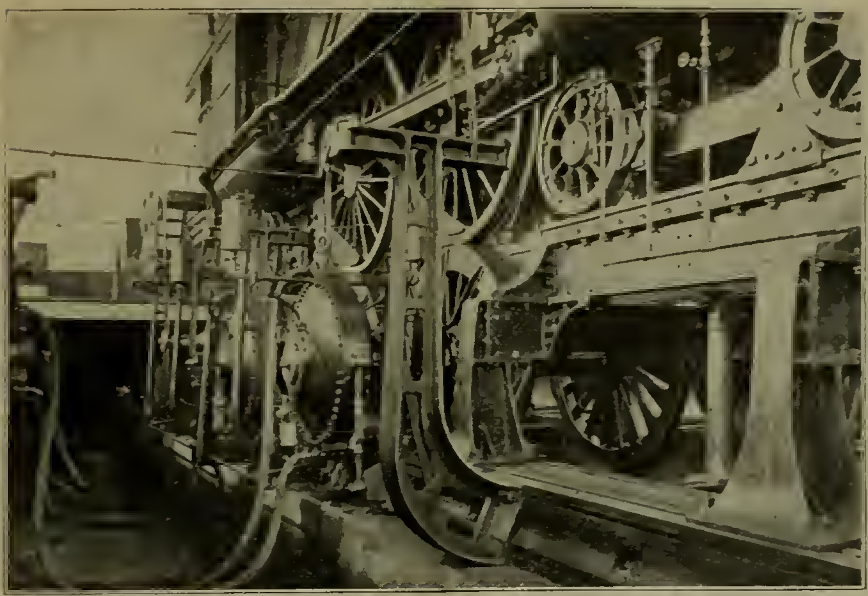


CROSS-SECTION OF LOCOMOTIVE TESTING PLANT AT ALTOONA—PENNSYLVANIA R. R.

desired. The work actually done by the locomotive consists in overcoming the friction resistance of the supporting wheels and brakes, the resulting force exerted at the drawbar being measured by a traction dynamometer. The axles of the supporting wheels run in heavy pedestals secured to cast iron bed plates resting upon a concrete foundation. There are two bed plates running parallel with the track, and in order that the supporting wheels may be directly beneath the locomotive drivers,



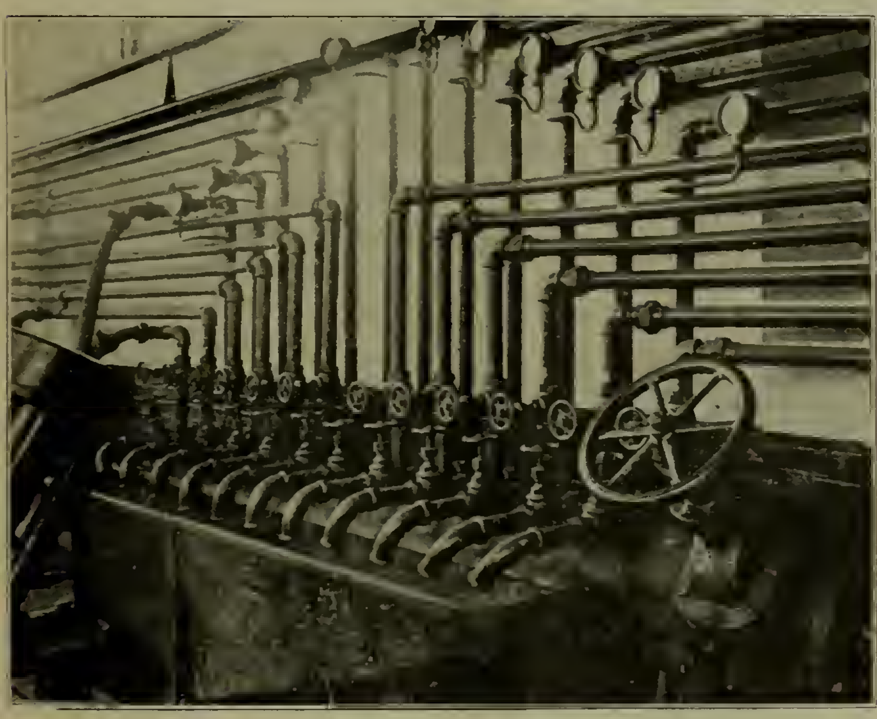
PLAN OF LOCOMOTIVE TESTING PLANT AT ALTOONA— PENNSYLVANIA R. R.



VIEW OF SUB-STRUCTURE SHOWING CONSTRUCTION OF SUPPORTS, ABSORPTION BRAKES, ETC., WITH LOCOMOTIVE READY FOR TEST—LOCOMOTIVE TESTING PLANT AT ALTOONA—PENNSYLVANIA R. R.

these bed plates are provided with T-slots, so that the pedestals can be moved along parallel to the track and secured in any position to suit the particular engine under test. The only wheels of the locomotive which move during a test are the drivers. The wheels of the leading truck rest upon rails secured to I-beams and supported upon the same bed plates which carry the pedestals. The wheels of the trailing truck rest upon supporting wheels (which remain stationary during the test) and are carried by pedestals secured to the longitudinal bed plates.

The axle for each pair of supporting wheels carries upon each of its over-hung ends an Alden absorption brake. Each of these brakes consists of two smooth circular cast iron disks, keyed to the supporting wheel axle. On each side of each one of these disks is a thin copper diaphragm secured at its periphery, and also at its inner edge to a housing which does not revolve and has its bearings upon the hubs of the circular revolving disks. The stationary housing is so designed that when it is filled with water under pressure the copper disks are forced against the revolving disks, creating friction.



ARRANGEMENT OF REGULATING VALVES, GAUGES AND PIPING TO ABSORPTION BRAKES—LOCOMOTIVE TESTING PLANT AT ALTOONA, PENNSYLVANIA R. R.

Provision is made for securing continuous and uniform lubrication of the surfaces of these revolving disks, and the water is caused to flow through the housing in order to carry away the heat generated. The water thus performs two functions; first, in supplying pressure to cause the friction, and, second, in carrying away the heat generated by the friction.

Each brake is connected with the source of water supply by a flexible hose. It is also connected with the discharge pipes by another flexible hose. The discharge pipes for all the brakes empty into an iron trough, and each pipe is provided with a valve located adjacent to the valve in the supply pipe for the same brake. In placing the load upon the locomotive these valves are adjusted until the individual brakes each absorb their share of the work. After this preliminary adjustment has been secured the power absorbed by all of the brakes may be increased or decreased by operating a large valve in the supply main.

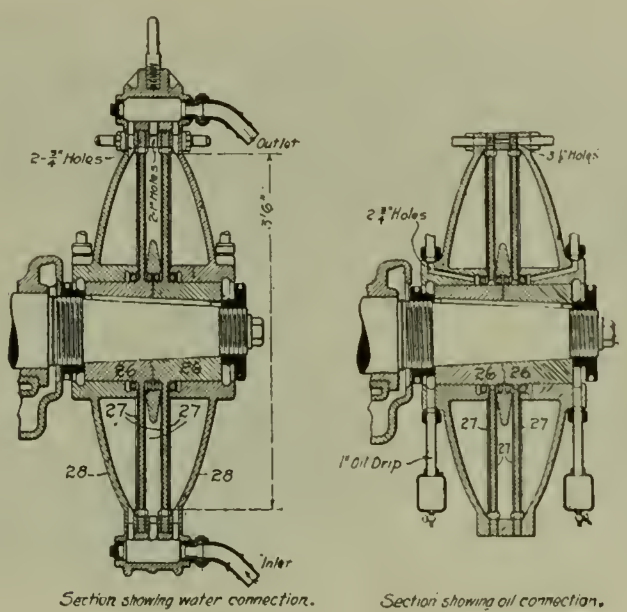
INTERIOR OF LOCOMOTIVE TESTING PLANT AT ALTOONA, SHOWING LOCOMOTIVE IN POSITION FOR TEST—PENNSYLVANIA R. R.

The locomotive is connected to the dynamometer by an adjustable drawbar, and the dynamometer housing is provided with means for raising and lowering the dynamometer proper to bring this drawbar truly horizontal for various heights of locomotive drawbar attachments in the tailpiece, varying from 30 to 42 inches above the track. To decrease the vibration transmitted to the dynamometer through the drawbar, the two safety bars are provided between the locomotive and the dynamometer frame. At their ends these bars have universal joints to insure perfect freedom of adjustment, and each bar is provided with an oil dash pot near the dynamometer end.

The traction dynamometer, which measures the drawbar pull of the locomotive is of the lever type. The weighing mechanism is supported by a frame which slides up and down in ways formed by the housings. These housings are very massive, rigidly secured together and anchored to a heavy foundation. The lever system is constructed upon the Emery principle in which flexible steel fulcrum plates take the place of knife edges used in ordinary scales.

An endless strip of paper 18 inches wide is mechanically drawn over the recording table upon which a continuous record of the test is made. The paper is driven by direct connection with one of the supporting wheels upon which the locomotive drivers rest. The speed reduction is so arranged that when the locomotive under test travels one mile on the supporting wheels the paper moves 52.8 inches, giving a scale of 100 feet to the inch upon the diagram. In order to secure the accurate movement of the paper it passes between a finely corrugated brass roller and another roller covered with rubber. The winding drum to which the paper is finally delivered is arranged to slip upon its shaft in order to accommodate its constantly increasing diameter as the test progresses.

There are several recording instruments, the first a datum pen marks a continuous straight line upon the paper.. A traction recording pen moves across the paper perpendicular to the datum line, its distance from the datum line being dependent upon the force transmitted by the drawbar from the locomotive. The maximum



CROSS-SECTION THROUGH ALDEN ABSORPTION BRAKE HOUSINGS, SHOWING INTERNAL CONSTRUCTION—LOCOMOTIVE TESTING PLANT AT ALTOONA, PENNSYLVANIA R. R.

travel for this pen away from the datum line is eight inches. Two sets of springs are provided. With the heaviest set the eight-inch movement of the traction pen corresponds to a load of 80,000 pounds upon the drawbar, which represents the maximum capacity of the dynamometer. With the other set of springs the eight-inch movement of the traction pen corresponds to a pull of 40,000 pounds upon the drawbar, and with all the flat springs removed, the eight-inch motion corresponds to a 16,000-pound load upon the drawbar. The multiplication of the recording and weighing mechanism is 200 to 1. An integrator is provided and attached to the traction recording mechanism, so that the foot-pounds of work performed by the locomotive is automatically summed up. Five additional electrically operated pens are provided. They normally draw continuous straight lines. One of them is electrically connected with a clock, so that each second is indicated by a jog in the straight line which this pen normally draws. Another pen is electrically connected to a roller which is rotated by the recording paper, causing the pen to make a jog in the line for every thousand feet which the locomotive travels. Another pen is electrically connected to the integrator and makes a jog in its line every time the integrator measures one square inch. The remaining electrically operated pens are used for recording such features of the test as taking indicator cards, etc.

A complete coal handling plant has been installed, which enables a few men to handle a large amount of coal with little labor. Ashes from the locomotive are discharged at the pit level, placed in a wagon, raised on the hydraulic elevator to the level of the main floor and run into a chute leading to a conveyor which delivers the ashes to cars on track outside. Water used by the locomotive is taken from a supply tank located in the corner of the laboratory. The water passes through a meter, the reading of which is used as a check on the weighing tanks. The smoke-jack for carrying away the smoke from the locomotive allows free passage for the gases, but deflects all the sparks into a hopper, from which they are taken and weighed. The jack is adjustable over a distance of 16 feet 6 inches, which allows the locomotive under test to be placed in any position and still be under the jack.

Personal Mention

Mr. C. Setzckorn has resigned as general foreman of the American Refrigerator Transit Co., and has accepted the position of superintendent of the American Car & Foundry Co., at Madison, Ill.

Mr. H. C. Pearce heretofore general foreman of the car department of the Illinois Central R. R. at East St. Louis, Ill., has been appointed general foreman of the American Refrigerator Transit Co., with headquarters at St. Louis, Mo. Mr. Pearce has been in the service of the Illinois Central R. R. for thirteen years.

Mr. W. H. Chambers, assistant master mechanic of the Denver & Rio Grande at Helper, Utah, has been appointed master mechanic of that road, the Rio Grande Western and the Colorado Midland at Grand Junction, Colo.

Mr. James Macbeth, master car builder of the New York Central Hudson River at East Buffalo, N. Y., died on July 7 at his home in Buffalo, aged 61 years. Mr. Macbeth was born in Aberdeen, Scotland, and came to America in 1855. He entered railway service in 1859 as apprentice in the machine shops of the Great Western of Canada. From 1864 to 1867, he was foreman of the New York Central Railroad, in charge of repairing and rebuilding locomotives, and was then until 1875 successively engineer on the Southern Central and the New York Central. In the latter year he was made master mechanic of the Ithaca Geneva & Sayre, which position he held until 1878, when he was appointed superintendent of construction and machinery of the Elmira Cortland & Northern. From 1880 to 1887 he was locomotive engineer on the Lake Shore & Michigan Southern, and was subsequently until June, 1891, in charge of the motive power and car department of the West Shore. In June, 1891, he became superintendent of transportation, motive power and rolling stock of the Adirondack & St. Lawrence, which position he held until January 1, 1893, when he was appointed master car builder of the New York Central & Hudson River.

Mr. H. C. Manchester, heretofore assistant master mechanic of the Boston & Maine R. R. at Mechanicsville, N. Y., has been appointed assistant superintendent of motive power of the Maine Central R. R. with office at Portland, Me.

Mr. W. O. Thompson, assistant superintendent of motive power of the R., W. & O. division of the New York Central & Hudson River Railroad, has been appointed master car builder at East Buffalo, to succeed the late Mr. James Macbeth.

Mr. J. W. Eck has been appointed electric engineer of the Southern Railway with office at Washington, D. C., to succeed Mr. G. W. Johnston, resigned.

Mr. Leonard Ruhle has been appointed master mechanic of the Colorado & Northwestern R. R., with office at Boulder, Colo., to succeed Mr. M. Fitzgerald.

Mr. H. W. Ridgway, master mechanic of the Colorado & Southern Ry. at Trinidad, Colo., has been transferred to Denver, Colo., to succeed Mr. D. Patterson, resigned.

Dr. W. F. M. Goss has resigned as dean of the schools of engineering and director of the engineering laboratory at Purdue University, Lafayette, Ind., to become dean of the college of engineering University of Illinois, Champaign, Ill. Dr. Goss is one of the most prominent investigators along railroad mechanical subjects and has contributed many important reports on locomotive performance. He has also taken an active part in the work of the Master Mechanic's and Master Car Builders' Associations and conducted many tests in line with committee work. Dr. Goss is a member of a number of engineering societies, among them the American Society of Mechanical Engineers. He was born at Branstable, Mass., on Oct. 7, 1859 and after leaving the Massachusetts Institute of Technology he went to Purdue in the year 1879, where he has since remained.

The American Coupling

The American Coupling Company, Pierce Building, St. Louis, Mo., have recently placed the American coupling on the market, which, as shown by the illustration, is of entirely new construction.

The claims made for this coupling by the company are that it is an instantaneous coupling, and can be used wherever the screw connection is used today. That it is mechanically correct, based upon a fundamental mechanical principle, and that it is the only gravity coupling in the world. The force of gravity tightens the coupling, and any vibration has the same effect. This is a remarkable feature, and becomes of paramount importance in railroad work. It is the only coupling which automatically adjusts itself to changes in temperature, to the expansion of heat or contraction of cold, always remaining tight. From the construction of the coupling there is practically no wear, there are no threads to strip, and the life of the coupling is many times that of any on the market today. The severest test of a coupling is its ability to successfully carry steam. The American coupling, it is claimed, is the only coupling that will carry high pressures of steam without waste. The company print a list of testimonials from prominent users, who have thoroughly tested this device, and the results given are perfectly satisfactory.

As will be observed, the coupling is of novel design and possesses a number of features which make it a great improvement over the old coupling of the usual form.

THE AMERICAN COUPLING

Notes of the Month

The Hicks Locomotive and Car Works, Chicago, have issued a very handsome book descriptive of their locomotive and car shops which contains a large number of illustrations showing views of the works and some of the products. The composition, make up, quality of press work and binding, are first class and give the book an appearance which is not excelled by many high priced publications.

The Bettendorf Axle Co., Davenport, Ia., are sending out a new catalogue of their trucks, bolsters, tank cars, underframes, etc., which is full of information of the products mentioned, arranged in a very attractive way.

The Washburn Steel Castings and Coupler Co., Minneapolis, Minn., have issued a new catalogue of the Washburn traction couplers and draft riggings for traction cars which is an excellent example of a high class selling medium.

The University of Illinois has recently added the school of Railway Engineering and administration to the studies already offered and will provide opportunities for men desiring an education along railroad lines. This school is divided into four courses that cover the field thoroughly. The courses are Railway Civil Engineering, Railway Electrical Engineering, Railway Mechanical Engineering and Railway Administration.

It is expected that these courses will prepare men to become efficient workers in the departments of maintenance of way, motive power and in the financial, traffic and operating departments. In the three engineering courses more time is given to the study of economics than is usually given in engineering courses, and the course in administration comprises enough work in engineering subjects to give its students an understanding of the technical problems arising in the engineering departments. It is hoped that these courses will meet needs which now are only partially provided for in most of our educational institutions.

Technical Publications

"Railroad Men's Catechism"—By Angus Sinclair. Published by the Angus Sinclair Publishing Co., 136 Liberty Street, New York, 16mo, 216 pages. Price $1.

This is a book which gives information that will be useful and acceptable to all classes of railroad men from the president to the newest brakeman. All will find in it something new and useful. All will find it worthy of study.

The questions are intended to impart information covering the entire practice of train operating, and to explain all details of mechanism. The questions and answers are the outcome of Sinclair's Locomotive Engine Running and Management, and are an enlarged code that grew up through many small forms, the best known having been the Questions and Answers prepared by the Traveling Engineers' Association.

Railroad Paint Shop

Edited by
J. H. PITARD
M. C. Painter, M. & O. R. R.

Devoted to the Interests of
Master Car and
Locomotive Painters

Official Organ of the Master Car and Locomotive Painters' Association

Mr. Robert McKeon

Elsewhere in this issue is a history of the life of Mr. Robert McKeon, lately deceased, which seems to be sufficiently comprehensive, but on behalf of his fellow members of the Master Car and Locomotive Painters' Association, we can not refrain from adding our tribute to the many virtues of this noble-hearted man. His was not a life of wasted opportunities, as his record shows. To him, life was duty, and actuated by this spirit, he willingly lent his services in all movements about him intended for the public good, and as a mark of tribute to his public-spiritedness, all business was suspended for half a day, and the flags on public buildings placed at half mast in his home city on the day of his funeral.

Mr. McKeon's long and arduous service of 31 years as Secretary and Treasurer of the Master Car and Locomotive Painters' Association of the United States and Canada, is worthy of all praise. In the early stages of the Association when failure seemed imminent, "Bob" McKeon, as he was familiarly known by his fellow members, struggled on undaunted, with the result that his faithful labors, assisted by the charter members of the association, succeeded in placing upon a firm basis an association of great usefulness that has grown into national prominence. This association in which Mr. McKeon has been so instrumental in building up, have not been unmindful of his faithful labors, but have from time to time given to him appropriate expression of their gratitude in the form of suitable testimonials, and retained him as their secretary long after his failing health rendered him unequal to the task, and when he, from a sense of propriety declined the further honor. But the spirit of friendship for him in the ranks of the association did not cherish the idea of relinquishing the great influence and wise counsel of this particular man, and hence his continuance in office even after it was apparent that the recovery of his failing health was doubtful..

In the annual conventions of the association Mr. McKeon's presence was always a source of inspiration. By his loving heart, he won all hearts, and all were wont to do him honor. His close application to his calling had resulted in making him a master of his art, and a recognized authority upon all matters pertaining to car and locomotive painting.

There were some incidents in the life of this noble man that were unusually pathetic, but which were borne by him with characteristic fortitude. A few years ago he was afflicted with failing sight, which gradually increased until he could not longer fill his position as master painter on the Erie railway, and for this reason relinquished the position that was the main support of himself and family. To this great affliction of losing his sight was soon added the great affliction and sorrow of the loss of his beloved wife, whose companionship in his affliction was a source of greatest comfort to him.

And now alas, this noble man whose well rounded life has given forth good influences that shall continue on down the ages of time, has gone to his long last sleep. The silver chord is broken and with sorrowing hearts and bated breath, we hear the sad news, "Bob McKeon is dead," and in sorrow we bow in humble submission to the will of Him who rules the universe.

The Master Car Painters' Association was represented at the obsequies of the late Mr. Robert McKeon by Mr. F. W. Bowers of Kent, Ohio, Mr. McKeon's successor, and Mr. J. H. Kahler, master painter on the Erie railway at Meadville, Pa.

Convention of Master Car and Locomotive Painters

The thirty-eighth annual convention of the Master Car and Locomotive Painters' Association will be held in St. Paul, Minn., Sept. 10, 11, 12 and 13. The Hotel Ryan has been selected as headquarters and in view of the number of conventions which will be held in St. Paul during the month, the secretary, Mr. A. P. Dane, Reading, Mass., advises all who expect to attend the convention to secure their accommodations as early as possible. The subjects to be discussed at the convention are as follows:

The Painting of Steel Passenger Equipment. (a) How should the interior be treated? (b) How should the exterior be treated? A composite paper by John D. Wright, H. M. Butts and R. J. Kelly.

Plainness, Problems, Perplexities and Prophecies, Pertaining to the Present-day Railway Paint Shop. Chas. E. Copp.

Disinfecting Passenger Cars at Terminals. What is the most improved method of disinfecting passenger equipment at terminals to comply with state laws? H. E. Smith, chemist; R. W. Mahon, chemist, and A. J. Bruning.

The Cleaning, Coloring and Lacquering of Metal Trimmings, Lamps, Etc., for Passenger Equipment Cars. B. E. Miller, Geo. Warlick and Chas. A. Cook.

Painting Locomotives and Tenders. (a) What parts should be varnished? (b) What parts can be treated with enamels to advantage? (c) Is it advisable to use asphaltum or oil paints. John H. Kahler, W. A. Buchanan and Eugene Daly.

To What Extent May the Various Linseed Oil Substitutes and Drying Oils Be Used in the Painting of Cars and Locomotives? W. O. Quest and W. H. Smith.

Queries.—Have you found any material or coating that will resist the action of rust? Discussion opened by Chas. E. Becker.

Denatured Alcohol.—Is it a satisfactory substitute for pure grain alcohol for railroad painters' use. Discussion opened by W. J. Orr.

Is it advisable to apply three coats of body color to a car, if two coats will cover? Discussion opened by John Gearhart.

Can the lasting qualities of light colored freight car stencil paints be improved? Discussion opened by Warner Bailey.

From a painter's standpoint, is pressed fiber as durable as a three-ply wood veneer headlining for passenger equipment? Discussion opened by O. P. Wilkins.

What should be the nature of a detergent for railway paint shops use? Discussion opened by B. E. Miller.

Mr. Bishop's Article

In the June issue of the Railroad Paint Shop is an article by Mr. Bishop, the main points of which are the proper treatment of cars, in order to obviate varnish cracking, which is the inevitable result of a repetition of coatings after they have reached a certain degree of thickness.

Mr. Bishop's plan is to deaden such coatings by the application of a solution composed of about equal parts of bar soap and sal soda, and the mass of varnish then removed with rubbing stone and water.

The preservation of the old surface seems to be the main consideration, as it is quite a costly process to burn off and re build a surface. The writer was once employed in a shop many years ago, where it was the practice then to build a surface in the usual way, and then apply two coats of varnish color, this was next rubbed down with water and pulverized pumice stone, and the ornamenting and varnishing then proceeded with. No flat color whatever was applied. When such cars returned for repainting, the varnish and varnish color coatings were removed with ammonia, and the old surface was retained uninjured. This process was repeated several times before burning off the old surface was resorted to. It is also worthy of mention that cracking was less prevalent then than under our present method of sandwiching our varnish coats with flat color coats.

It has perhaps never been determined just how many coats of varnish it is safe to apply before cracking will result. If this could be predetermined, varnish cracking could be obviated in most all cases, simply by removing the coatings after the (limited number had been reached) either with ammonia or with the solution suggested by Mr. Bishop. In our opinoin this subject contains some very good points worth discussing, and we would be glad to hear from others on the subject.

One important question, however, must be considered in following this method, that is, is the surface in a state of preservation that would warrant repainting upon it after the varnish is removed?

This seems to be a practical suggestion, and worthy of consideration. That the accumulation of varnish is responsible for the unsightly cracking that ultimately occurs upon all cars that are regularly varnished, is beyond controversy, therefore some method of prevention seems desirable. The method mentioned by Mr. Bishop is about the same as that formerly practiced, except that the varnish coatings were removed down to the surface with ammonia instead of the solution of soap and sal soda. Neither of these methods are applicable where a car is striped, and it is desired to retain the old stripes, as the stripes would be removed along with the old varnish, but in all cases where cars are not striped this is an expeditious method of handling passenger equipment.

Color Scale

Harmony of color, heretofore depending solely upon the training and taste of the individual handling pigments, has been reduced to as exact a science as the harmony in music. This assertion of a great principle, forming a foundation for all art in which colors are used, is made by Hardesty G. Maratta, a Chicago artist, who has devoted the last twelve years to its solution..

So simple is this system, according to Mr. Maratta, he is surprised it remained for a man of the twentieth century to discover.

In fact, it is his belief that he has merely rediscovered something that was known hundreds and perhaps thousands of years ago, for it is to an application of this scientific color harmony that he ascribes the great power and feeling in the paintings of the old masters.

This harmony of colors, which is expected to mean so much to artists and even artisans of the future, is divided into twelve parts, corresponding to the chromatic scale of twelve half notes in music. The component parts are:

1. The six colors of nature, as Mr. Maratta schedules them, deducting one from the usual spectrum of seven—green, blue, purple, red, orange and yellow. These might be compared to the full notes in music.

2. Secondary color tones, like half notes in music, which Mr. Maratta has christened Margo hues.

Thus each color has its hue and each of these in turn its proper complement. The complement is the color or hue possessing the greatest contrast to the pigment in question, and is invariably three shades or notes away.

These hues are in reality scientifically or mathematically divided colors. In a painting, for example, they are the different colors as compared to the particular shade of a prismatic color in the foreground. To be exact, they are suppressions of colors to the fourth intensity, beyond which point they become so nearly neutral that only the most cultivated eye can distinguish them.

With this scale of twelve colors, says the inventor, the artist can play with pigments with the exactness of a musician on a piano. He can make a scale of an intensity desired by an addition of white or black and choose any color needed or desired for his predominating one.

As a diagram of his system Mr. Maratta drew a circle in which at equidistant points from one another he wrote the names of the six colors and their corrresponding hues. Thus at the top he placed a yellow color and at the bottom yellow hue. Reading from right to left and from the top the colors thus were orange, red, purple, blue and green, while the hues read in the reverse order. Two bars at right angles to each other and acting as a spindle would always point to the proper hue and complement of any particular color.

"I began studying this subject," explained Mr. Maratta, "when I discovered the analogy that exists between color, music, architecture and chemistry. Music is a division of sound into harmonic ratios; architecture a division of space and form into harmonic ratios, and chemistry the division of elements in the same manner.

"Now, color occurs between light and darkness, and addresses the eye by reflected light. The source of all these harmonies is the same—that is, the odd and even numbers. It is by the careful selection of these numbers, or notes, as they are called in music, that the musical chord is derived, and in the same way one may play color chords by this system, and the result may be harmonious.

"Just to illustrate. They say it took Whistler two hours to set his palette, but by this system the veriest tyro can set one in five minutes at the outside. Heretofore artists have secured approximate effects by careful selection, but by a mathematical choice of the colors and hues the absolute and scientific effects will be attained in the factory where the paints were compounded. Thus the artist may devote his attention to a more careful rendition of the subject."

Mr. Maratta is a Chicagoan by birth, and made a name as an artist for himself before he undertook the study of this subject. After completing an art course here he went abroad and absorbed the best thoughts of the masters there. He then returned to America and studied the coloring in the plains of the Southwest.

When he finally decided to devote all of his time to the study of color harmony he first experimented to find out what colors resisted fire, and to that end made many burnt clay pictures of the highest artistic value. He also went into the factories where paints were made and studied them there at first hand. For a year, to demonstrate his theory, he painted stage scenery, using only the three primary colors—yellow, red and blue.

It was while cleaning several paintings by Guido Reni, one of the old masters, that Mr. Maratta first became convinced that color harmony was a known science several hundred years ago. The blending and harmonizing of shades and colors were so exact in each of these that he does not believe it could have been accidental. Examination of pictures by other old masters confirmed his belief.

Mr. Maratta has applied for a patent for his system. The system was explained to the authorities at Washington, and they declared it was a great underlying principle, and only the application of it could be patented. As to that, however, the discoverer cares little. In his workshop at Evanston and Wilson avenues he continues to experiment and demonstrate his system to his pupils, content if the world accords him credit. And this, he believes, is coming to him. Artists of fame, both in this country and abroad, have written him congratulatory letters, which are his greatest treasures, except the Margo hues.—Chicago Tribune.

Preparing Zinc White Paint

An Amsterdam manufacturer says that the zinc white commonly used with oil is altered by the action of oxygen and carbonic acid so as to become grey and peel off. To avoid this we add to the zinc oxide oil color small quantities of zinc chloride so as to produce a certain quantity of zinc oxy-chloride which is then converted by the addition of a quantity of alkali carbonate presumably to zinc carbonate. On the other hand this effect is not obtained by rubbing together in oil a previously prepared mixture of zinc oxide with a small quantity of zinc carbonate. The same effect may be obtained if in roasting the zinc ore vapors of zinc of chloride are introduced and sodium carbonate dissolved in water is added. This product is then stirred with oils in the usual manner. When oil and lime water are added to this product the covering capacity of the color is considerably increased the lime water producing an emulsion with the oils. A useful result is obtained as follows. 250 parts of zinc white and 125 parts raw linseed oil are rubbed together so that the zinc white is well saturated with oil, then 15 parts of the zinc chloride are added dissolved in three parts of distilled water, and these mixed together, and then 25 parts of raw linseed oil and 25 parts boiled linseed oil added. Then a quantity of 2.5 parts sodium carbonate dissolved in 7.5 parts of warm water is added. There are then mixed therewith 10 parts bleached linseed oil, 10 parts boiled oil, and 10 parts manganese siccative, and finally 40 parts of lime water. There may then be added a further mixture of 20 parts raw linseed oil, 10 parts bleached linseed oil, and 5 parts boiled linseed oil so as to give the color the necessary softness.—The Master Painter.

History of Robert McKeon

Robert McKeon, a resident of Kent for over forty years, for thirty-five years foreman of the paint department of the Erie shops, and for thirty-one years secretary and treasurer of the Master Car and Locomotive Painters' Association of the United States and Canada, died at his home on Mantua street at 7:10 Wednesday morning.

Mr. McKeon had been quite feeble for some years past and the end had come gradually. For the past few months he had been growing weaker day by day, and only his strong vitality prolonged his life..

On the first of October, 1901, he gave up his long years of service at the railroad shops, confident that he would be able to take up the work again after a few months of rest. But he was doomed to disappointment. The continuous strain on his eyes had caused an impairment of the optic nerves and rest and treatment failed to restore them to their former condition. A year later Mrs. McKeon died, bringing sorrow to the afflicted man.

During his declining years he had the tender care of his two devoted daughters, Misses Clara and Nellie McKeon.

While his demise had been generally expected, the news was a message that carried sadness everywhere. Robert McKeon was a widely known and respected citizen. As a master painter, he had a national reputation, serving as the leading official of the leading organization in his trade in the world for thirty-one years, meeting with them in the various years in practically every large city in the United States. Locally, as a school and corporation official, as a lodge man, as amember of the M. E. church, and as a citizen, he was held in high regard. He served his company well and every man who ever worked under him at the Erie shops always had a good word for Robert McKeon. He will long be remembered as a good and useful citizen, one whose taking away has brought universal sorrow.

Mr. McKeon spent his boyhood days in Brooklyn, N. Y. He came west in the spring of 1852 and entered the car shops of Stone & Witt in Cleveland, to learn the trade of car painting. Eighteen months later the same firm opened a branch of their works in Chicago, which was called the Union Car and Bridge Works. Mr. McKeon went with the company, working there two years, when the shops were destroyed by fire. He then went to work at the Illinois Central Railroad shops in the same city, remaining there until the spring of 1857, when he went to Norwalk, Ohio, to work for the Cleveland & Toledo road (which was later consolidated with the Lake Shore & Michigan Southern Ry).

He remained there until the fall of 1858, when he returned to Brooklyn and was employed at the John Stephenson Omnibus & Street Car Works in New York until the spring of 1859, when he was appointed foreman at the shops of the Sixth Avenue Omnibus line. He remained there eighteen months, when he returned to Norwalk and entered Nelson Pebble's Carriage works as foreman painter, remaining there three years, when he went back to Brooklyn and opened the business of sign painting, continuing in it until January, 1867, when he came to Kent and was employed at the shops of the Atlantic & Great Western Railway. One month later he was appointed foreman painter, which position he held for 35 years.

Mr. McKeon had served one term on the village council and three terms as a member of the school board. He was a Past Grand of Brady Lodge, No. 183, I. O. O. F., and a member of Akron Encampment, No. 18, I. O. O. F., of Akron.

For many years he was treasurer of the Knights of Honor.

He was one of the oldest members of the Kent M. E. church and had long been a member of its official board. He was a member of the board at the time of his death. In his demise the church has lost one of its true and faithful members.

Mr. McKeon had been an active member of the Master Car and Locomotive Painters' Association of the United States and Canada ever since 1872, when he joined the organization, then in its third year, at Cincinnati. The following year, at Buffalo, he was elected secretary and treasurer. So well had he filled the office, keeping the accounts accurate at all times, that the board did the unprecedented thing of re-electing him from year to year until he had filled the office for thirty-one successive years. In that time the conventions were held in all the large cities of the United States.

The election every year was by a unanimous vote. the members, about 250 in number, attesting their appreciation of his untiring work and energy on behalf of their organization. The association is composed of foremen car and locomotive painters from all the large railroads of the country. Every state in this country is embraced in the membership, while several reside in Canada. He was kept in office even after he was unable to be present, the members loth to give him up. In 1905, at the Cleveland convention he sent in his resignation which was regretfully accepted and resolutions passed which testified to the regard in which he was held by all.

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Contents

Good Enough !

IN a certain round house of a road which has been having an epidemic of engine failures, the expression is frequently heard, "that's good enough, let her go!" The foreman has become used to the term, and so have the men—in a measure, it has grown to be the accepted way of finishing up a job. Meanwhile the engine failures continue, and no one seems to be able to explain why.

Perhaps the real reason is obscure and difficult to find, but it would seem that the three words, "that's good enough," explains it all. Where the round house organization is tainted with the "good enough" spirit, the natural result will be engine failures. Under the present day conditions, more than a "good enough" job is necessary if failures are to be avoided, as an engine must leave the round house in shape to stand the hardest kind of service from one end of the division to the other.

The expression, "that's good enough," coming from anyone connected with a round house, is an apology for a poor job, and generally the advance notice of an engine failure to come.

Locomotive Mechanical Stokers

DURING the last convention of the Traveling Engineers' Association the president called attention to the mechanical stoker as a practical means of increasing the evaporative performance of boilers of large locomotives. At the meeting this month a paper is to be presented on the merits of the mechanical stoker as compared with hand firing. The natural inference is that those officials most closely associated with locomotive operation—road foremen of engines—believe the mechanical stoker is needed in locomotive service. The committee charged by the Master Mechanics' Association to investigate and report upon progress made in the development of mechanical stokers, has not considered that advance has been sufficient to recommend a favorable report.

While it is not generally agreed that the mechanical stoker is necessary on all locomotives, due to conditions peculiar to locomotive service, there is no doubt that some classes of locomotives have reached the limit of human physical endurance to fire. Until a mechanical stoker is developed, the endurance of the average skilled fireman is the real limit governing the size and capacity of the locomotive. By providing a mechanical device that will transfer coal from the tender to the door of the firebox and impart to the coal sufficient force to deliver it properly upon the grate, the arduous portion of the fireman's duties will be minimized. The locomotive of today requires two skilled men of intelligence in the cab and the mechanical stoker provides a means of accomplishing work of high efficiency by the use of intelligent management rather than by means of mere, main strength.

Locomotive service has presented a number of obstacles difficult to surmount in the development of the mechanical stoker. At the same time it is believed that by contriving to meet the peculiar requirements of locomotive service, a device will be developed that will improve the condition of firemen on large locomotives.

Improving Locomotive Performance

IT is evident upon investigation of locomotive performance records that considerable variation exists in the economy of different types of locomotives designed for and operated in the same service. Generally one particular type of locomotive heads the list with not only the greatest ton mileage, but also the best record in fuel consumption. When this performance is repeated month after month, and the difference in the economy of the various types is expressed in dollars, the natural result will be an investigation to determine why one type is more efficient than another.

Tests will then be resorted to for positive figures and results. These tests may show that one type of locomotive has the most efficient boiler or a higher efficiency from cylinder to drawbar than another type. But they do not go beyond this. As a means of showing the reasons for a difference in the steam economy of two types of locomotives when the boiler efficiencies and cylinder drawbar efficiencies are the same in each, they are of little value.

On another page of this issue, Mr. J. G. Crawford, in an article entitled, "Locomotive Characteristic Curves," presents an original method of conducting tests for determining the relative efficiency of different types of locomotives, when operated under the same conditions of tonnage and speed. The method involved consists in establishing the mean effective pressure, back pressure, pressure drops, indicated tractive force and water rates of the locomotives under consideration, for all cut-offs and speeds.

The data thus obtained represents the characteristic performance of a locomotive and for practical use is plotted in a series of curves. By this means the steam performance of any type of locomotive can be compared with another and the reasons for the variation in the efficiencies of the two types readily ascertained. Thus the method furnishes the facts which the ordinary efficiency test fails to do and provides a definite plan for improving locomotive performance.

A Detail of Shop Practice

AN inspection of the average railroad machine shop indicates that considerable attention has been given to the arrangement of belt shifters in order to make them convenient for the machine operators. The reason for this is self evident, as it follows that the cost of rigging up a convenient belt shifter is more than compensated for by the increased production which naturally results. This same principle can be applied to every detail of shop practice, and it is observed that the shops, showing [illegible] production, not only have convenient belt shifters, but other appliances in constant use are arranged for rapid operation The labor charge is the principal item in shop expense and effort directed toward improvement of facilities will reduce the cost of labor. Increased output and economy of production naturally follow.

With the substitution of the electric motor for the belt drive it would seem that the same attenion should be given to the location of electric switches and starting boxes for the individual machines as was earlier directed toward the arrangement of the belt shifter. Although different in form, both are for the same purpose. As convenience paid with the belt shifter, why not with the starting box? Although this is a logical conclusion, it is observed that convenience has not always governed the location of the starting box

Shop columns seemed to make the best natural supports for both motors and starting boxes, consequently they were mounted on columns nearest the machine. Usually such a position for the starting box is not convenient to the machine operator, but there are many instances in which his convenience has been overlooked when installing machines and equipment.

A variation from this practice was recently observed in a modern shop. Instead of mounting starting boxes on shop columns, individual stands located conveniently beside each machine were provided for the purpose. This enabled the operators to control the movement of their machines with a minimum loss of time. With a high-price man and a heavy duty machine, time wasted in needless movement is expensive and when multiplied over and over, is extravagance. As one means of preventing this waste the shop column as a starting box support should be abandoned for the individual stand.

The Man and the Salary

CAN results consistently be expected from a railroad shop where the foremen's salaries are so small as to offer no inducements to capable men? This is an old question but conditions make it as pertinent today as it was years ago.

Unless there is an efficient organization centering in a capable general foreman, who works to the interest of the shop and the master mechanic and is worthy of the master mechanic's confidence, a state of unrest exists throughout the entire shop force. This condition reflects itself in the nature of the work done—or not done—it is felt on the road and the effect is shown in the records of locomotive performance. A permanent cure can not be effected by a bulletin to the effect that scratching the work report book without doing the work required will result in the dismissal of the foreman responsible.

An organization of forces is needed that will provide for a proper maintenance of running repairs and such a class of general repairs that the engine turned out will not require more than ordinary attention after every trip. To accomplish this, reliable foremen are necessary and to attract and retain them, the salaries must be sufficiently greater than the average monthly check of a round house machinist to induce a man to assume the responsibilities of a foremanship.

That good results cannot be obtained without competent, well paid supervision, is illustrated by the following case which may be taken as typical.

A division point at which four divisions terminate and where about sixty engines are handled a day, is frequently calling on headquarters for master mechanics and foremen. Within a very few years two master mechanics at this point were discharged and two others accepted more remunerative positions with another road, one of the latter having since become a superintendent of motive power. The general foremen in the locomotive department and several of the under foremen have been changed frequently. At the last change of master mechanics the incumbent of the general foreman's office was "allowed to resign" and it took several months to fill the position, though an appeal was made to the general office of the machinery department and an attempt was made to get a man from a neighboring road.

With such an instance in view, does it not show that organization was lacking at the division point in question and on the entire system, when men could not be provided to fill positions as needed? If this road can not make foremen and general foremen, what will it do for future master mechanics and possibly for higher officials? Employing officers from other roads is far from encouraging to the men when there is good material in the ranks of a large system which can be found if properly sought.

While a certain initial saving is made in the wages of a cheap man, the final results are expensive and a competent foreman receiving a satisfactory salary will not only operate a round house with less difficulty and delay to locomotives, but also more economically than the cheaper man. The most expensive part of a round house organization is a cheap foreman.

Car Repair Shops at East Decatur

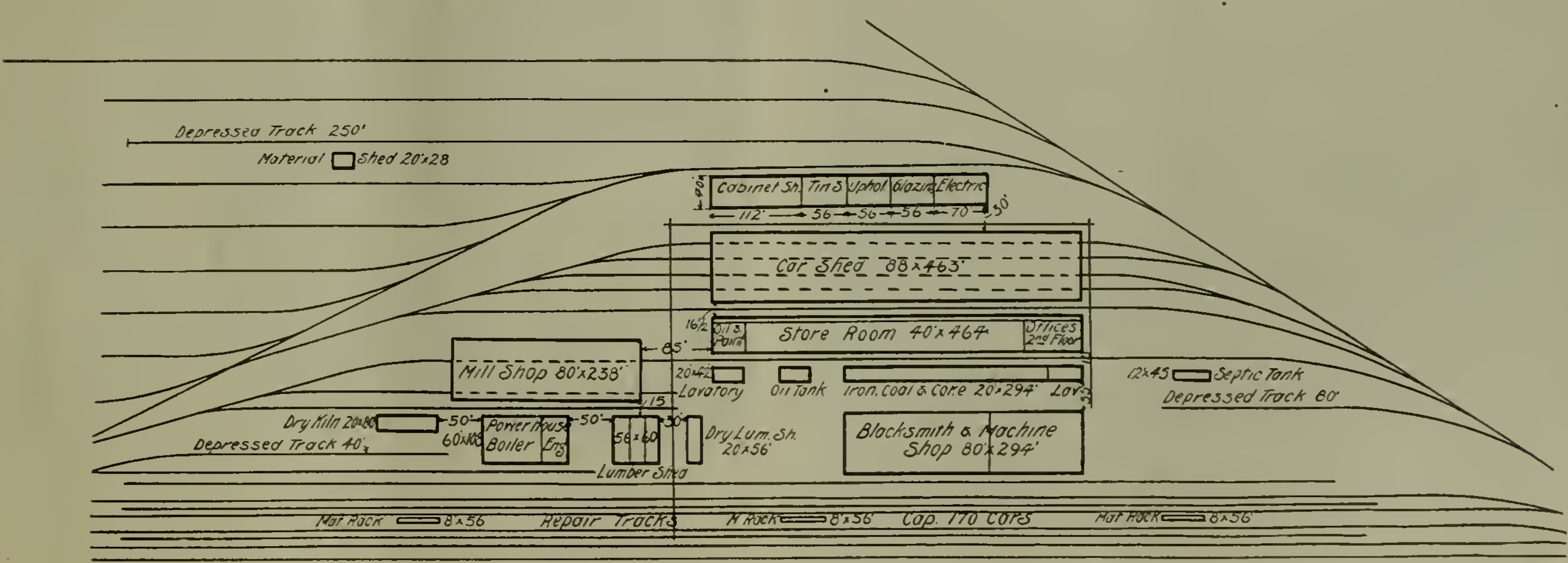
Wabash Railroad

THE principal car repair shops of the Wabash System are located on a tract of land of 78 acres one mile east of Decatur, Ill., at a place now known as East Decatur. This is one of the few plants, devoted entirely to car work. The plant was built to supercede the old shops near the station which were not only congested and out of date but entirely too small for maintaining the repairs to the equipment of the lines in Illinois and Indiana. The old shops are now being dismantled to make way for a new roundhouse, coal shed and other facilities, of a modern locomotive terminal, made necessary by the large increase in business on the Wabash lines.

As the new car shops have been in operation since the first of the year only, the maximum output has not yet been reached, owing to the large amount of work necessary to put the plant in condition to obtain the best results. However, the output is being gradually improved and the showing made in the last few months is a fair indication of what may later be expected from the plant. During the month of July 9,599 freight cars were repaired representing an increase of 1,649 cars or 20 per cent over the output of the old plant for the corresponding month of 1906. Twenty-eight passenger cars were overhauled in July as against 15 a year ago, an increase of 86 per cent. The output of the planing mill is now about 200,000 feet of finished material per month an increase of more than 40 per cent over the old mill and the blacksmith shop shows an increase of over 20 per cent in output over the shop, at the old plant. Considering the unfinished condition of the grounds and facilities for communication between the buildings at the time the plant was put in operation, the results accomplished are to be commended and indicate a rapid organization of the plant.

ARRANGEMENT OF BUILDINGS.

By referring to the general layout it will be observed that the longitudinal arrangement of buildings is followed with through tracks for car repairs and a system of industrial tracks for the movement of material.



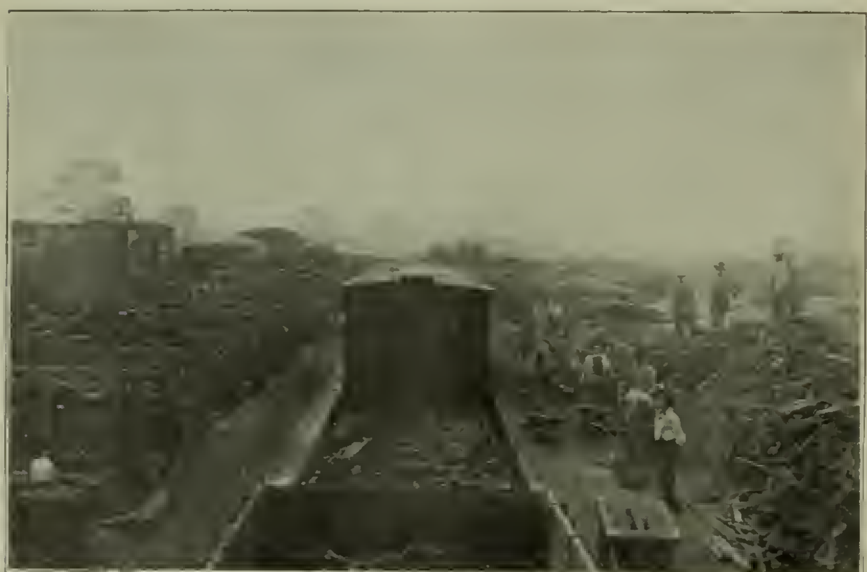
GENERAL LAYOUT OF CAR REPAIR SHOPS AT EAST DECATUR, WABASH RAILROAD.

VIEW OF SHOPS FROM SOUTHEAST—CAR REPAIR SHOPS AT EAST DECATUR, WABASH RAILROAD.

VIEW OF SHOPS FROM NORTHWEST, LUMBER YARD IN FORE GROUND—CAR REPAIR SHOPS AT EAST DECATUR, WABASH RAILROAD.

CABINET, UPHOLSTERING AND TIN SHOP ON LEFT, COACH SHOP ON RIGHT—CAR REPAIR SHOPS AT EAST DECATUR, WABASH RAILROAD.

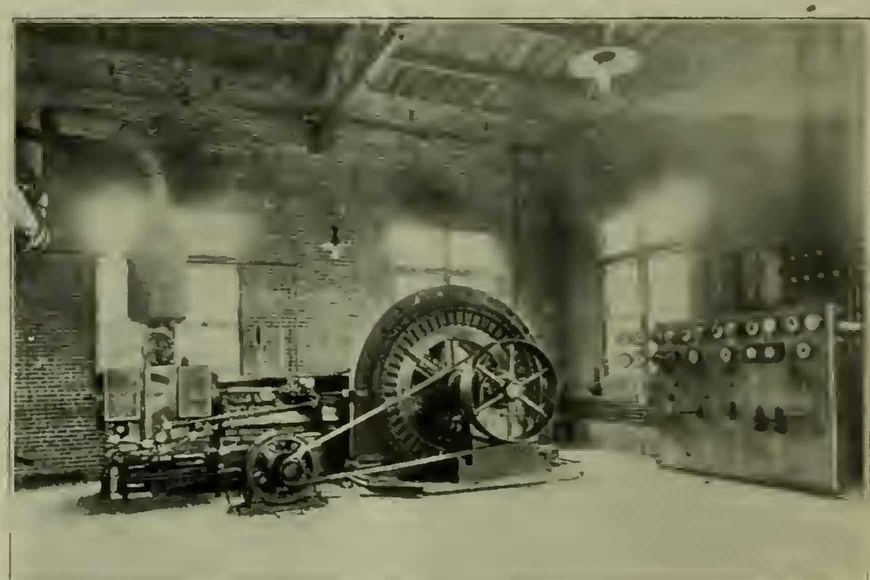
PLANING MILL AND POWER HOUSE FROM THE WEST—CAR REPAIR SHOPS AT EAST DECATUR, WABASH RAILROAD.



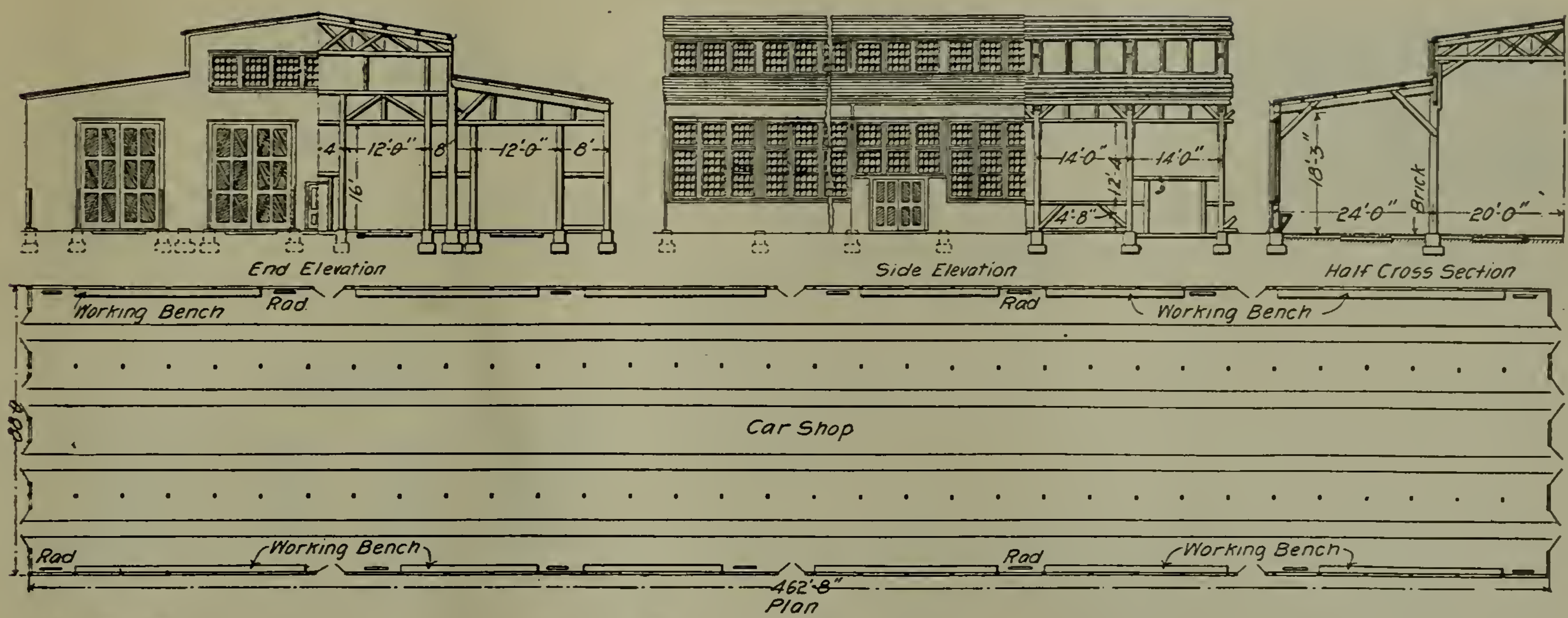
DEPRESSED TRACK AND ARRANGEMENT OF SCRAP BINS—CAR REPAIR SHOPS AT EAST DECATUR, WABASH RAILROAD.

BLACKSMITH SHOP ON LEFT WITH IRON RACKS, COAL AND COKE STORAGE BINS ON RIGHT—CAR REPAIR SHOPS AT EAST DECATUR, WABASH RAILROAD.

COUPLER YOKE RIVETING PRESS, LOCATED UNDER SHED, WEST OF BLACKSMITH SHOP—CAR REPAIR SHOPS AT EAST DECATUR, WABASH RAILROAD.



INTERIOR OF POWER HOUSE SHOWING ONE GENERATING UNIT AND SWITCHBOARD—CAR REPAIR SHOPS AT EAST DECATUR, WABASH RAILROAD.



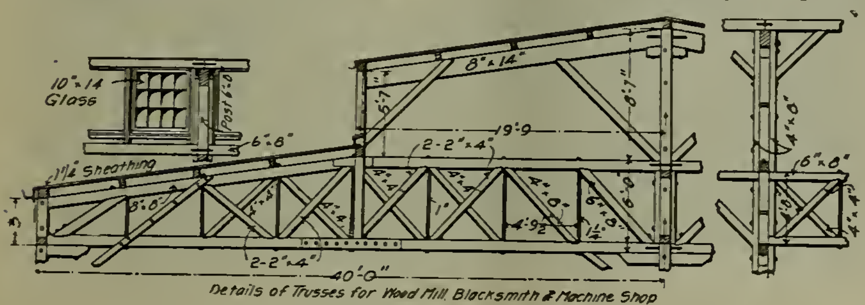
PLAN, END AND PARTIAL SIDE ELEVATIONS AND SECTIONS OF CAR REPAIR SHOP—CAR REPAIR SHOPS AT EAST DECATUR, WABASH RAILROAD.

By omitting the transfer table a compact arrangement of buildings has been secured.

The general plan provides for the progressive movement of unfinished material from the lumber yards through the mill and to the various departments. The minimum distance between buildings is 15 feet and there are a few instances where 85 feet has been allowed.

FREIGHT CAR REPAIR FACILITIES.

Owing to the mild winter weather usually experi-



ROOF TRUSS CONSTRUCTION USED IN PLANING MILL, BLACKSMITH AND MACHINE SHOPS—CAR REPAIR SHOPS AT EAST DECATUR, WABASH RAILROAD.

enced at Decatur but little provision has been made for repairing cars under roof, as the bulk of the repairs are to be made on the four repair tracks arranged on the south side of the grounds. These tracks have a capacity of 170 cars and are arranged in groups of two each on 20 foot centers with material distribution tracks between each pair of working tracks. Three material racks, 8 by 56 feet are located at convenient intervals. Two additional tracks with a capacity of 80 cars which may be employed for car repairing when the occasion demands, are now used for storage purposes.

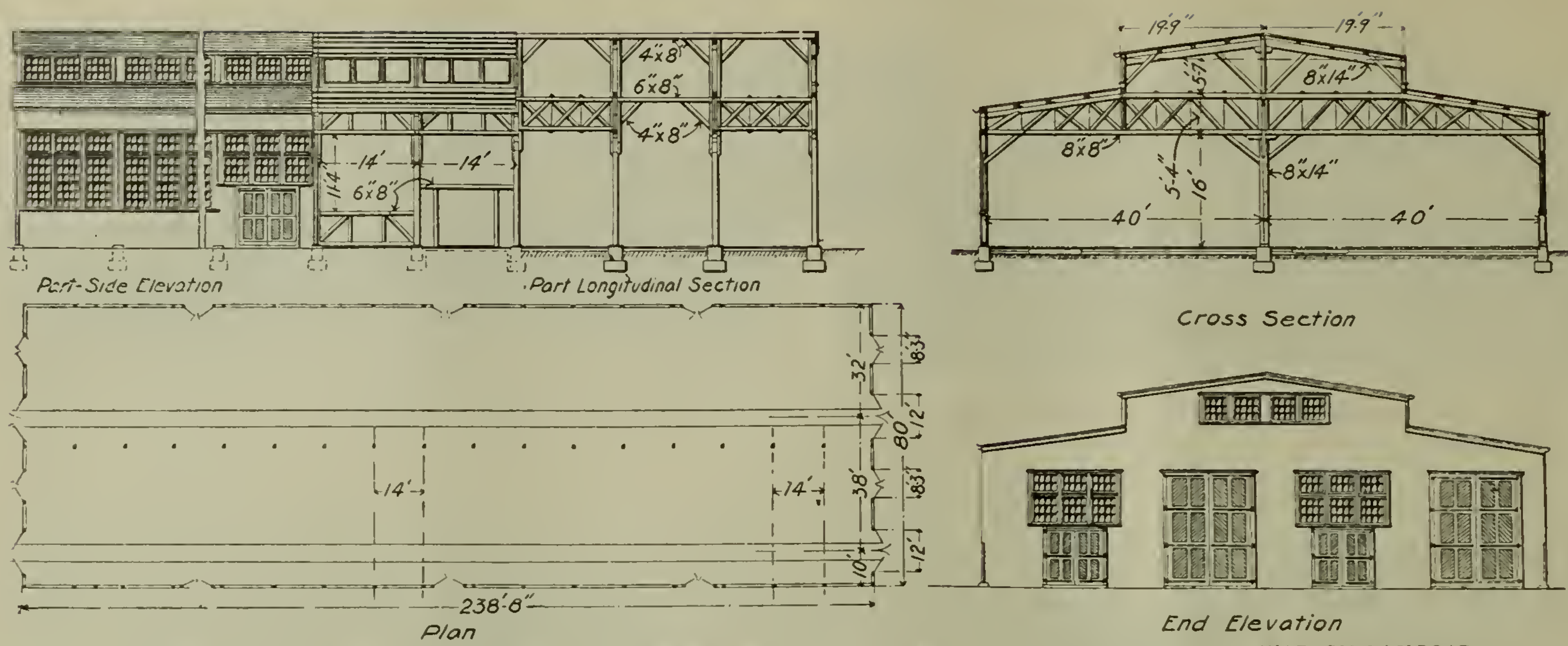
DESIGN AND CONSTRUCTION OF BUILDINGS.

The general character of the buildings as shown by the illustrations is of a uniform wood and cement construction with the exception of the store house, office and power house, which are of brick. One of the noticeable features of construction is the ample provision made for natural lighting by means of large windows in the side and end walls and monitors equipped with windows the full length of the buildings. Roof trusses and frame work are of wood construction throughout. The foundations are concrete and the walls built up of Portland cement plaster on expanded metal about 1½ inches thick on both sides. The roof covering is of tar and sheeting with a heavy layer of fine crushed stone. Although the buildings are of simple design and lack all unnecessary ornamentation they present a very harmonious appearance.

CAR REPAIR SHOPS.

The car repair shop is 88 by 463 feet with 4 longitudinal tracks on 20 foot centers, arranged primarily for coach repairs and painting. Owing to the press of freight repairs, one track is now being used for overhauling caboose cars. The shop is divided into 3 longitudinal bays, the two outside bays having a width of 24 feet each and the center bay a width of 40 feet with a clear height from floor to roof truss of 20 feet. Each track has a capacity of 5 of the large or 80 foot cars and 7 of the smaller or 54 foot cars, giving the three tracks used for passenger car work an average standing room of 18 cars. The shop is well lighted naturally and an equipment of 55 arc and numerous incandescent lamps, provides an exceptional amount of arti-

INTERIOR OF CAR REPAIR SHOP SHOWING NORTH BAY—CAR REPAIR SHOPS AT EAST DECATUR, WABASH RAILROAD.



PLAN, ELEVATIONS AND SECTIONS OF PLANING MILL—CAR REPAIR SHOPS AT EAST DECATUR, WABASH RAILROAD.

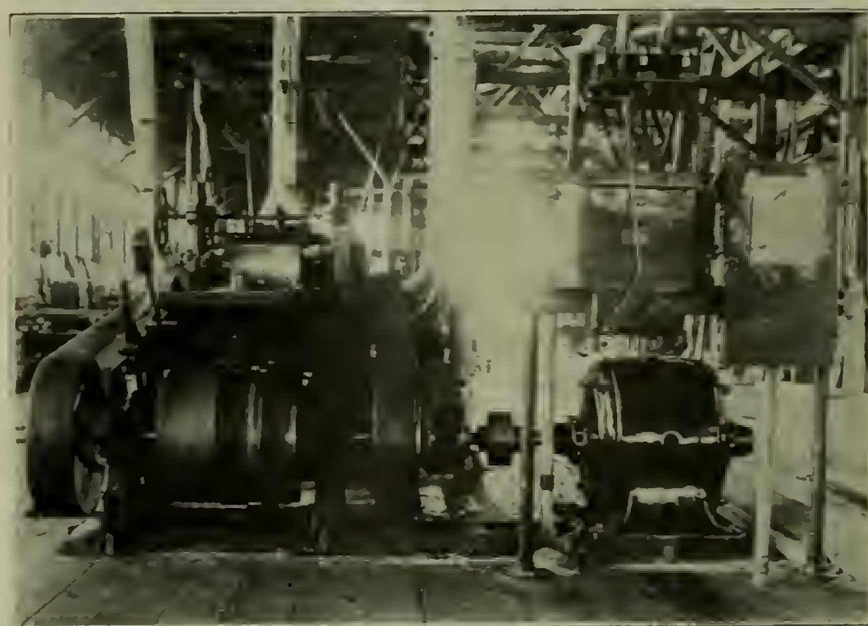
ficial light. About 60 men are employed in this shop and the average output exceeds 25 cars.

One of the interesting details in connection with the work done in the coach shop is the construction of locomotive pilots. The parts are finished in the mill and assembled by one man in from 6½ to 9 hours at a cost considerably below the usual figure.

PLANING MILL.

The planing mill is 80 by 238 feet with two longitudinal service tracks which connect with the yard tracks on the west and the system of industrial tracks on the east, providing a rapid and economical means of distributing material. The mill building is located 85 feet west of the coach shop and adjacent to the power house for the convenience in the delivery of shavings and refuse from the machines to the boilers. The mill is divided into two bays 40 feet wide by a center row of columns, and the height from floor to roof truss is 16 feet. The construction of the building is after the same general plan as previously outlined, with ample facilities for both natural and artificial lighting. As the unfinished material enters from the west, the heavy planers and surfaces are located in that end of the shop and adjacent to the material tracks, with the cut-off saws, inside moulders, etc., arranged in succession at convenient intervals. In this way material progresses through the shop with minimum amount of unproductive movement.

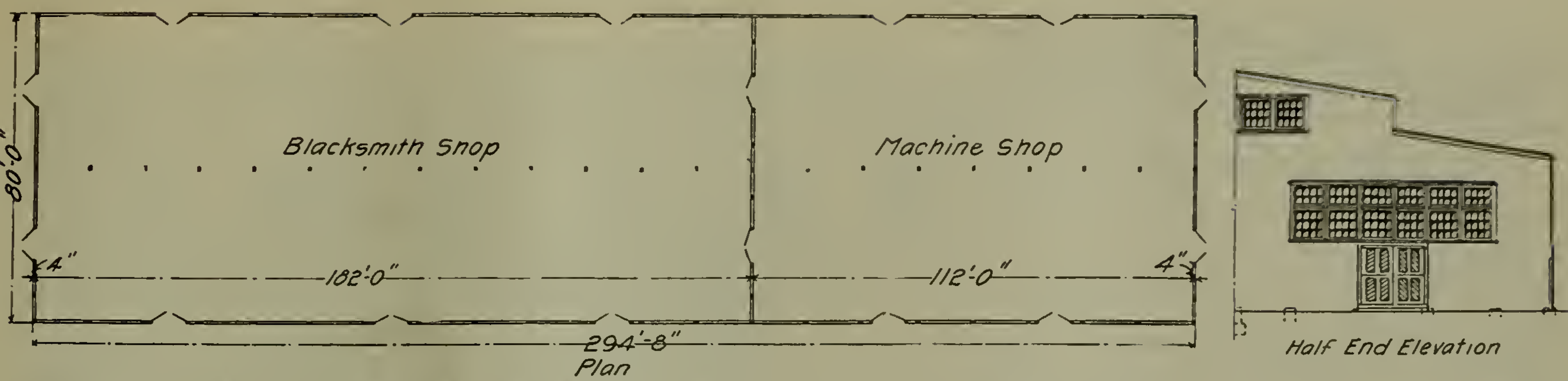
INTERIOR OF MILL SHOWING SOUTH BAY FROM THE WEST END. ON THE RIGHT, CAR SILL IS LEAVING THE PLANER TO CUT OFF SAW—CAR REPAIR SHOPS AT DECATUR, WABASH RAILROAD.



AN EXAMPLE OF GOOD PRACTICE IN MOTOR DRIVE. 40 H. P. WAGNER MOTOR DIRECT CONNECTED TO 15 BY 6 IN. BERLIN INSIDE MOULDING MACHINE—CAR REPAIR SHOPS AT EAST DECATUR, WABASH RAILROAD.

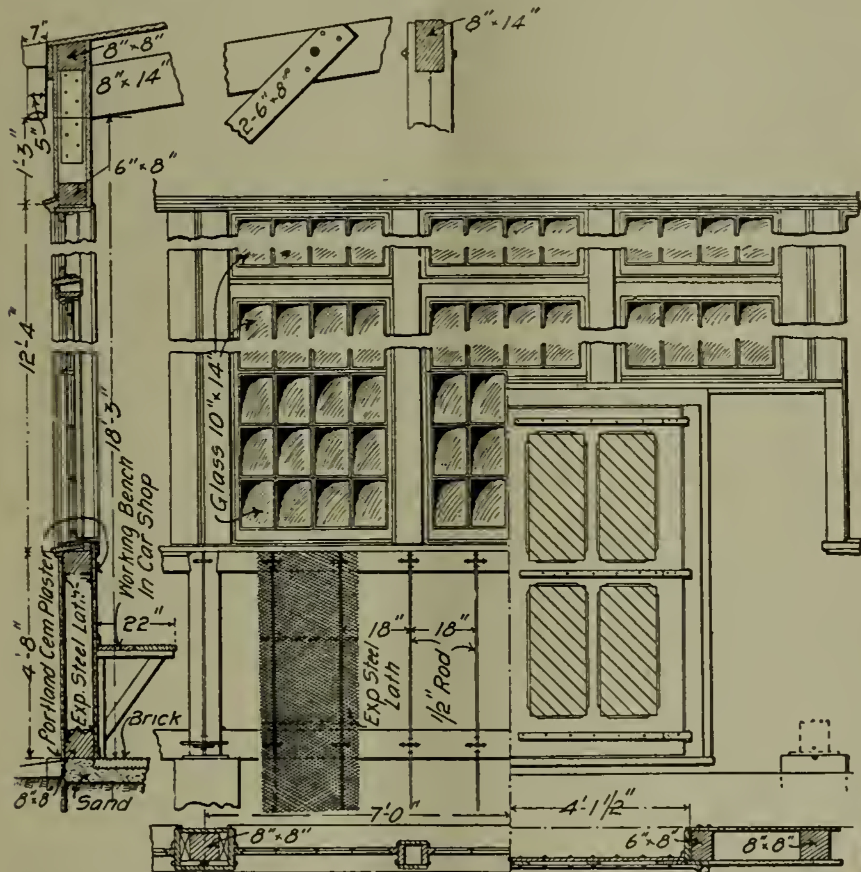
The mill is equipped with high speed modern machines, all motor-driven, arranged in a very careful

VIEW DOWN MATERIAL TRACK IN NORTH BAY OF PLANING MILL—CAR REPAIR SHOPS AT EAST DECATUR, WABASH RAILROAD.



PLAN AND HALF END ELEVATION OF MACHINE AND BLACKSMITH SHOPS—CAR REPAIR SHOPS AT EAST DECATUR, WABASH RAILROAD.

manner. The substantial installation of motors on concrete foundations and direct connections with convenient arrangement of switches and starting boxes on individual stands, is one of the excellent features of this shop. In every case motors of ample size have been provided so that the capacity of the machines can at all times be maintained. An exhaust system with pipes to each machine was installed by the H. L. Day Manufacturing Co., Minneapolis, conveying the cuttings and shavings to the boiler room. The exhaust fan is 90 inches in diameter and operated by a 75 H. P. motor.



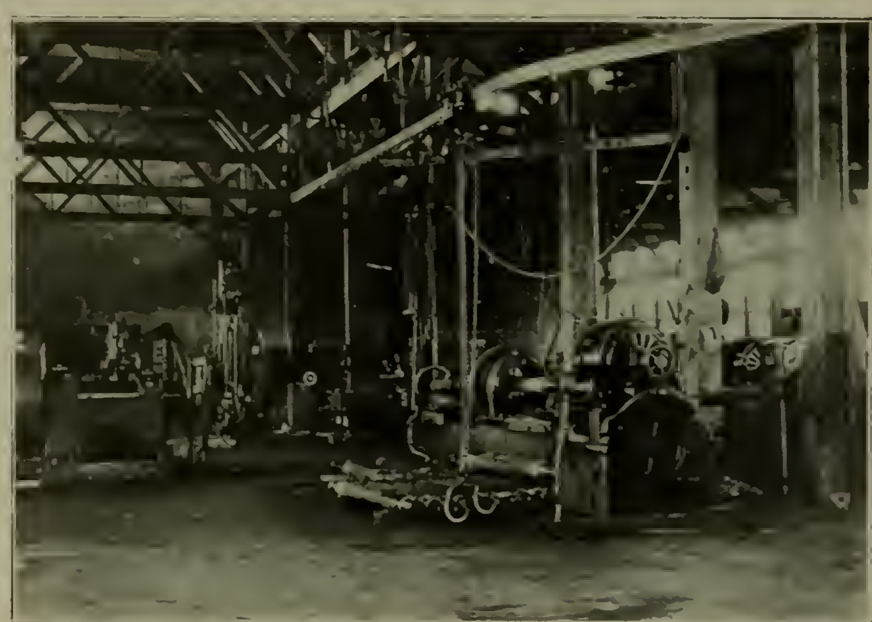
DETAILS OF WOOD AND CEMENT WALL CONSTRUCTION—CAR REPAIR SHOPS AT EAST DECATUR, WABASH RAILROAD.

Owing to the rapidity with which work can be handled in the mill it is gradually becoming the principal supply point of the whole system for finished car material.

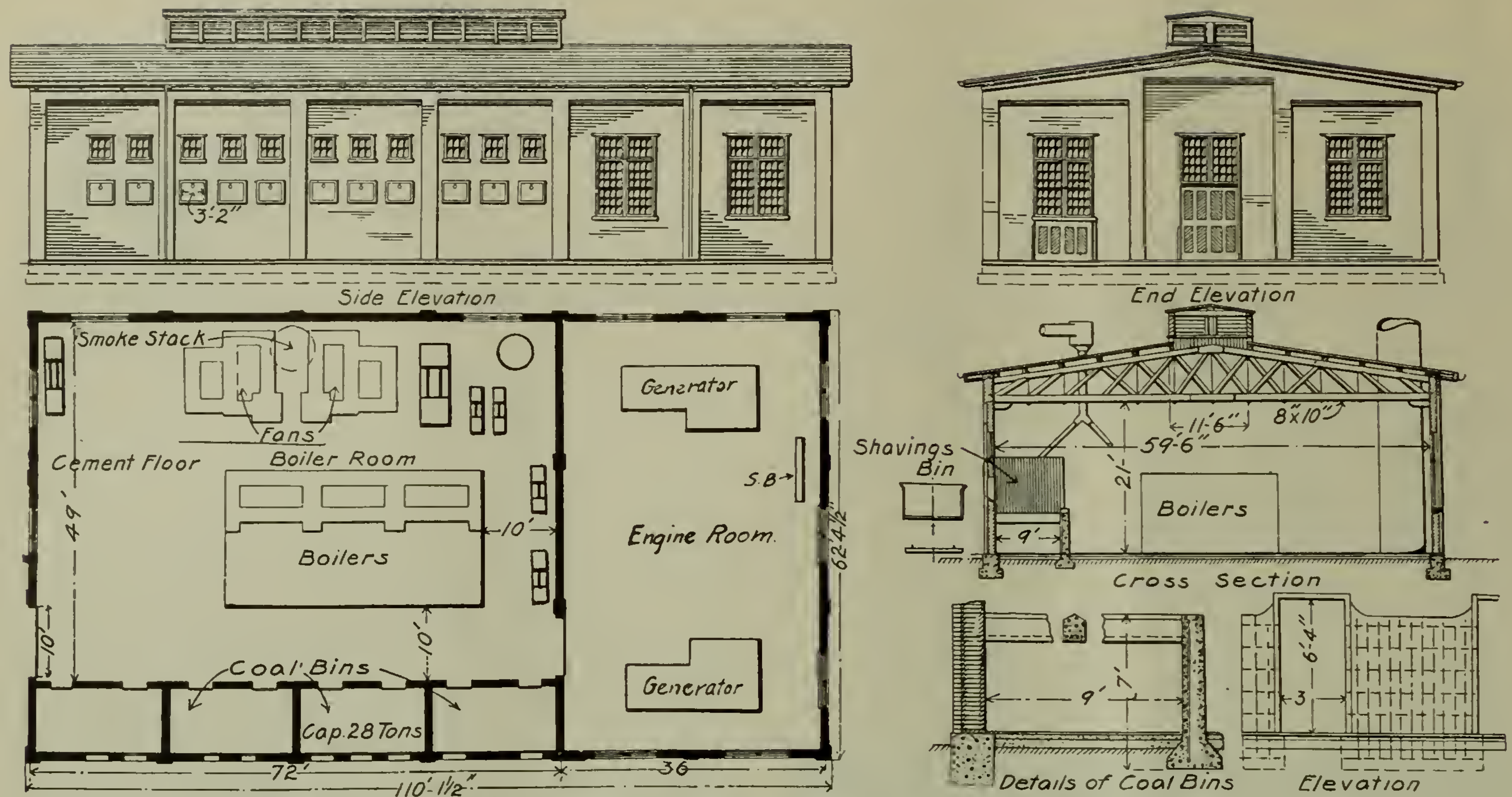
MACHINE SHOP.

The machine and blacksmith shops are housed in one building 80 by 294 feet, located adjacent to the repair tracks. The building is of wood and cement construction, and is provided with the same facilities for natural lighting as the other buildings of the plant. The machine shop is at the east end of the building and has a floor area of 80 by 112 feet. Owing to the large amont of space available, the machines were arranged to the best advantage without crowding.

The wheel yard and depressed track for handling wheels to and from cars, is located just east of the shop so the wheel presses, axle lathes and wheel borers are grouped in that end of the shop about the two outside doors as shown in the floor plan. Duplicate sets of wheel presses, axle lathes and wheel borers are provided in order to take care of any unusual demand for wheels which is liable to occur. The drill presses are located near the door leading to the blacksmith shop for economical handling of forgings and drill parts. Although the lighter machines such as engine lathes, shaper and grinding machines are group-driven by a 15 H. P. motor, the heavier machines have individual motor drives. A few old machines were moved from the old shop but the heavy machines are new and modern. Among the machines of especial interest may be mentioned a Foote-Burt arch bar drill, Putman 42 inch wheel lathe and wheel borer, Niles wheel presses, Cincinnati shaper, etc. The Wagner motors connected to these machines are of sufficient size to maintain the heaviest cuts so that the machines can be worked up to their capacity. In practice the maximum amount of work is obtained from these machines and the performance of some is above the average. With the Putman 42 inch wheel borer driven by a 20 H. P. motor, taking a ⅜ inch cut, wheels are bored out in a little over 2 minutes or 18 per hour, a very creditable record. On a Putnam axle lathe running 64 feet per minute, one man turns out 34-5 by 9 axles in 9 hours, a record far above the average performance. In July 675 pairs of cast iron wheels were remounted beside a large number of steel tired wheels. Air hoists and trolleys facili-



INTERIOR OF MACHINE SHOP SHOWING CORNER DEVOTED TO CAR WHEEL AND AXLE WORK—CAR REPAIR SHOPS AT EAST DECATUR, WABASH RAILROAD.



PLAN, ELEVATIONS AND SECTIONS OF POWER HOUSE—CAR REPAIR SHOPS AT EAST DECATUR, WABASH RAILROAD.

tate the handling of heavy parts and a number of special appliances have been devised for shortening the time of certain classes of work.

BLACKSMITH SHOP.

The blacksmith shop occupies the west half of the building in common with the machine shop and has a floor space of 80 by 182 feet. The equipment of this shop consists in general of 12 open forges, 7 Ferguson crude oil furnaces, 2 steam hammers, 2 inch power punch and shears, 2 bulldozers, 2 Ajax forging machines, 1 eye bender, taper rolls, 1 Justice and 1 Bradley hammer, bar shears, 4 threading machines, drill press, etc. A 50 inch Buffalo Forge Co., pressure blower driven by a 50 H. P. direct-connected motor furnishes air for the forges and furnaces. There are a large number of special dies and appliances in use which have been devised and built in the shop. Air hoists and cranes are provided where necessary. At present the output of the shop is over 20 per cent greater

BOILER ROOM SHOWING DELIVERY TUBES FOR SHAVINGS—CAR REPAIR SHOPS AT EAST DECATUR, WABASH RAILROAD.

than that of the old shop. In July 55 tons of new iron and 41 tons of old iron were worked up in addition to the special work for other points on the road. Also 28 tons of old bolts were straightened and threaded. This shop is now supplying the whole system with certain classes of work such as arch bars, brake levers, brake beams, etc. About 50 men are employed, all on the day rate basis. Adjoining the shop on the west a small shed is provided for riveting coupler yokes. Thirty-five feet to the north of the shop is located the coal and coke bins and the iron racks, under a shed 20 by 294 feet.

CABINET, GLAZING AND TIN SHOPS.

A building 40 by 350 feet, of wood and cement construction, contains the cabinet, upholstering and varnish, electrical and tin shops, and is located 30 feet north of the car shop. The cabinet shop is equipped with a number of wood-working tools driven by motors as shown in the accompanying floor plan. The upholstering and glazing departments have the usual racks, work benches, etc., and the tin shop at the east end of the building is also equipped with the usual quota of tools. A Ferguson crude oil furnace for heating babbitt metal is one of the noticeable features of this shop. A small building adjoining the tin shop on the east is arranged as a cleaning and dipping room. A home-made electric oven for baking on lacquer is being tried with excellent results. It consists of a battery of 24, 16 candle power lamps which maintain an even temperature of 170° and requires practically no attention.

The electrical repair shop is also located in the building where the electrical equipment for the whole road is repaired.

POWER HOUSE.

The power house is a substantial brick building 60 by 108 feet located 15 feet south of the planing mill. A partition at the second pilaster from the east wall divides

FERGUSON FURNACE FOR MELTING BABBITT IN TIN SHOP—CAR REPAIR SHOP AT EAST DECATUR, WABASH RAILROAD.

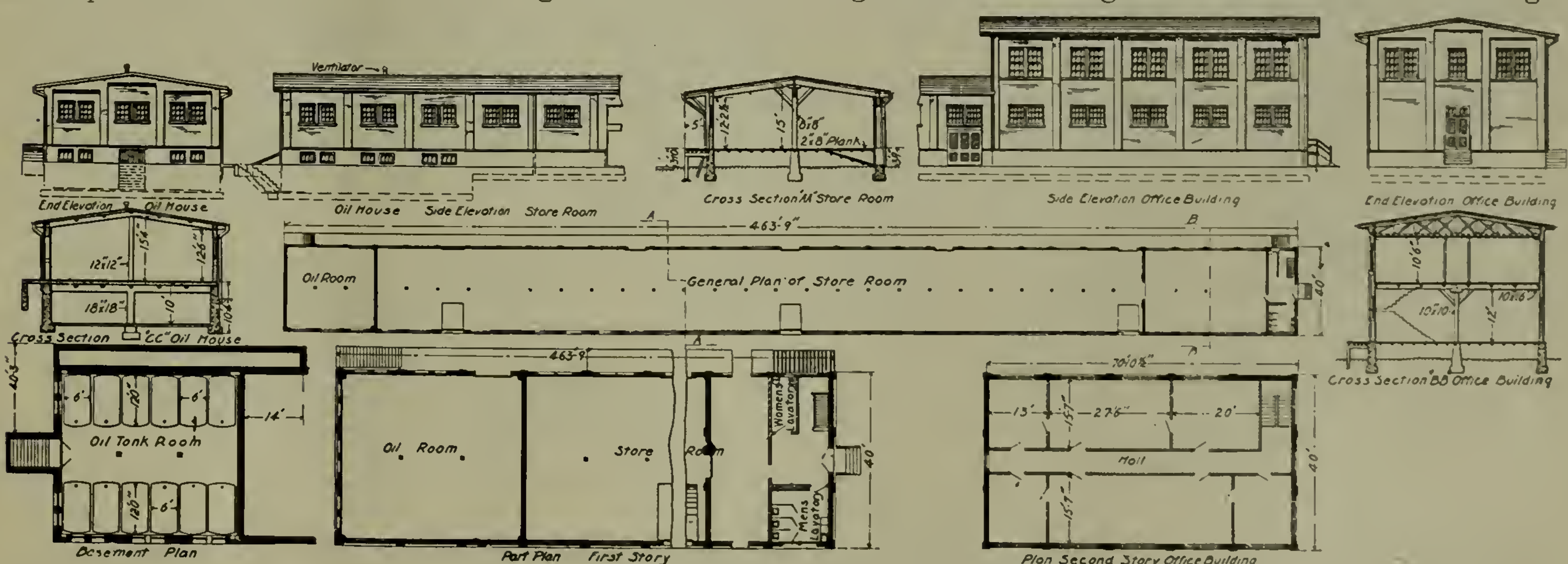
the building into an engine and boiler room. In the engine room which is 36 by 60 feet, are installed 2 direct-connected 300 K. W. 3-phase, 440-volt Westinghouse A. C. generators, driven by two, 24x30 inch simple 4 valve engines made by the Erie City Iron Works, operating at 150 R. P. M. Two 22½ K. W. exciters are driven by belt. The current used will be 440-volt 60-cycle, 3-phase to supply the motors and the new 440-volt, 650-candle power lamps of the General Electric Company of which there are 110 in service about the shops in addition to 500 incandescent lamps. All motors for driving machinery are of the three-phase A. C. type furnished by the Wagner Electric Company of St. Louis. The boiler room in the west half of the building has an inside measurement of 49 by 72 feet with a height of 21 feet from floor to roof truss. The installation consists of four 300 horse power Heine boilers carrying 120 pounds pressure with an induced draft system ending in a 6 foot iron stack, 30 feet high. The system was furnished by the American Blower Company in duplicate, each unit consisting of a 75 inch fan driven by a 7 by 7 inch engine and having a capacity for over 1,200 boiler horse power. As a large proportion of the fuel was expected to be utilized from shavings from the mill, mechanical devices for handling coal and ashes were not installed. Two 10 by 6 by 12 in. Fairbanks-Morse boiler feed pumps with Williams steam pump governor automatically supply the boilers with water. Two 8 by 10 by 12 in. Knowles vacuum pumps are furnished for the steam heating system which was installed by the Miller Heating Company, Chicago. For heating feed water an open heater of 1,500 horse power made by the Cookson Co., Joliet, is added. A high pressure 16 by 9 by 12 inch Gardner pump is supplied for fire protection purposes. Coal bins of reinforced concrete are located immediately in front of the boilers.

STOREHOUSE.

The storehouse is a brick structure 40 by 464 feet, one story in height, except 70 feet on the east end which is of two stories with the offices of the general foreman and store-keeper on the second floor. The general storeroom occupies the whole lower floor with an office at the east end and oil room at the west end. Cross racks

INTERIOR OF LAVATORY, ONE HALF OF ROOM IS SHOWN, DOORWAY LEADING TO OTHER SECTION IS SHOWN ON RIGHT—CAR REPAIR SHOP AT EAST DECATUR, WABASH RAILROAD.

with shelves and bins for the storage of material are arranged each side of a broad central aisle between each set of windows. A trucking platform extends the full length of the building on the north side for loading di-



PLAN, ELEVATIONS AND SECTIONS OF STORE HOUSE AND OFFICE BUILDING—CAR REPAIR SHOPS AT EAST DECATUR, WABASH RAILROAD.

rect to and from cars. Inclines are provided at the doors in the south wall for distributing material by trucks to the various shops. The lumber yard occupies the western extremity of the grounds and by a complete system of switching tracks, material can be readily loaded on cars for delivery to any part of the plant. The scrap yard with 40 large bins and depressed track for convenience in loading is located in the lumber yard.

LAVATORIES AND SEWER SYSTEM.

One of the improved features of the plant will be seen in the two lavatory buildings located at convenient points. These buildings are of wood and cement construction and 20 by 42 feet in size. Each is equipped with 38 porcelain wash bowls and the clean manner in which the lavatories are maintained is worthy of more than passing note. A complete system of sewerage on the septic system is installed, the tank for this purpose 12 feet wide by 45 feet long is located at the extreme east end of the shop grounds. The water supply is obtained from the City of Decatur.

The shop buildings were constructed by the Stewart Contracting Company from the plans of Mr. A. C. Cunningham, chief engineer, and Mr. J. B. Barnes, supt. car and locomotive department. The electrical installation was supervised by Mr. W. A. Hopkins, electrical engineer of the road. We acknowledge the courtesy of Mr. Barnes and Mr. J. C. Meehan, general foreman at Decatur, for assistance rendered in the preparation of this article.

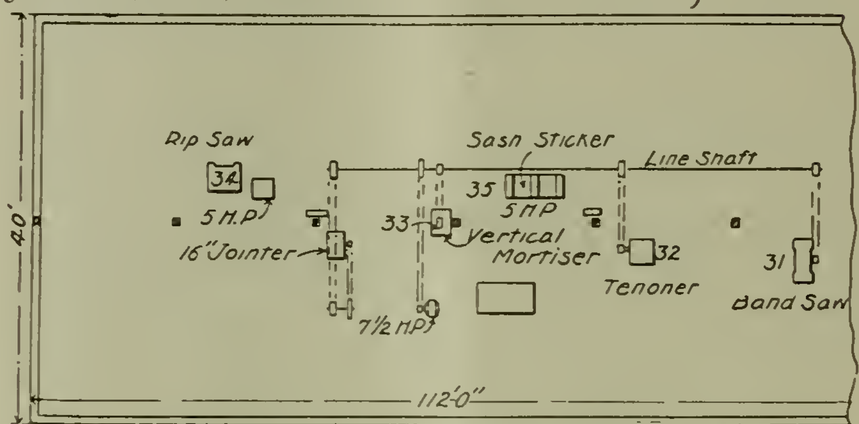
Following is a list of tools in the various shops with the names of the makers and the size of motors driving them:

PLANING MILL.

No.		Motor.
3	Knife grinder, Diamond Machine Co.	7½ H. P.
2	Saw gummer, Covel	
1	Band saw sharpener, Covel	
4	Pattern maker's lathe, Robbins	
5	Band saw, 4 in. self-feed, Berlin	15 "
6	Car sill planer, 16 by 26 ins., S. A. Woods	50 "
7	Cut off saw, 36 ins., Greenlee	15 "
8	Cut off saw, 40 ins., Greenlee	15 "
9	Car sill tenoner, S. A. Woods	15 "
10	Five spindle vertical drill, Greenlee	15 "
11	Hollow chisel mortiser, S. A. Woods	15 "
12	Self feed rip saw, Greenlee	10 "
13	Gaining machine, 4 in. cut, Greenlee	15 "
14	Mortiser, old	5 "
15	Combination band, rip and resaw, Greenlee	15 "
16	Double surfacer, 12 by 30 ins., Berlin	30 "
17	Cut off saw, Greenlee	10 "
18	Outside moulder, 14 by 6 in., Am. Wood Wk. Co.	20 "
19	Circular rip, 24 in., Fay and Egan	15 "
20	Jointer, 24 in., Greenlee	5 "
21	Single surfacer, 36 in., S. A. Woods	10 "
22	Inside moulding machine, 15 by 6 in., Berlin	40 "
23	Tenoner, Fay and Egan	5 "
24	Car brace cutter, Greenlee	10 "
25	2 spindle shaper, Berlin	10 "
26	Band saw, Fay and Egan	5 "
27	Universal wood worker, 16 in., Greenlee	7½ "
28	Hollow chisel mortiser, 2½ in., Fay and Egan	15 "
29	Horizontal boring machine, 4 spindle, Greenlee	10 "
30	Four-sided sash sticker, American Wood Wk. Co.	5 "
31	Goose neck tenoner, Greenlee	15 "
32	Horizontal and radial boring machine	5 "
	Exhaust fan, 90 in., American Blower Co.	75 "

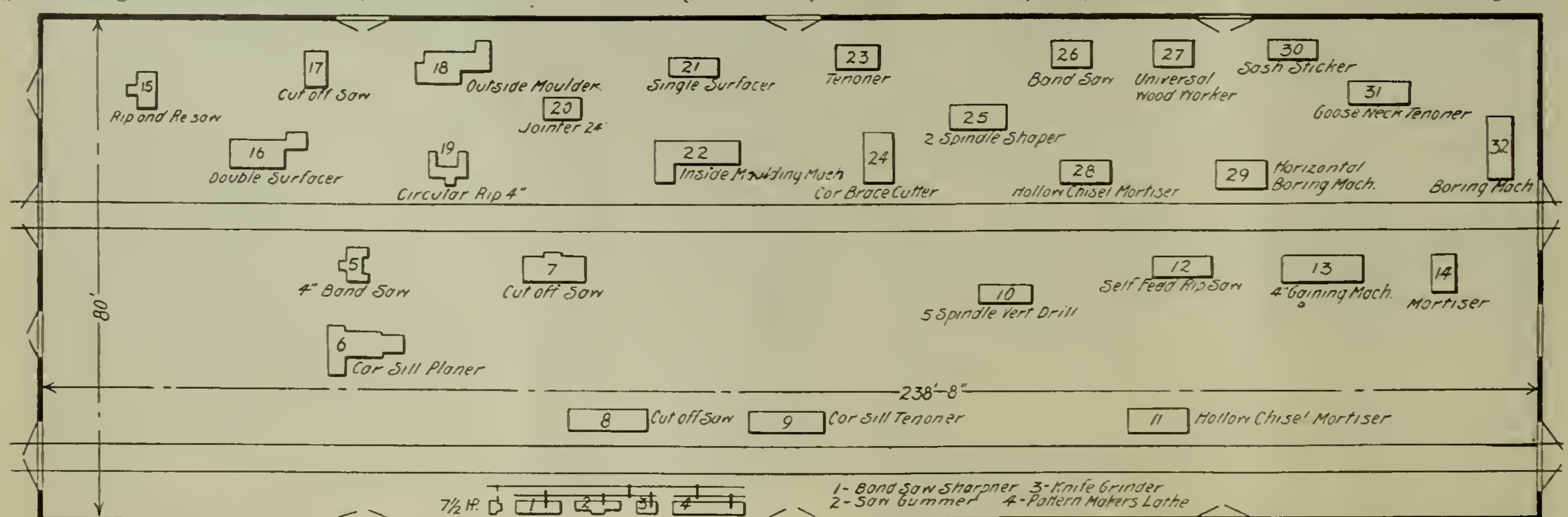
MACHINE SHOP.

50	Emery wheel	15 H. P.
51	Grindstone	
52	Back gear shaper, 20-inch, Cincinnati	
53	Lathe, 16 in., Niles (old)	
54	Lathe, engine, 28 in., Blaisdell (old)	
57	Drill grinder	
57½	Planer, 26x6 in., Niles (old)	
58	Lathe, 16 in., Le Blond	

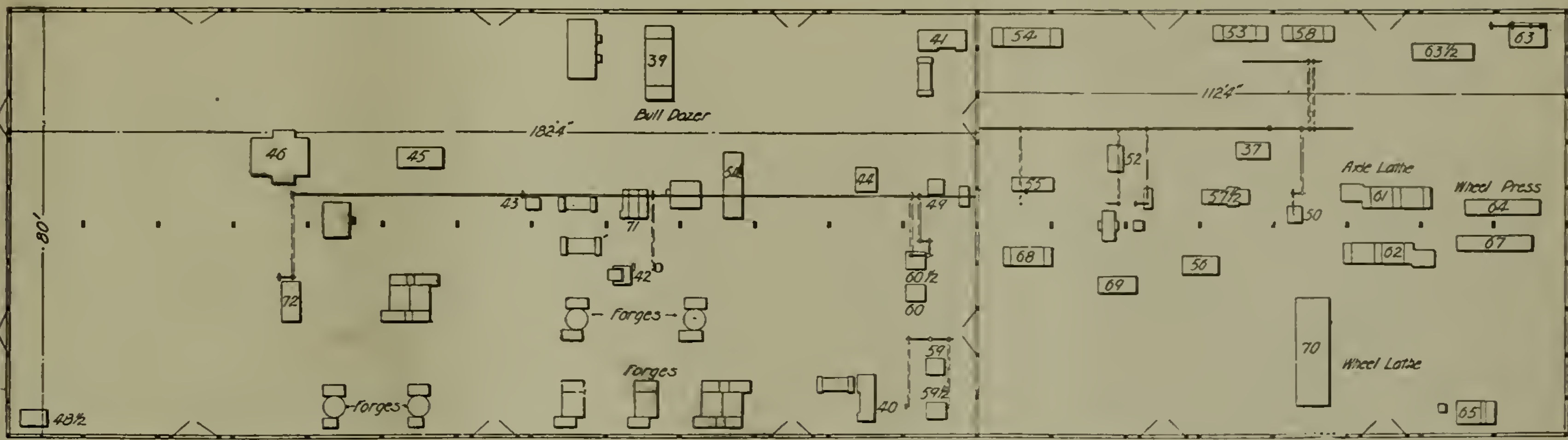


PLAN OF CABINET SHOP SHOWING ARRANGEMENT OF MACHINES—CAR REPAIR SHOPS AT EAST DECATUR, WABASH RAILROAD.

56	Vertical drill, 42 in., Barnes	3 "
61	Double head axle lathe, 5½ by 10 in., Putnam	20 "
62	Double head axle lathe, 5½ by 10 in., Putnam	20 "
63	Double head axle lathe, Niles (old)	20 "
64	Wheel press, 200 tons, Niles	7½ "
65	Car wheel borer, 42 in., Putnam	20 "
67	Wheel press, 200 tons, Niles	7½ "
68	Arch bar drill, 6 spindle, Foote-Burt	10 "
69	Drill press, 4 spindle, Foote-Burt	7½ "
70	Wheel lathe, 42 in., Putnam	30 "



PLAN OF PLANING MILL SHOWING ARRANGEMENT OF WOOD WORKING MACHINES—CAR REPAIR SHOPS AT EAST DECATUR, WABASH RAILROAD.



PLAN OF BLACKSMITH AND MACHINE SHOPS SHOWING LOCATION OF MACHINES, FORGES, ETC.—CAR REPAIR SHOPS AT EAST DECATUR, WABASH RAILROAD.

BLACKSMITH SHOP.

39	Bulldozer, Williams & White	30 H. P.
40	Bolt forging machine, 2 in., Ajax	10 "
41	Forging machine, 2½ in., Ajax	10 "
42	Justice hammer, 200 lbs., Williams & White	
43	Eye bender, Williams & White	
43½	Bradley hammer	
49	Emery wheel	20 H. P.
51	Grindstone	
51½	Bulldozer (old)	
59	Double head bolt cutter, 2 in., National	
59½	Double head bolt cutter, 2 in., National	
60	Triple head bolt cutter, 1 in., National	7½ "
60½	Double head bolt cutter, 2 in., National	7½ "
44	Bar shears, 2 in., Williams & White	7½ "
45	Punch and shear (old)	7½ "
46	Steam hammer, 1,500 lbs	
46½	Steam hammer, 800 lbs	
48	Pressure blower, Buffalo Forge Co	50 "
71	Taper rolls, Williams & White	15 "

CABINET SHOP.

17	Jointer, 16 in.	
31	Band saw, 36 in	
32	Tenoner, small	7½ H. P.
33	Vertical hollow chisel mortiser	
34½	Grindstone	
34	Comb. rip and cut-off saw, American Wood Wk. Co.	5 "
35	Four-sided sash sticker, American Wood Wk. Co.	5 "

Locomotive Characteristic Curves

By J. G. Crawford

IT frequently happens that when two different types of engines of the same theoretical power are running in the same class of service on the same division, that one type will prove to be considerably more economical than the other, and in some cases the better engine will prove itself capable of hauling more tonnage at a greater speed and with a less amount of coal.

From month to month as one type of engine by using less coal per 100 ton miles proves itself to be more economical than the other, the question arises as to wherein lies the difference between the two types of engines and what must be done to the poorer engine to bring it to the standard of the better one.

To say that one engine is more economical than the other when operated in the same class of service, means that it uses less coal per 100 ton miles or that it uses less coal per draw-bar horse-power per hour. The coal used per draw-bar horse-power hour depends upon four things, namely:

First—Boiler evaporative efficiency.
Second—"Cylinder-drawbar" efficiency.
Third—Efficiency of steam flow from boiler to valve.
Fourth—Valve and cylinder efficiency.

Two engines have the same boiler evaporative efficiency when the boilers will produce an equal amount of steam for the same number of pounds of coal burned in each.

To ascertain whether or not there is a difference in boiler efficiency between two engines, it is only necessary to make evaporation tests on these engines thereby establishing the ratio of the number of pounds of water evaporated per pound of coal.

The "cylinder-drawbar" efficiency includes not only the mechanical efficiency of the engine, but all losses between the cylinders and tender drawbar. The cylinder-drawbar efficiency can be obtained from the indicated tractive force of the engine as determined by the indicator cards and the tractive force at the tender drawbar as determined by a dynamometer placed there. It is thus an easy matter to ascertain just how much power is lost between the cylinder and drawbar in different types of engines.

The water rate of an engine in terms of pounds of water per indicted horse-power per hour is obtained from the indicator cards.

As a basis for this article, we will assume that the two different types of engines operating in the same class of service on the same division have been tested and the results show that the boiler evaporative efficiencies of both types of engines are the same. Also that the comparison of indicated and tender draw-bar tractive force show that the losses between cylinders and draw-bar are the same in the case of the two types, and finally, that the water rate of the superior type of engine is less.

It was with the idea of ascertaining why water rates differ in different types of engines when operated under the same conditions of tonnage and speed, that the fol-

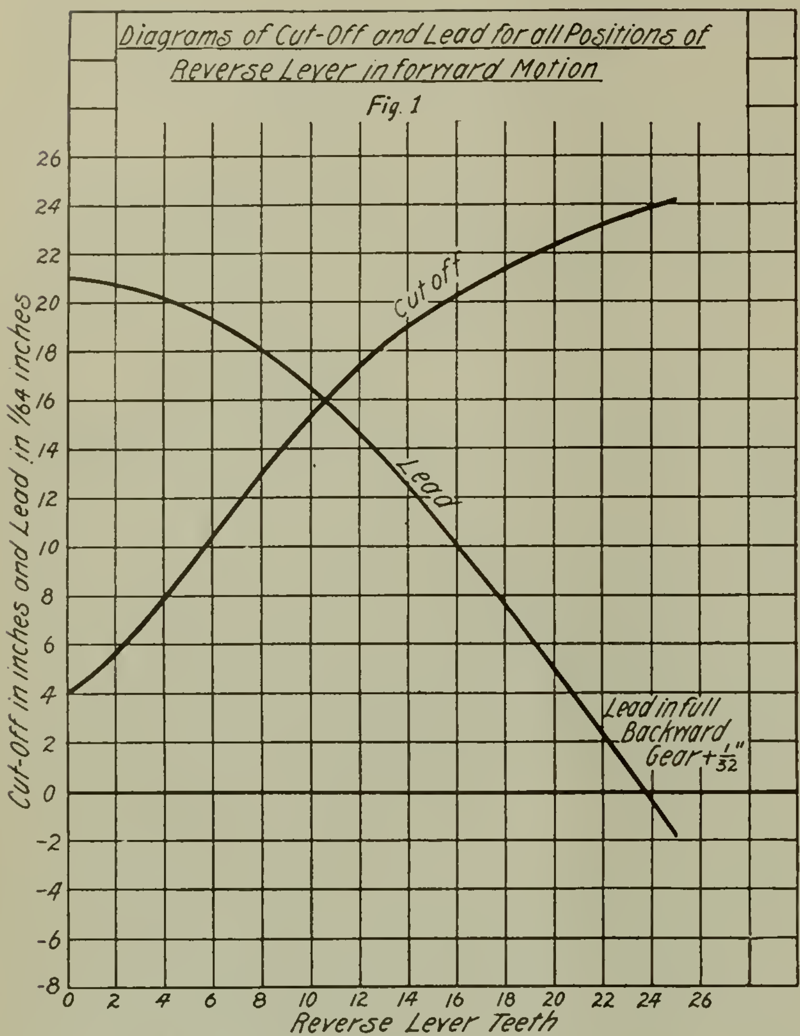


FIG. 1—DIAGRAM OF CUT-OFF AND LEAD FOR ALL POSITIONS OF REVERSE LEVER IN FORWARD MOTION.

lowing curves which I have designated as "Characteristic Curves" were derived. They are the results of some preliminary tests made on a consolidation engine with 22 in. x28 in. cylinders and 57 in. drivers.

As the derivation of these curves involves a number of points, the methods used will be taken up in detail.

The valves were set nearly line and line in both full forward and full backward gear and the setting was checked from time to time to make sure that there had been no slipping of eccentrics or blades. The teeth on the reverse lever quadrant were arbitrarily numbered, full forward gear being number 25. With the reverse lever in each position the lead and cut off were observed for each quarter and the average of the four quarters plotted as shown in Figure 1.

Figure 1.—All indicator cards were taken with a full throttle. The indicator cards were planimetered for mean effective pressure, back pressure and pressure drops as illustrated in Figure 2.

The pressure drop from boiler to steam chest is the average ordinate of "A" and the pressure drop from

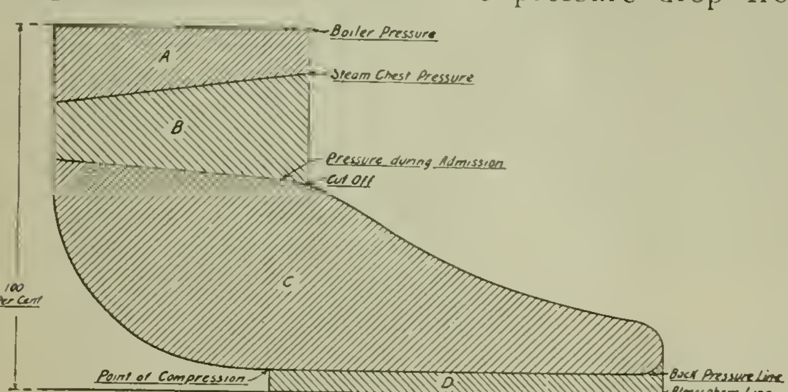


FIG. 2—DIAGRAM SHOWING METHOD OF PLANIMETERING INDICATOR CARDS—LOCOMOTIVE CHARACTERISTIC CURVES.

steam chest to piston is the average ordinate of "B." The pressure drop from boiler to piston is the sum of the average ordinates of "A" and "B." The mean effective pressure is the average ordinate of "C." The mean back pressure is the average ordinate of "D," being the average back pressure to the point of exhaust closure.

As it was impossible to take all the cards at full boiler

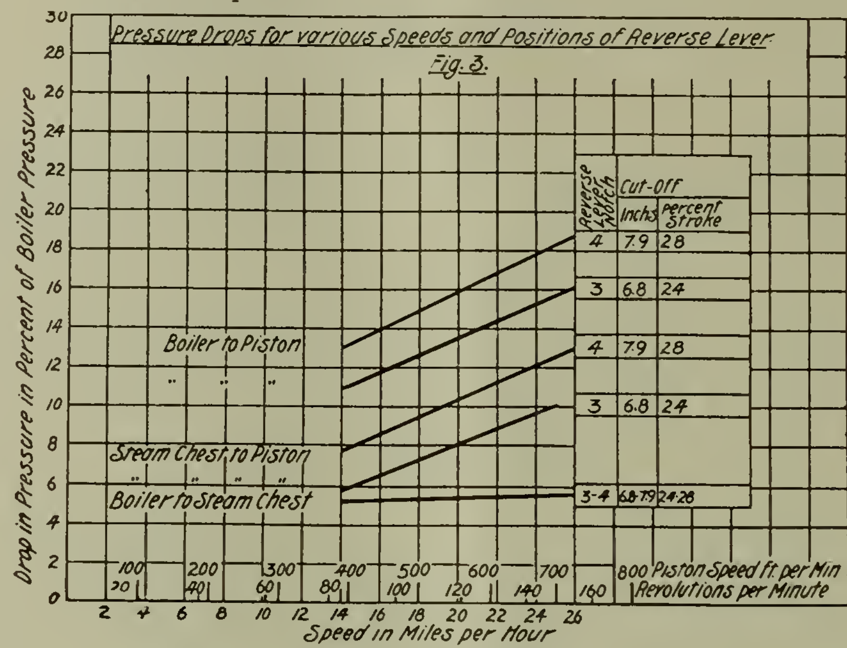


FIG. 3—PRESSURE DROPS FOR VARIOUS SPEEDS AND POSITIONS OF REVERSE LEVER.

pressure, the mean effective pressures and back pressure were calculated in percent of boiler pressure; cards taken at boiler pressures of 181 to 210 pounds being used. The results were then grouped according to speed and reverse lever position, and the following "Characteristic Curves" represent the average results.

Figure 3 shows the drop in pressure from boiler to steam chest, and from steam chest to piston during the admission period and the sum of these two drops at speeds ranging from 14 to 26 miles per hour and at cut off of 24 and 28 percent.

A comparison of curves of pressure drops from boiler

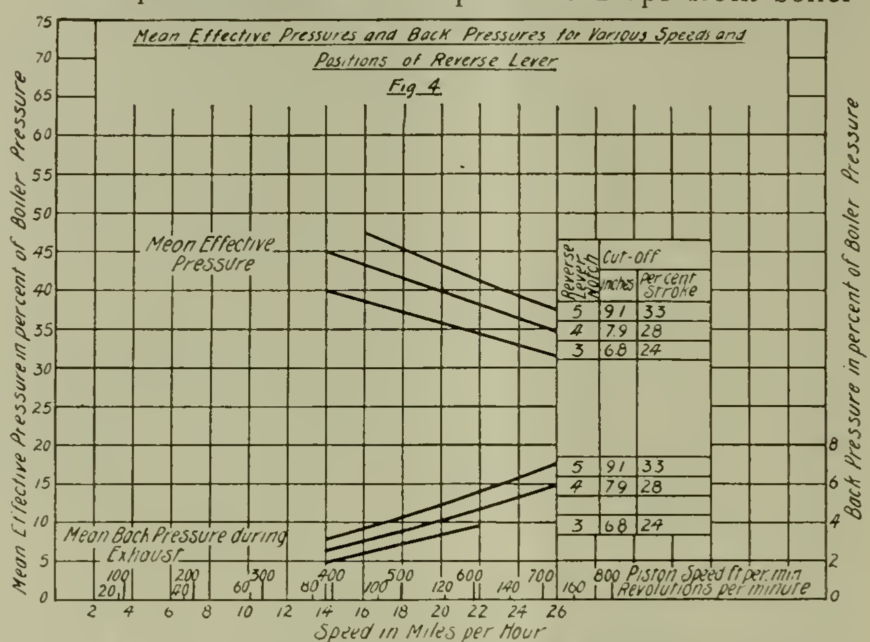


FIG. 4—MEAN EFFECTIVE PRESSURES AND BACK PRESSURES FOR VARIOUS SPEEDS AND POSITIONS OF REVERSE LEVER.

to steam chest, taken on different engines, would show the relative freedom of the passage of steam from the boiler to the steam chest.

The curves of pressure drops from steam chest to piston would show the pressure lost in going through the valves and ports. These curves would not only be use-

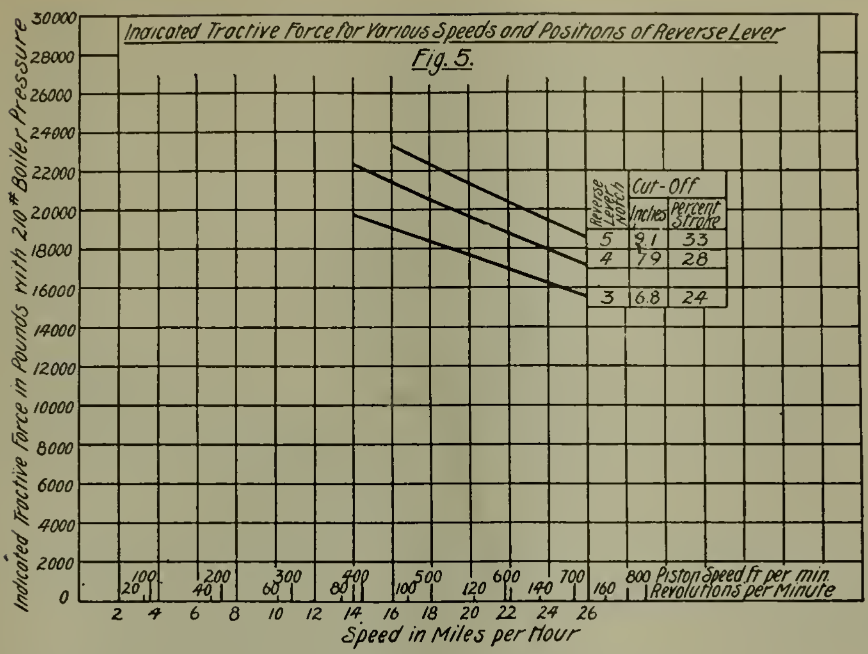


FIG. 5—INDICATED TRACTIVE FORCE FOR VARIOUS SPEEDS AND POSITIONS OF REVERSE LEVER.

ful in comparing different engines, but also comparing different valve motions and settings on the same engine.

Figure 4 shows the mean effective pressure and back pressures at speeds ranging from 14 to 26 miles per hour for reverse lever positions corresponding to 24, 28 and 33 percent of stroke.

Figure 5, which is derived from the mean effective pressure curves shown in Figure 4, shows the indicated tractive force in pounds, which could be obtained with a full boiler pressure of 210 pounds, at speeds ranging from 14 to 26 miles per hour for reverse lever positions corresponding to 24, 28 and 33 percent stroke.

If these curves of tractive force were drawn for every position of the reverse lever, and superimposed on them were a set of curves of water rate, it would then be possible to tell the tractive force and the water rate for any position of the reverse lever at any speed and tell exactly what change in the engine performance could be made by increasing or decreasing the size of the drivers.

Assuming that the steam entering the cylinders of an engine is proportional to the cut-off and pressure on the piston during admission, the following table is prepared which shows how the water rates would be benefited by increasing the diameter of the drivers from 57 inches to 67 or 77 inches.

EFFECT OF SIZE OF DRIVERS ON STEAM CONSUMPTION.

Diameter of drivers	57"	67"	77"
Speed, M. P. H.	25	25	25
Speed, R. P. M.	147.5	125.5	109.2
Speed, R. P. M., per cent	100	85.1	74.0
Tractive force, pounds actual	15900	15900	15900
Tractive force, pounds	15900	18700	21500
Cut-Off, inches	6.8	7.7	8.7
Cut-Off, per cent	100	113	128
Efficiency of steam flow, boiler to piston	84.3	84.2	83.1
Per cent steam used	100	96	93.5

Note: Under 67 in. and 77 in. drivers are shown equivalent tractive forces of 18,700 pounds and 21,500 pounds respectively. They are the tractive forces which would be produced if the engines had 57" drivers, and are used only for computations.

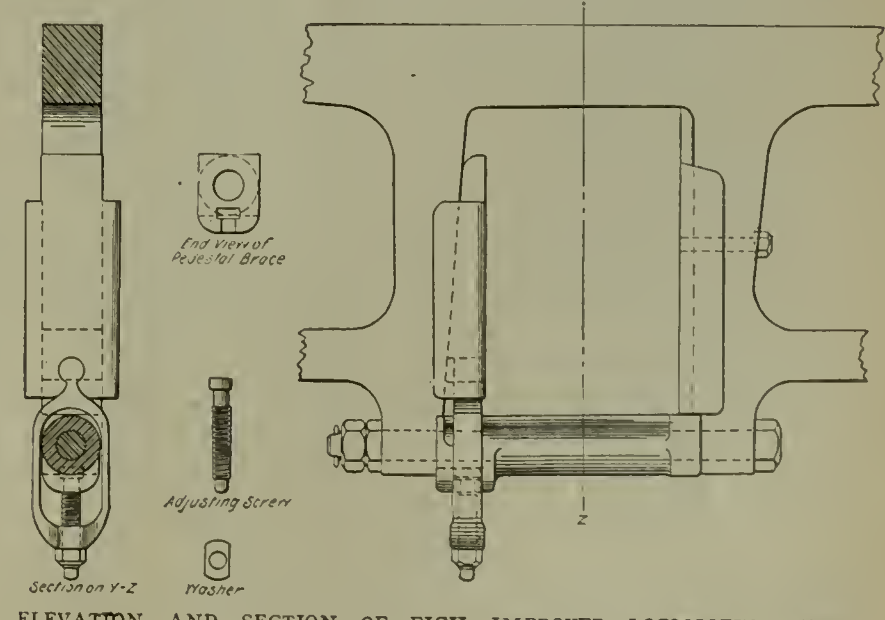
The above table shows that by increasing the size of the drivers of an engine from 57 inches to 67 or 77 inches that the engine with 67 inch drivers will use 96 percent as much steam, per indicated horse-power per hour, as the 57 inch driver engine and the 77 inch driver engine 93.5 percent as much as the 57 inch driver engine; when all three engines are maintaining an indicated tractive force of 15,900 pounds at a speed of 25 miles per hour. These figures should not be taken as absolute, for, as above stated, they are based on the results of a few preliminary tests, and it is hoped that those in charge of tests, where indicator cards are taken, will work up the data as above outlined establishing the mean effective pressure, back pressure, pressure drops, indicated tractive force and water rate for all cut-offs and speeds, thus ascertaining the "characteristics" for the engine.

An Improved Locomotive Wedge Adjuster

THE proper adjustment of shoes and wedges, especially on heavy locomotives is one of the most important items in the economical maintenance of locomotives. The pound of the driving boxes when the wedges are down, causes rapid wear of bearings and rod brasses, loosens bolts and eccentrics, breaks driving boxes and sometimes results in broken frames. The damage to machinery from this cause is especially marked in large locomotives with their heavy parts and great cylinder capacity.

The methods commonly used for adjusting wedges, are in a measure responsible for the way the wedges are kept up. With an unhandy adjusting arrangement, the wedges will not receive the attention they would if a convenient method of adjustment is provided. Always a more or less difficult part to inspect and adjust, the wedges of a locomotive should be equipped with an easy and positive method of adjustment in order to insure the best results.

Among the practical arrangements for adjusting wedges, the adjuster designed and patented by Mr. H. C. Eich, general foreman of the Illinois Central Railroad, at Freeport, Ill., possesses a number of features which are not found in other designs. As shown by the illustration the adjuster consists of a cast steel yoke which spans the binder. A circular head at the upper end of the yoke is fitted into a recess at the lower end



ELEVATION AND SECTION OF EICH IMPROVED LOCOMOTIVE WEDGE ADJUSTER.

of the wedge, so that any movement of the yoke is imparted to the wedge. The adjusting screw or wedge bolt passes through the lower end of the yoke, which is tapped out to receive same, and the head of this bolt fits in a pocket on the lower side of the binder. By turning the wedge bolt with a wrench, the yoke and consequently the wedge, is moved either up or down and a jamb nut on the bolt locks it in position. The lower end of the wedge bolt is made square to fit a wrench. A washer is inserted under the head of the bolt, so that lost motion can be taken up by substituting a thicker washer instead of renewing the wedge bolt.

The adjuster as illustrated, is not only simple in construction and positive in its action, but is so arranged that the wedges can be adjusted from outside the engine, which is a decided advantage. To illustrate, on one occasion all the wedges on an engine equipped with the adjuster were adjusted in 9 minutes, by the engineer, while waiting on a side track. This would have been impossible with the ordinary wedge bolt arrangement. Service tests on the road have demonstrated that, the adjuster is not only a practical device but an improvement over some of the types now in use.

Mallet Compound Locomotive

Erie Railroad

THE first Mallet Compound locomotive was introduced into American locomotive practice a little over three years ago by the Baltimore and Ohio Railroad. Although a radical departure from the usual design in use in this country, the performance of the locomotive has been entirely satisfactory from the standpoints of operation and maintenance. The success of this type led to its adoption by the Northern Pacific Railway, first for helper service and later for regular road work. The latest development in this type is the locomotive just completed at the Schenectady Works of the American Locomotive Company for the Erie Railroad, which is the heaviest and most powerful locomotive in the world.

BOILER OF MALLET COMPOUND LOCOMOTIVE—ERIE RAILROAD.

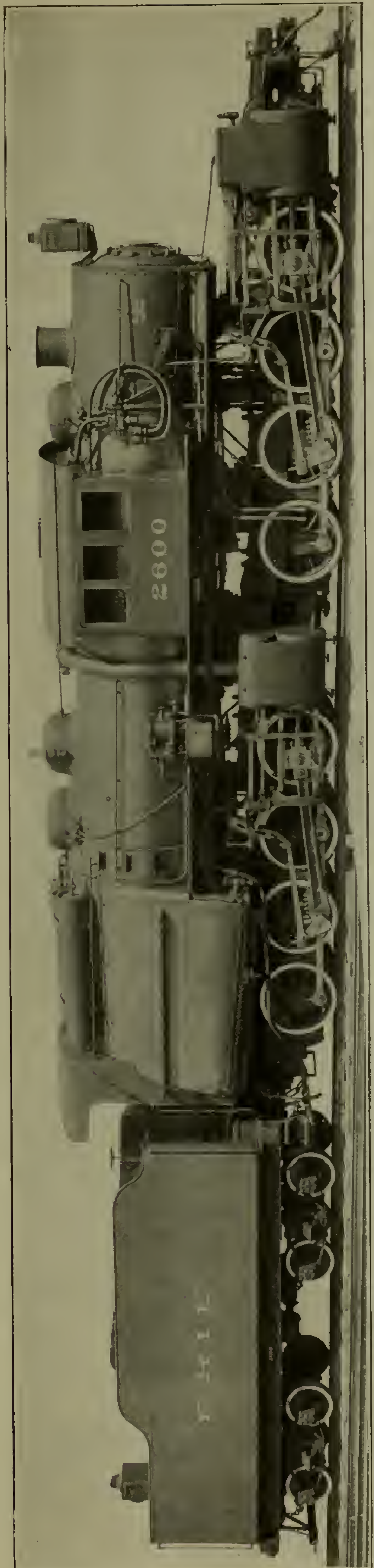
The enormous size and capacity of this locomotive is shown by the total weight of 410,000 pounds, all of which is on the drivers and the available tractive force of 94,800 pounds. The locomotives were designed for pusher service between Susquehanna and Gulf Summit where the grade is 1.3 per cent. If the tractive force is maintained the locomotive should handle over 3000 tons in a train of 60 cars up the grade in fair weather, which demonstrates the capacity of the locomotive and its adaptability to helper service on heavy grades.

For the purpose of comparison the dimensions of the three examples of Mallet locomotives in helper service are given in tabular form as follows:

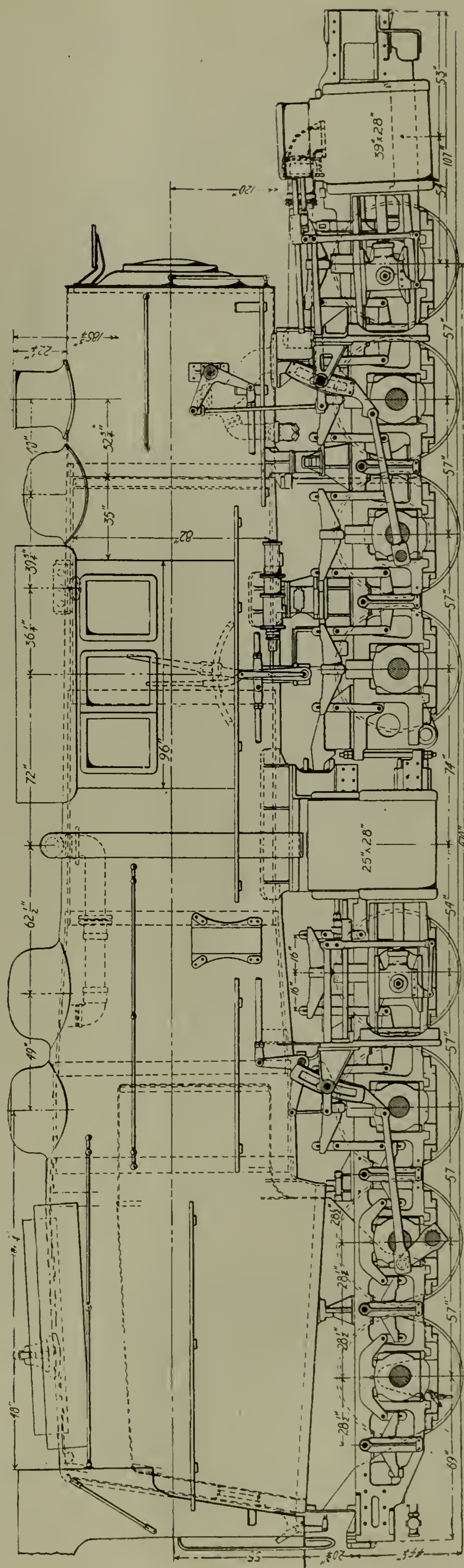
	Erie.	Gt. Nor.	B. & O.
When built	1907	1906	1904
Builder	Am. L. Co.	Baldwin	Am. L. Co.
Wheel base	0-8-8-0	2-6-6-2	0-6-6-0
Tractive force, lbs	94,800	71,600	70,000
Total weight, lbs	410,000	355,000	334,500
Weight on drivers, lbs	410,000	316,000	334,500
Weight of tender, loaded	163,000	148,000	143,000
Wt. on drivers÷tractive force	4.2	4.8	4.8
Total weight÷tractive force	4.2	4.9	4.8
T. F. x diam. of driv.÷tot. H. S.	820.0	690.0	700.0
Total H. S.÷grate area	61.0	73.0	77.3
Firebox H. S.÷total H. S.	.57	.41	.39
Wt. on drivers÷total H. S.	61.0	55.2	59.5
Total wt.÷total H. S.	61.0	62.0	59.5
Cyl. volume, cu. ft.	24.0	20.7	19.0
Total H. S.÷cyl. vol.	255.0	275.0	295.0
Grate area÷cyl. vol.	4.2	3.8	3.9
Cylinders, diam., inch	25 & 39	21½ & 33	20 & 32
Cylinders, stroke, inches	28	32	32
Valve gear	Wals.	Wals.	Wals.
Drivers, diam., ins	51	55	56
Boiler, type	Wooten	Balp	Straight
Steam pressure, lbs	215	200	235
Boiler, diam. first ring, ins	84	84	84
Firebox, length, ins	126	117	108
Firebox, width, ins	114	96	96
Grate, area, sq. ft	100	78	72.2
Tubes, number	468	441	436
Tubes, size, ins	2¼	2¼	2¼
Tubes, length, ft., ins	21-0	21-0	20-10¾
Heat surface, tubes, sq. ft	5760	5473	5380
Heat, surface, firebox, sq. ft	348	230	220
Heat surface, total sq. ft	6108	5703	5600
Wheel base, driving, ft. ins	14-3	10-0	
Wheel base, engine, ft. ins	39-2	44-10	30-8
Wheel base, total, ft. ins	72-2	73-2¼	64-7
Tender, coal cap., tons	16	13	16
Tender, water cap, gals	8500	8000	7000

The presence of a combustion chamber 4 feet long, in the Erie locomotive changes the ratios given above, as the total amount of heating surface is reduced. On account of the great weight of the locomotive 4 pairs of driving wheels were arranged in each group reducing the average load per axle to 50,200 pounds which is less than many of the large locomotives of other types. In this manner the maximum adhesion for tractive force with a minimum weight per wheel on the rail is obtained.

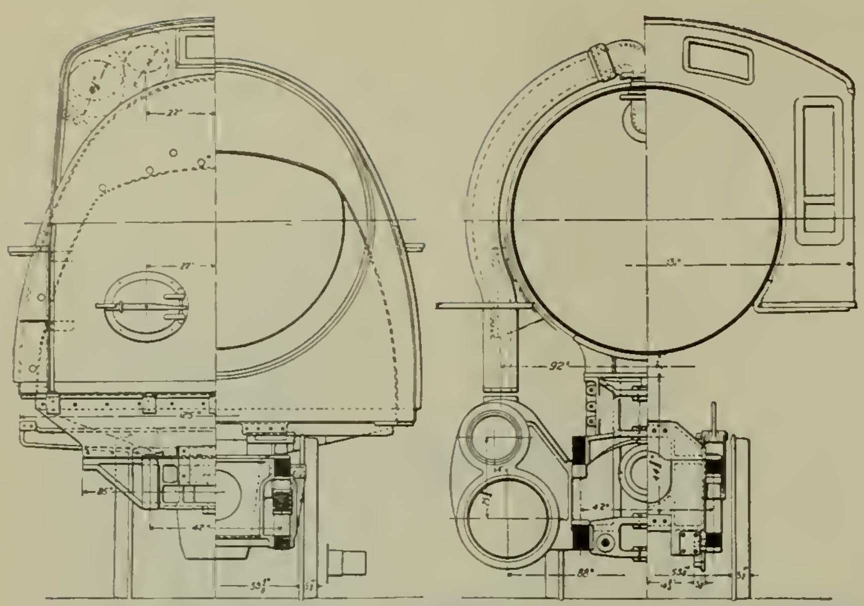
The boiler shown in the accompanying illustration is the largest locomotive boiler ever built. It is of the radial stayed type with conical connection, the inside



MALLET COMPOUND LOCOMOTIVE FOR PUSHER SERVICE ON ERIE RAILROAD—WEIGHT 410,000 POUNDS, TRACTIVE FORCE 94,800 POUNDS.



SIDE ELEVATION OF MALLET COMPOUND LOCOMOTIVE—ERIE RAILROAD.



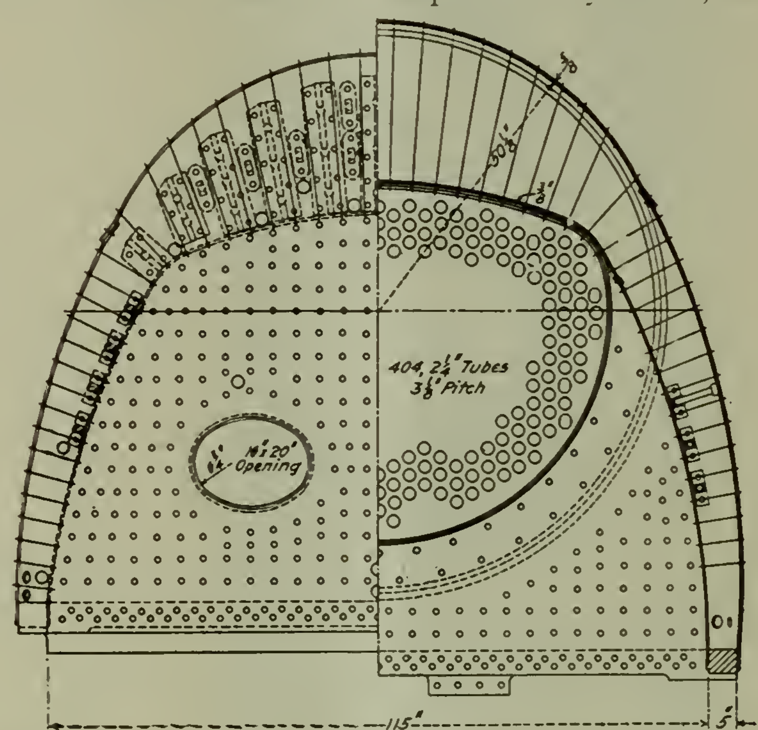
END ELEVATIONS AND SECTIONS—MALLET COMPOUND LOCOMOTIVE, ERIE R. R.

diameter of the first or smallest course being 82 inches, while the inside diameter of the largest course is 96 inches. The heaviest ring of the shell is 1 3-16 inches thick. The water alone in the boiler weighs 42,700 pounds and the tubes of which there are 404 in number, 2¼ inches outside diameter and 21 feet long, weigh 23,700 pounds. The total weight of the boiler with water is 139,900 pounds. The fire box is of the Wooten type 120⅛ inches long and 114¼ inches wide, and has a grate area of 100 square feet. The water space at the mud ring is 5 inches on all sides. As will be seen from the illustration the boiler is provided with a combustion chamber 4 feet long, which is radially stayed to the shell of the boiler.

As these engines will work as much backward as forward, it was necessary to locate the dome as near the center of the boiler as possible. The dome, therefore, which is of cast steel has been placed on the top of the conical course. The throttle valve acts as a steam dryer, as the steam is admitted at the top only and the entrained water passes down through the center of the valve instead of going into the dry pipe. Steam is led from the throttle pipe through a short dry pipe to a point directly in line with the high pressure cylinders, from whence it passes through the top of the shell and is divided in a tee-pipe and passes down through wrought iron steam pipes on either side of the boiler to each of the high pressure valve chambers.

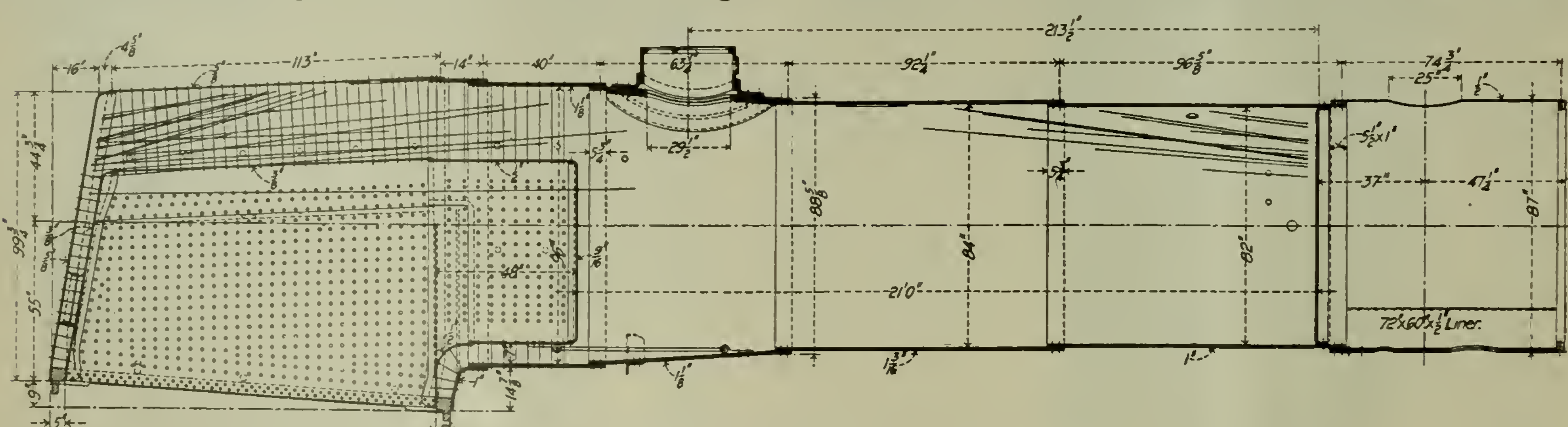
The engines are compounded on the Mellin system, the intercepting valve being located in the upper part of the left cylinder casting. Exhaust steam from the right high pressure cylinder passes through a cored passage to the back of the cylinder casting from whence it passes through an outside U-shaped pipe connecting to a passage in the left cylinder casting leading up into the intercepting valve chamber into which the exhaust steam from the left high pressure cylinder also passes. The emergency exhaust valve is located in the side of the left cylinder casting and has a 4½ inch jointed pipe connection within an opening in the back of the exhaust nozzle in the smoke box.

Steam from the high pressure cylinders passes into a 9 inch receiver pipe extending forward from the center of the cylinder saddle to which it is connected by means of a ball joint. In order to facilitate putting in place or removing this pipe is made up of three sections and is connected at the front end by means of a slip joint to cover variations in length due to curving, to a Y pipe through which steam reaches each of the low pressure steam chests. The receiver pipe is laid out for 16° curves. Steam from the low pressure cylinders, which



SECTIONS THROUGH FIREBOX—MALLET COMPOUND LOCOMOTIVE ERIE R. R.

are located considerably ahead of the front end of the boiler, exhausts back through a flexible pipe connection to the exhaust pipe in the smokebox. The high pressure cylinders are equipped with piston valves, and the low pressure cylinders with Richardson slide valves. The valve gear is of the Walschaert type and by an ingenious arrangement of the reversing gear, the weights of the



LONGITUDINAL SECTION OF BOILER—MALLET COMPOUND LOCOMOTIVE ERIE RAILROAD.

valve motions of the front and rear engines counterbalance each other. The valve motion is reversed by means of a pneumatic operating device. That portion of the weight of the boiler carried on the forward group of drivers is supported by a self adjusting sliding bearing located between the third and fourth driving wheels. This bearing consists of a built up saddle casting designed so that it adjusts itself to the alignment of the engine yet carrying the correct proportion of the load. A safety connection prevents the frames from dropping away from the boiler in case of derailment. Another sliding support is located between the second and third pair of driving-wheels. This support is so adjusted that it does not take any of the load except under unusual conditions when inequalities in the road bed make it necessary. By means of coiled springs under an initial compression of 30,000 pounds, any unusual movement of the engine will be taken off of the other supports. Still another sliding support is formed between the exhaust pipe elbow and the guide yoke casting and forms a connection between the boiler and frames.

The four pairs of front driving-wheels are equalized together on each side and cross equalized in front of the forward drivers, making this system equivalent to a single supporting point. The rear engine on the other hand is equalized throughout on each side only without cross equalization. This forms a complete three point suspended engine or the best obtainable condition for flexibility and ease on the track.

Locomotive Sanding Devices

SINCE the advent of heavy locomotives and the subsequent tendency toward decreasing the factor of adhesion, the question of proper sanding devices has grown in importance until it is one of the principal factors entering into locomotive operation. Sand is an absolute essential where tonnage trains are handled and locomotives must be provided with appliances which will allow the engineer to put sand on the rail quickly and with little effort.

The gravity sander is the oldest device of the kind and has been a feature of all the early locomotives and its use is still largely continued on modern power. It has proved to be a reliable sander and as applied to the smaller type of locomotives is a convenient arrangement for use of the engineer, but with the large locomotives it is not possible to arrange the levers so they can be operated by the engineer from a sitting posture and the inconvenience resulting from their use has prompted the question as to the advisability of continuing the use of gravity sanders on heavy power.

There are a number of points of interest more or less closely related with the care and operation of the gravity sanders and while it is generally considered that air sanders are more convenient to operate and more economical in the use of sand, there is a strong argument in favor of retaining the gravity sanders as a reserve for the air sander.

In order to secure information of interest on this subject, based on varied and general experience, we have obtained expressions from several practical road men in regard to the sander. The expressions of the several writers are given, the first one as follows:

"Service has taught me that the gravity sander is a very reliable sander, but useless when applied in conjunction with the air sanding device, for unless it is in constant use, sand will pack so hard and tight around valves that it is almost impossible to move lever after engine has made 50 miles. In fact on one or two occasions, I have seen lever and reach rod broken off in the effort to move valves.

"While it is more simple in construction with no chance of a sand failure when the air pump stops, which is so seldom that I would not recommend a gravity sander over a reliable air sanding device.

"I worked on a division at one time of 104 miles; had nothing but the gravity sander for years and it was necessary to take sand many trips, 12 miles out of terminal; then 52 miles, or half way over the division. After the air sander was applied to these same engines, the company did away with two sand stations, and it was possible many trips to take full train over this division on light rail, with one-half box of sand, and I never ran out or heard of any engineer running out of sand after the air sander was applied to all engines. This meant a great saving in sand and delays, not to speak of the worry and manual labor imposed on the engineer. We all know what a hardship the gravity sander works on all engineers; with a bad rail it keeps him constantly tugging at the sand lever, and in most cases standing on his feet to operate same, when his attention is needed elsewhere. The engineer of today is too over-burdened with other duties and responsibilities to even think of going back to the gravity sander. It is true the air sander has it's disease, which is the cutting or wearing out of the pipes, caused by the velocity of the sand passing through them. I have used, I think, nearly every air sander there is on the market, and I am sure that all different makes are on this road, and there are only two styles that will work in damp weather. No sanding device can ever be expected to work on a damp night or rainy day, that drops the sand down out of the box into a trap above or below the running board, where it will gather atmospheric dampness. The sand must stay in sand box where it is warm and dry, and when it leaves the sand box, go to the rail direct.

"We have several different sand devices on the road at present, and they would all be more reliable and less expensive if a little more attention was paid to screening the sand. We all know that sand must be shipped to many points in cars that are not altogether sand tight, and the men who load the cars use straw, rags and paper to stop up holes and cracks. The result is, this is not picked out as it should be when sand is unloaded into sand house, and from there into sand box with same trash in it. This means stopped up sand pipes, then follows a double or reduction of tonnage on account of sand pipes not working. Next is the expense and delay to engine in round house while machinist cleans out sand box or repairs broken parts.

"I would recommend that all sand be screened through a screen placed at about an angle of 45 degrees in sand houses, which will let the good clean sand go through, and the trash roll off, which I am sure from personal experience will cut down sand pipes stopping up."

Following is an expression from a road foreman of engines which shows clearly the value he places on the gravity sander: "There are a number of fairly reliable air sanders but I do not think that any sanding device operative by air is as reliable as the one known as the 'Gravity Sander.' It is only the question of saving of sand, as I understand it, that leads up to the application or the invention of sanders operated by air pressure. Another point, to my mind, is that with any sanding device operative by air, the sand should be blown directly from the box to the rail and not dropped by gravity to some trap above or below the running board. One of the greatest troubles with any sanding device, in my opinion, has been the neglect of making the joints water tight. I believe that a gravity sander could be so constructed, and arranged in the cab, that we could reduce the mount of sand used over the old device very materially, and at the same time could arrange it in a manner that would not work a hardship upon the engineers who operate it."

The opinion of a practical road official is expressed as follows:—"I don't believe that an air sander will furnish enough sand for the average big engines that we have, and I believe also that it is not a good plan to do away with the gravity sander, from the fact that there is little expense to maintain them and they will save them a failure in case of air pump failing. Another thing is, that the air sanders do get defects in the construction in the box, so that it is hard to tell just what position to put the valve in the cab, and they use a good deal of air. They are used with a globe valve, and when the engine slips, the first thing the engineer does is to open the valve, and where your feed valve is not thoroughly clean, you will have a case of stuck brakes"

The next writer favors the use of the air sander but points out some of the defects in construction which tend to reduce the efficiency of the air sander as follows: "There are probably several forms of air sanders that I have never tried, and I am not in a position to state which I regard as the best, but I believe at the present time, we should regard an air sander as preferable over a gravity sander, but I would be most heartily in favor of maintaining both and having the gravity sander as an auxiliary device should the air sander fail, and I believe that it could be maintained reasonably cheap, using the same pipes, and if necessary give the valves a greater leverage; make them of wrought iron so they might not be used frequently. Regarding the application of pipes to any of the sanding devices that I have seen: I believe that that has been proven one of the chief failures of the old style sanding device—too small pipes. Some that I have seen are ½ inch, a large number of them are ¾ inch. I believe that any of the sand pipes should be larger than that. Another prime feature of the air sander that I consider should receive care, is the nozzle or air outlet. If the nozzle becomes worn and the valves that are used are large, it is quite easy for an engineer to open up the air sander so quickly that he will stick his brakes if his air pump is working anywhere near up to the maximum. Another feature to be considered is putting a screen in the sand box. I would favor a screen protection over the sand pipes and sanding outlet down in the base of the box so that the sand must necessarily filter in through the screen to reach the sanding device. I believe that where sanding device is properly put up and the nozzles are kept central with the pipe, and do not become worn so that unnecessary air is wasted, I am of the opinion that they can be very easily kept in good working order."

The defects of both the air and hand sanders have been pointed out but the quality of sand and the condition it is in when put on the engine has a great deal to do with the proper operation of either type of sander as shown by the following communication:—"I believe that with the sand trap close to the sand box, we get the best results. Where the trap is located below the running board, there is an opportunity for the sand to cake in the pipe and in order to make the sander work best, the less joints we have, the less trouble we will have. There is not attention enough paid in the shop in putting the pipes on and if it is a little hard to bend a pipe to get it in, they cut it and put in a union, which gives lots of trouble in wet weather. I do not think we can afford to do away with the gravity sander or the air sander. We want both of them on the big engines, so if one gives out, we can use the other. I believe it would improve conditions if the leverage was increased so we could work the gravity sander with more ease. They usually work so hard that the engineer cannot operate them. The greatest trouble we have, is poor quality of sand. There is not enough attention paid to getting first-class quality of sand. We do not realize the money that is spent on a sanding device by having poor quality of sand. I don't think that it really can be figured out. You take a big heavy engine and let her slip continually going over the division just because the sand won't run—the sanding device may be in good order, and the trouble in the quality of sand. This is something we are giving more attention to, but I do not think we have got it up to a high standard yet. When the engine reaches the division point with poor quality of sand, it means a machinist and helper for an hour or two to get it in shape, and probably it works for 15 minutes and you have the same trouble again. I do not agree with the idea of putting a screen inside of the box. I would suggest using a funnel with a screen in the funnel so that the sand would be screened a second time. I don't know of any one thing that we have to contend with that gives more trouble than getting sand to the rail with a heavy engine on a slippery rail. By locating the traps close to the box, I believe we will improve the condition, and by getting a better quality of sand, will also improve conditions."

The concensus of opinion expressed by the writers above, which may be taken as representatives of universal experience in this country, shows that the use of both air and gravity sanders is still considered necessary to successful operation of locomotives. Attention is also directed toward the necessity of a convenient arrangement of hand levers for the gravity sanders and the need of placing the trap of the air sanders close to the sand box. The practical discussion of the question of proper sanding devices for locomotives as presented by the active railroad men quoted, is especially valuable as the information given is founded on results of actual experience.

Heavy Electric Traction

New York, New Haven and Hartford R. R.

(First Installment)

THIS and the succeeding article which will be presented in the next issue of the RAILWAY MASTER MECHANIC on Heavy Electric Traction, are abstracted from a paper on the subject by Mr. E. H. McHenry, vice-president of the New York, New Haven and Hartford Railroad.

On May 7, 1903, an act of Legislature of the state of New York, made it compulsory for the roads entering the city of New York over the New York and Harlem R. R. to operate their trains by some motive power other than steam, which did not involve combustion in the motors themselves. As electricity was the only motive power that would meet the requirements of the law and fulfil traffic conditions, the New York Central

SINGLE PHASE ELECTRIC LOCOMOTIVE AND TRAIN—NEW YORK, NEW HAVEN AND HARTFORD R. R.

and the N. Y., N. H. & H. R. R. as the roads involved, immediately began preparations for the electrification of their terminals within the city of New York. The adoption of the continuous current system by the New York Central and the complete installation of equipment and operation of terminals by electricity for some months, is a matter of record. In this system there is a high tension transmission of 11,000 volts alternating current from power house to sub-stations located about every 5 miles, where the voltage is transformed to 666 volts continuous current.

On July 21st, the New York, New Haven and Hartford began the operation of trains out of New York by the alternating current single phase system. This is the first large installation of a system which is generally considered to be the most practical plan for the electrification of steam trunk lines. The system adopted by the N. Y., N. H. & H. is based on the use of alternating current motors, taking current from overhead conductors. The current used is 11,000 volts, 25 cycles, A. C. and is stepped down by transformers on the locomotives to 560 volts for use at the motors.

The service began with 35-1000 horse power locomotives, each capable of pulling a train of 10 coaches at an average speed of 75 miles an hour. The locomotives are of steel construction, 36 ft. 4 in. over couplers and weigh approximately 90 tons. Current collectors are of the pantagraph type and for operation on the New York Central joint tracks, third rail contact shoes are provided. The motors are arranged to operate with both A. C. and D. C. Current. In order to carry the high pressure conductors safely under all conditions, the Catenary system of support, with steel supporting bridges was adopted. Two feeder wires parallel the main conductors and act as auxiliaries in order to feed around any one section in case of accident. The power house for furnishing the electric current for the system is located at Cos Cob, Conn. The generating equipment of the power house

ANCHOR BRIDGE OVER 4 TRACKS SHOWING CIRCUIT BREAKERS IN PLACE AND CATENARY OVERHEAD CONSTRUCTION—N. Y. N. H. & H. R. R.

consists of three multiple expansion Parsons steam turbines direct connected to 3 Westinghouse generators of 3,000 K. W. capacity each. The boiler plant consists of 12—525 H. P. Babcock and Wilcox boilers, equipped with superheaters and mechanical stokers. It will be noted that all the details of the installation are of the most modern and approved type.

In order to present a complete description of this installation, the locomotive and power station will be considered in the following issue and the principal features of the overhead construction are given as follows:

OVERHEAD CATENARY CONSTRUCTION.

One of the chief advantages derived from the use of alternating-current is that a high pressure may be used on the supply system, and in the present instance the potential of the overhead conductor is 11,000 volts. This high pressure renders it necessary to support the conductors over the tracks in a very substantial manner, and accordingly the catenary system of support was adopted.

This system in the present instance consists of two steel cables each having an ultimate strength of 33,800 pounds, supported at intervals by steel bridge structures. A copper conductor or trolley wire is suspended below the two supporting cables by means of hangers placed every ten feet.

Whenever the cables pass over the steel supporting bridges they rest upon massive porcelain insulators, and at intervals heavy bridges are provided to which the cables are anchored by means of specially constructed strain insulators.

SPECIAL BRIDGE OVER YARD TRACKS—NEW YORK, NEW HAVEN & HARTFORD R. R.

The steel supporting bridges are of varying lengths so as to accommodate 4, 5, 6, or as many as 12 tracks, as the local conditions require, without the necessity of placing posts between tracks. These bridges are of a uniform design and consist of angle iron and lattice bar construction. The intermediate bridges are of course much lighter than the anchor bridges, which are used only at intervals of about two miles. The former have side posts of square cross section and comparatively light construction. On the other hand, the anchor bridges have A-shaped posts and are made heavier, in order to withstand the strain of the cables.

The anchor bridges are provided with automatic circuit-breakers by means of which the different sections may be isolated, and also the several parallel tracks separated from one another in case of accident to any one track. The anchor bridges also carry lightning arresters, shunt transformers for operating the circuit-breakers, together with foot walks, hand railings, lighting circuits and the wires and conduit for the auxiliary control circuits.

The main conductors consisting of standard No. 0000 B & S gauge grooved copper, over the running tracks are paralleled throughout their entire length from Stamford to Woodlawn by two feeder wires. These feeders constitute auxiliaries to the main track conductors and are connected with the latter at each anchor bridge through circuit-breakers. The office of the auxiliary feeders is to provide means for feeding around any one section in case it is cut out of service on account of some accident in that particular section.

Provision is made on all of the bridges for carrying two separate feeder wires called "power feeders," which are connected to the third phase of the generating system and are used for operating three-phase apparatus at certain intervals along the road. Provision is also made on the bridges for carrying two three-phase circuits, one circuit being supported on the top of each post at the ends of the bridges.

In laying out the bridges for the section from Woodlawn to Stamford, it was found that the sharpest curvature was 3°. As this curvature will permit of stringing trolley wire in straight lines between points of support 150 feet apart without deviating from the center of the track more than 8½ inches on each side, it was decided to place all bridges a fixed distance of 300 feet apart, and on curves to provide guide poles from which pull-over wires are attached and secured to the catenary spans. By this means a minimum amount of overhead wiring was obtained, and the deviation from the center of the track was maintained within safe limits for use in connection with the sliding pantagraph trolleys on the locomotives.

While definite comparisons of the cost of installations of the continuous and alternating current systems cannot be furnished at the present time, the experience already gained by the New Haven engineers indicate that the total cost of the single-phase installation is the cheaper of the two. This in addition to the higher electrical efficiency, lower fixed charges, maintenance and operating expenses illustrates the advantages of the single-phase alternating system over the continuous current system for trunk line operation.

The difficult and responsible task of determining and analyzing operating conditions and requirements was assigned to Mr. Calvert Townley, Consulting Engineer, and Mr. William S. Murray, Electrical Engineer, of the N. Y., N. H. & H. R. R.

The Westinghouse Electric and Manufacturing Company of Pittsburgh furnished the electrical equipment consisting of steam turbines, generators, locomotives, line construction, etc., and Westinghouse, Church, Kerr and Company installed the entire system.

The Bothwell Locomotive

THE original idea of providing a locomotive with a supplemental set of small driving wheels which can be substituted at will for the regular wheels, in order to obtain greater tractive force on grades, has been embodied by Mr. George A. Bothwell, of Owen Sound, Ontario, Canada, in what is termed the Bothwell locomotive. The ingenious arrangement of parts and the principles involved in the design, are shown in the accompanying illustration of an old locomotive which was recently rebuilt at the Hicks Locomotive and Car Works, Chicago, according to the designs of Mr. Bothwell.

The locomotive under consideration, is an 8 wheeler with 17 by 24 inch cylinders, carrying 140 pounds pressure and with drivers 60 inches in diameter. Back of the regular drivers are arranged a set of supplemental drivers 32 inches in diameter, which are driven from the large drivers by means of connecting rods of suitable length. A shifting mechanism, arranged in connection with the spring rigging, and operated by a valve in the cab, throws the weight of the engine on either group of drivers as desired, at the same time raising one group of drivers several inches above the rail.

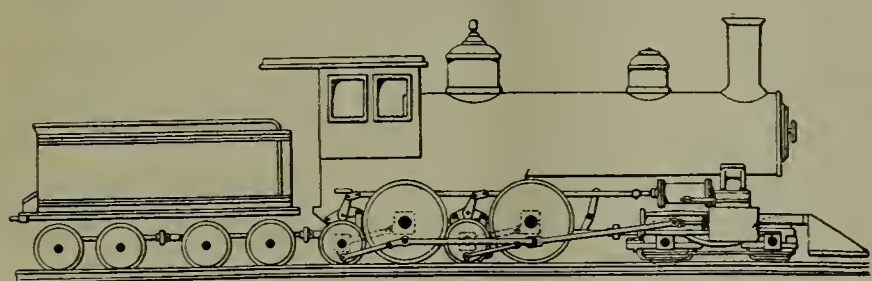
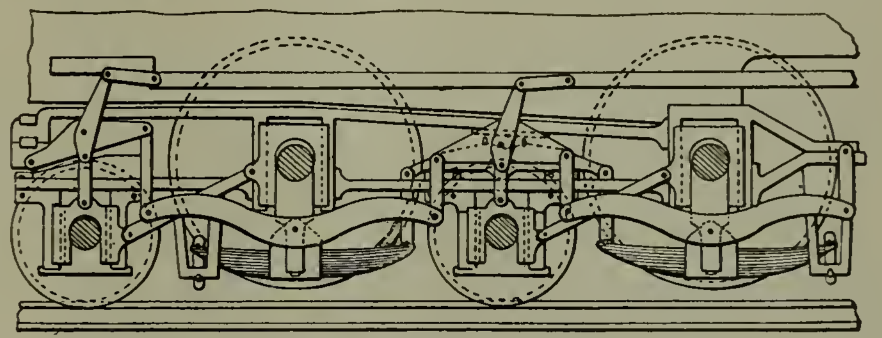


DIAGRAM OF BOTHWELL LOCOMOTIVE SHOWING ARRANGEMENT OF SUPPLEMENTAL DRIVERS AND SHIFTING MECHANISM.

As the tractive force of the locomotive is largely increased when the small drivers are used, the requisite adhesion is obtained by utalizing the weight on the truck wheels through a geared shaft operating from the small drivers. A clutch, which may be operated by compressed air, throws the truck wheels in or out of gear, so that when the large drivers are used, the gearing is out of clutch and the small drivers revolve idly. The adhesion of the tender is also available by extending the geared shaft, with universal couplings to allow for the movement of the tender and trucks, but in the present locomotive this has not been necessary.

Considering the design more in detail, it will be observed that the shifting mechanism on each side is actuated by a cylinder 10 by 29 inches, bolted to the frame just back of the steam chest. A long rod connected to the piston operates the mechanism, which accomplishes the result by shifting the points of suspension of the equalizers. This rod also operates the clutch of the geared shaft, so that the truck is automatically thrown out of gear when the large drivers are used. Shoes and wedges are not provided for the driving boxes of the small drivers in order to allow the necessary longitudinal movement of the box, when the weight is shifted from one set of drivers to the other, but connecting bars securely hold both sets of driving boxes in the same relative position at all times. The driving cellars are of special design in order to sustain the weight of the driving wheels when raised above the rails.



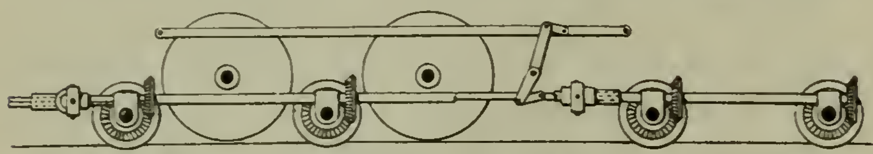
SIDE ELEVATION OF SHIFTING MECHANISM FOR THROWING WEIGHT OF LOCOMOTIVE ON EITHER SET OF DRIVERS—BOTHWELL LOCOMOTIVE.

When using the large or 60 inch drivers, the locomotive will develop a tractive force of 13,756 pounds and with a weight on drivers of 72,000 pounds the factor of adhesion is 5.2. This is rather high on account of the 12,000 pounds extra weight of the supplemental parts, of which 8,000 pounds is carried on the drivers. With the small or 32 inch drivers the locomotive will

THE BOTHWELL LOCOMOTIVE.

develop a tractive force of 25,790 pounds which is an increase of 87 per cent over the tractive force obtained when the 60 inch drivers are used. With the weight of the locomotive, or 108,000 pounds, available for adhesion when the small drivers are in operation, the factor of adhesion is 4.2 which is within the limits of average practice.

In a recent test on a short grade near the Hicks



ARRANGEMENT OF GEARED SHAFT FOR DRIVING TRUCK WHEELS—BOTHWELL LOCOMOTIVE.

works, the locomotive pulled 25 cars over the grade when using the large drivers, but stalled with 27 cars. With the small drivers the locomotive took 45 cars over the grade but stalled with 50 cars. This test demonstrated that the theoretical advantages to be obtained from the supplemental drivers were realized in actual service and that the 87 per cent increase in tractive force was undoubtedly developed and converted into work.

Although the tests made up to the present time are not conclusive in regard to the best construction of parts etc., the merits and practicability of the design have been fully demonstrated.

Communications

Wearing Qualities of Brake Shoes

Editor Railway Master Mechanic:

The very interesting table and diagrams presented in the report of the Standing Committee on Brake Shoe Tests of the M. C. B. Association at their recent meeting, while clear to many of those who have followed closely the work and reports of the Committee, do not, in the opinion of the writer, give sufficient information to enable comparison to be made between the various shoes tested.

The table which I submit herewith is part of my discussion on the subject, and is intended to supply some information in detail to supplement the Committee's report.

I realize the Committee's report is in the nature of a preliminary one intended to show what the brake shoe testing machine can do in regard to defining the relative durability and wearing qualities of brake shoes.

It is important in the study of the question, to take into account not only the surface of insert and hard metal on the face of the shoe, but also the volume of each, realizing that the durability of the brake shoe depends largely on the percentage of hard and tough material in the insert rather than to the surrounding body metal, which may be soft cast iron acting as a holder for the inserts, and that 90 per cent of the life of the shoe may be comprised within the period necessary to wear out the insert.

In the case of the records in question, some of the tests were made on shoes in which the inserts had been worn through or had fallen out, and of course such records are not true indications of the performance of the original shoe; for that reason this new table has been prepared, which takes into consideration the actual conditions on the face of the shoe during the test. With this clearly understood, the column of comparative durability can be fairly considered.

Yours truly,

Chicago, Ill. F. W. SARGENT.

The Four Cylinder Compound in Actual Service

Editor Railway Master Mechanic:

In your May issue I note an interesting article by Mr. H. A. F. Campbell on the subject. "The Four Cylinder Balanced Compound in Actual Service."

Some space is devoted to the tests of Baldwin Balanced Compound Engine 2,700 and other engines which are made between McCook, Neb. and Akron, Colo., in 1904. On page 152 I note the following: "If the tests with a 12 car train, which over-loaded the compound, had been left out of the results given, the water per cylinder horse-power (hour) would have averaged 22.86 pounds. This low water rate is without doubt a record for an American locomotive in high speed road service.

"That the C. B. & Q. compound used 24 per cent less water ——————— etc."

On the tests of these engines no indicator cards were taken and the indicated horse-power and all results based thereon, were computed from the dynamometer horse-power as obtained by the dynamometer at the tender draw-bar.

The tests were made for the purpose of furnishing the officials of this company with certain information which

No. of Shoe	Trade Name of Shoe	Description of Shoe	Area of Shoe Face in Square Inches	Percentage of Shoe Face: Inserts	Chill	Unchilled Cast Iron	Comparative Durability Million foot-pounds of work done per 1-10 of Shoe Wear	Shoe Tested, Made by	Shoe Tested, Furnished by	Graphical Record of Shoe Wear In Million foot-pounds of work absorbed per one pound of material worn away (100, 200, 300, 400, 500, 600)	Mean* Coefficient of Friction percent	Number of Shoe
175	Plain cast iron	Unchilled soft cast iron, no inserts	45	0	0	100	80.8	Griffin Wheel Co	W. & L. E.		30.3	175
205	"	"	47	0	0	100	92.0	Am. Br. Shoe & Fdy. Co.	L. S. & M. S.		23.5	205
179	Pittsburg (Mal)	Malleable iron shell, composition filling	44	Mal. iron 36	Comp. 64	0	114.3	Pittsburg Br. Shoe Co.	W. & L. E.		34.8	179
161	Streeter	Cast iron body, white iron inserts	51	32	0	68	148.6	Am. Br. Shoe & Fdy. Co.	N. Y.		21.8	161
184	Congdon	" wrot steel inserts	47	13	0	87	162.5	"	D. M. & N.		24.1	184
209	"U"	" tapered ends chilled	54	0	13	87	172.0	"	L. S. & M. S.		24.7	209
183	Pittsburg (steel)	Pressed steel shell, composition filling	45	Prd. steel 22	Comp. 78	.0	173.8	Pittsburg Br. Shoe Co.	D. M. & N.		38.7	183
178	Plain cast iron	Unchilled hard cast iron	48	0	0	100	227.7	Am. Br. Shoe & Fdy. Co.	W. & L. E.		20.0	178
172	Hard insert Sectoral	Cast iron body, wrot steel inserts, boiler plate punchings	45	12	0	88	258.2	Seaton Fdy. Topeka Kan.	A. T. & S. F.		22.8	172
215	Congdon	Cast iron body, wrot steel inserts	47	16	0	84	270.9	Am. Br. Shoe & Fdy. Co.	D. S. S. & A.		20.9	215
163	"U" Dia "S"	Cast iron, ends chilled soft steel inserts	53	30	13	57	350.1	"	A. T. & S. F.		21.7	163
200	Streeter	Cast iron body, white iron inserts	45	37	0	63	387.0	"	L. S. & M. S.		22.7	200
158	"	"	51	32	0	68	407.2	"	N. Y.		22.5	158
220	Congdon	" wrot steel "	48	25	0	75	504.7	"	C. & A.		26.5	220
194	"	"	47	40	0	60	554.6	"	L. S. & M. S.		26.5	194

Speed constant at 20 miles per hour. Pressure of shoe on wheel 2808 pounds. Revolutions of wheel during application 190. Equivalent distance run during application 1641-5 feet

* Mean Coefficient of Friction is obtained from tests of the various shoes in question on chilled wheels under a load of 2808 pounds stopping the wheel from a speed of 40 miles per hour.

TABLE SHOWING WEARING QUALITIES OF BRAKE SHOES WITH INSERTS OF DIFFERENT MATERIAL.

they desired but were not made for the purpose of establishing the cylinder water rate of a Baldwin compound engine. If such had been the case indicator cards would have been taken.

This water rate of 22.86 pounds may or may not be correct, and it was not the intention that this figure be taken as absolute.

My original report on these tests covers this matter thoroughly, but a number of published articles which have referred to the McCook-Akron tests, have made no mention of the fact that the cylinder horse-power was computed from the dynamometer horse-power.

It is with the idea of getting on record that the above water rate of 22.86 for a balanced compound engine is a computed value that I write you this letter.

Yours truly,

J. G. CRAWFORD.

Chicago, Ill.

All Steel Passenger Cars

Pennsylvania Railroad

(Second Installment)

70-FOOT STEEL PASSENGER COACH.

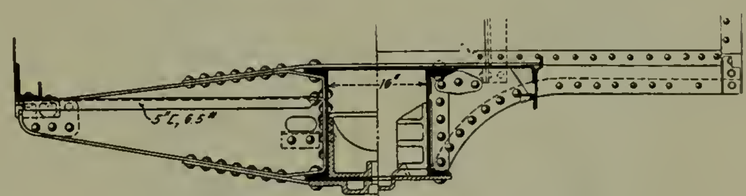
IN general arrangement and appearance the 70-foot all steel passenger coach is almost an exact copy of the standard wooden passenger coach.

The underframe is shown in the accompanying illustrations consisting of two 18 in. by 44.2 lbs. channels with ½x24 in. cover plates top and bottom form the center sill. Cast steel center plates are riveted to the under side of the sill, which is reinforced at these points by steel castings riveted inside. Projecting beyond each end of the center sills are steel castings designed to transmit directly to the center sill the loads due to buffing, and to support the spring roads carrying the vestibule buffer plates. These castings are provided with projecting lugs and flanges to which the platform end sills and vertical channels forming vestibule posts are riveted. Within the center sill near each end are riveted steel castings arranged to carry the couplers and draft gear.

The side sills are made up of 5x3½ in. by 9-16 in. angles. Each sill is supported at its end by end sills, and at two intermediate points about 14 feet from each end by cross bearers. End sills are of the cantilever form, riveted to the center girder and built up of angles, the outside sheathing plate acting as the web.

The cross bearers are also of the cantilever form, each composed of two triangular plates flanged about the edges, and riveted at their base to the center sill. Opposite cross bearers are joined by cover plates which pass over the top and under the bottom of the center sill. Each side sill is held in line by 9 struts of 5 in. channels connected to the center sill. These struts do not transmit any vertical load from the side sills to the center sill. Cast steel side bearings for engaging the trucks are secured to the side sill in line with the center plates.

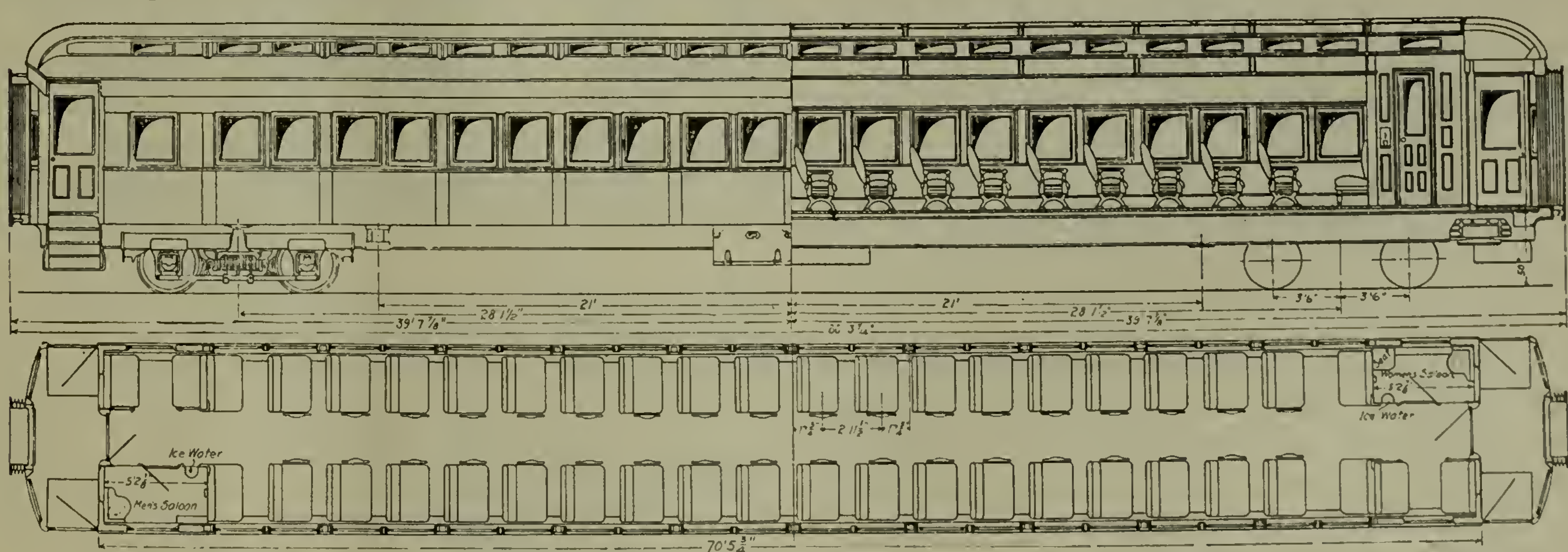
Pressed sheet steel posts spaced on 5 ft. 11 ins. centers support the superstructure. They are of channel section and the edges are flanged out and riveted to the inside sheating, forming a box section. Their lower ends are securely riveted to the outside sills and their upper ends are tapered down and bent inward forming lower deck



CROSS SECTION THROUGH CENTER SILL OF 70 FOOT STEEL COACH SHOWING UNDERFRAME CONSTRUCTION—ALL STEEL PASSENGER CARS, PENNSYLVANIA R. R.

carlines. At their upper ends these posts are riveted to the plate carrying the deck sash. The lower edge of this plate is bent out beneath the ends of the posts and forms a continuous beam of angle section running the entire length of the superstructure. Between the main posts are shorter intermediate posts, which extend only from the window sill to the plate carrying the deck sash.

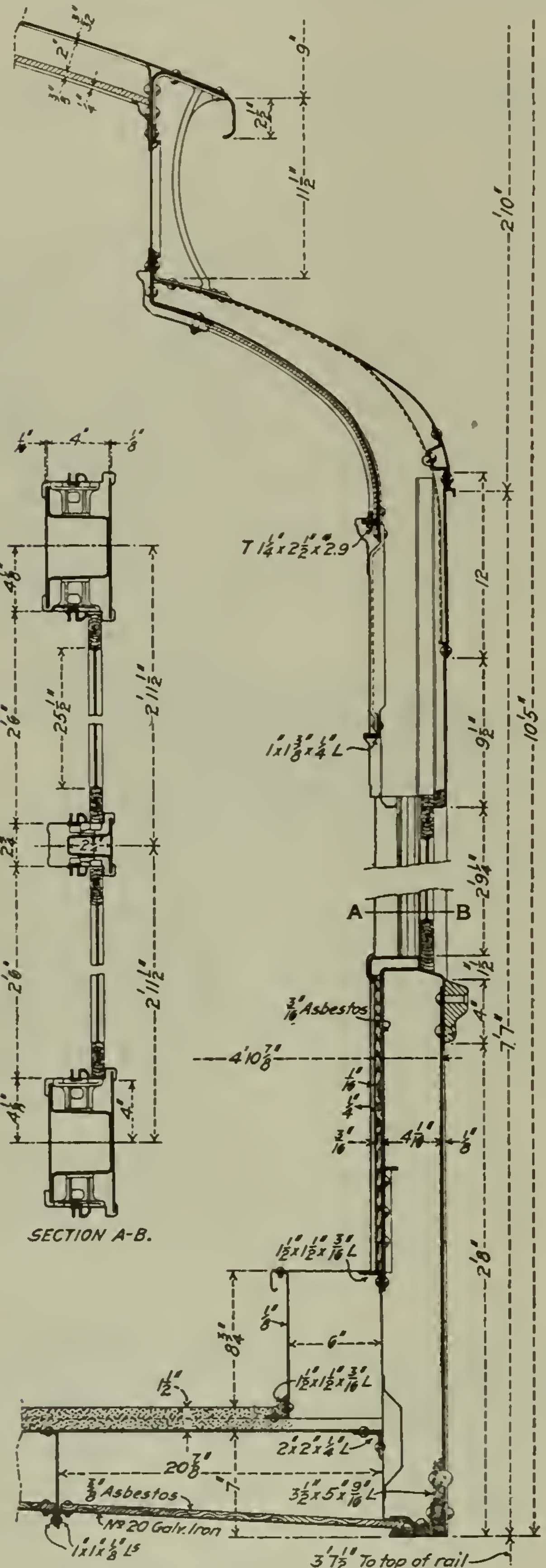
The upper deck carlines are of sheet steel pressed to channel section with edges flanged out for riveting to the 3-32 in. steel roof plate. Ends of the carlines are riveted to the plate carrying the deck sash. The upper



PLAN, SIDE ELEVATION AND SECTION OF 70 FOOT ALL STEEL COACH, WEIGHT 113,500 LBS., CAPACITY 88 PERSONS—ALL STEEL PASSENGER CARS, PENNSYLVANIA RAILROAD.

edge of this plate is bent outward and down forming a continuous beam of channel section, to which the edge of the roof-plate is riveted. Malleable iron braces unite the end of each post and its corresponding carline.

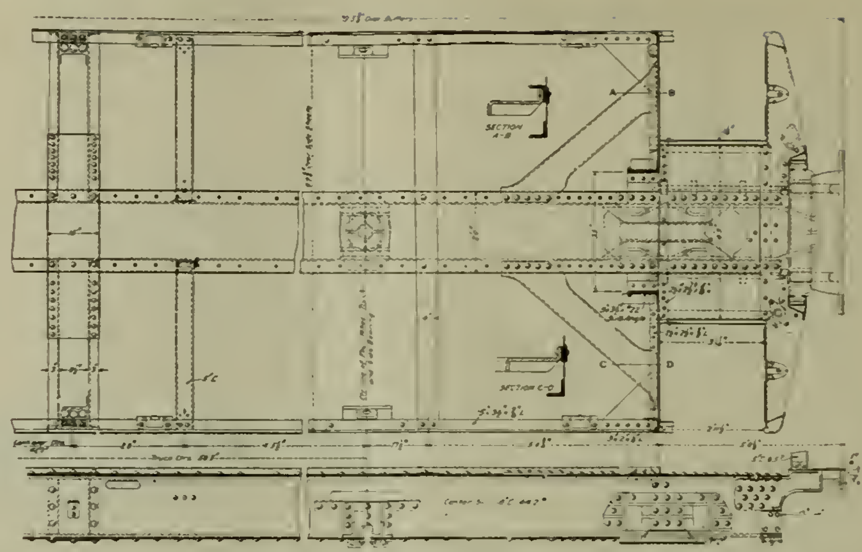
The outside sheathing is of ⅛ in. steel and the course below the belt rail is riveted to the outside sill and vertically to each post. The steel shape forming the under sill for the windows laps over the side sheathing, and



SECTION OF SIDE WALL, 70 FOOT STEEL COACH—ALL STEEL PASSENGER CARS, PENNSYLVANIA RAILROAD.

rivets passing through the belt rail, which runs the entire length of the car, secure this joint. Outside sheathing above the windows is riveted vertically to the posts and its upper edge is riveted to a channel shaped steel section forming the eaves for the lower deck and extending the entire length of the superstructure.

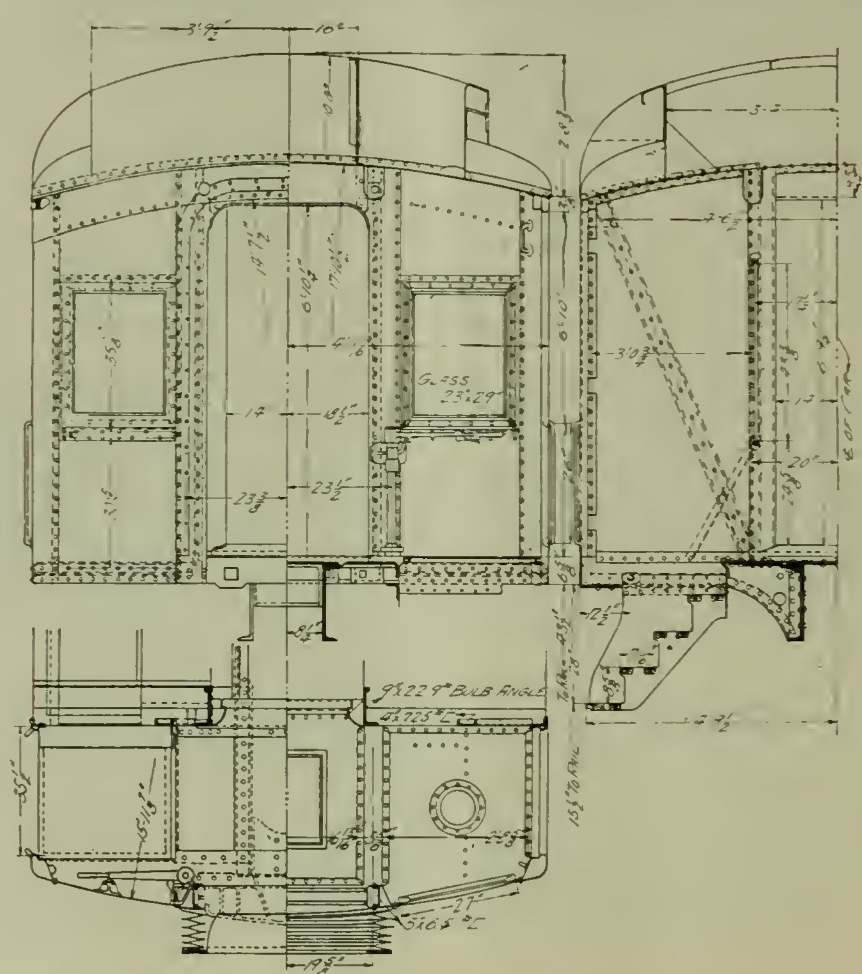
Headlining for the upper and lower decks is of composite board secured to the carlines and posts with metal



PLAN AND SIDE ELEVATION OF PLATFORM AND END CONSTRUCTION OF 70 FOOT STEEL COACH—ALL STEEL PASSENGER CARS, PENNSYLVANIA RAILROAD.

strips. Below the belt rail the inside sheathing is of 1-16 in. steel, to the unexposed face of which 3-16 in, asbestos is cemented. Bulkheads and remaining parts of the inside lining are of 1-16 in. sheet steel. Mouldings, closely resembling those used in wooden construction, are pressed from steel and their use adds greatly to the artistic appearance of the interior. Through care in design it has been possible to almost wholly eliminate machine screws from the construction and it is believed that economy in both construction and maintenance has been secured thereby.

Window sash are of wood and slide in a formed steel frame. Although steel sash have been successfully built, after careful consideration, wooden sash were deemed preferable. Malleable castings riveted to the posts support the window frames. These castings are machined by jig, after riveting in place, so that the frames will be true and parallel regardless of any slight irregularity in

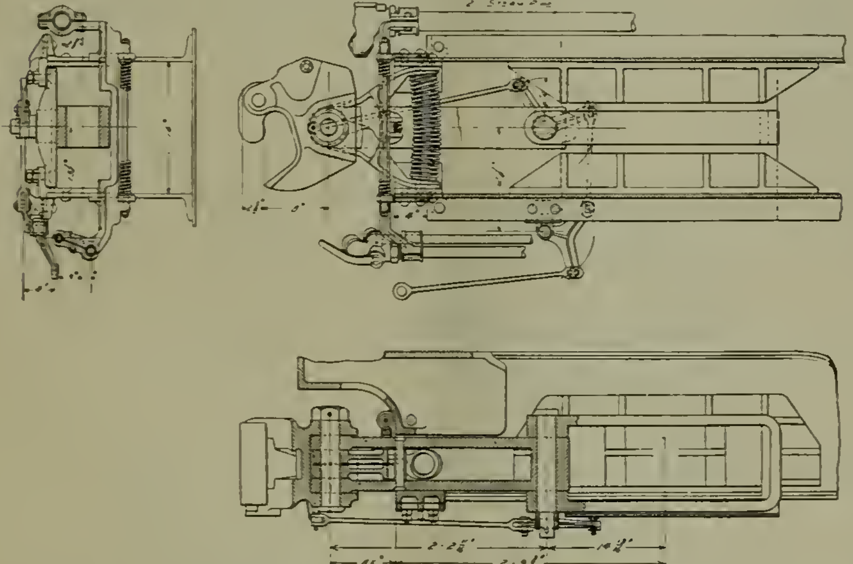


PLAN, END ELEVATION AND SECTIONS OF VESTIBULE CONSTRUCTION OF 70 FOOT STEEL COACH—ALL STEEL PASSENGER CARS, PENNSYLVANIA R. R.

location of the posts. Window stops, which also form ways for the curtains, are of extruded bronze. Deck sash are of malleable iron.

The floor is formed by corrugated steel plates which are supported by the center sill and upon longitudinal angles secured to the side posts. These corrugated plates are covered to a maximum depth of 1½ inches with a plastic surface filling, composed largely of cement. A sub-floor of asbestos ⅜ in. thick supported by No. 20 galvanized sheet steel is secured to the center and outside sills. Along each side of the car just above the floor rectangular ventilating ducts are provided, which enclose the heating pipes and discharge warmed fresh air into the car.

Platform and vestibule construction is shown by the accompanying illustration. An effort has been made to secure sufficient strength in the end of the car to prevent the superstructure from being swept off from the underframe by the next car in event of a collision. The center sill is the main support of the entire vestibule and to it are securely framed the 9 in. bulb angles forming the end door frame together with the 5 in. channels forming the vestibule posts. These vertical members are relied upon



PLAN AND SECTIONS OF DRAFT RIGGING—ALL STEEL PASSENGER CARS, PENNSYLVANIA RAILROAD.

to prevent damage to the superstructure during collision. The vestibule floor plate, the end sills and sheathing, and the vertical bulb angles, are securely framed together to give an exceptionally strong foundation for the entire end construction. Vertical corner angles uniting with the sides, and an angle across the top secured to the vestibule ceiling form the support for end sheating. Two diagonal braces running from the eaves down to the floor, and securely riveted to the sheathing give additional stiffness to the ends.

The end of the vestibule is supported by two outside posts of pressed sheet steel together with two channel posts forming a doorway. The base is formed by a pressed steel platform end sill, and the top support is given by the vestibule ceiling plate. Door jambs and lintels are of pressed steel closely imitating the forms used in wooden construction and provided with cast diaphragms at intervals to prevent collapse and furnish support for attaching hinges, railings, etc.

The end construction of the roof is of formed steel plates reinforced by angles secured to the end carline and the vestibule ceiling.

COUPLER AND DRAW-BAR CONSTRUCTION.

It was found upon careful investigation that the standard form of draw-bar and coupler heretofore used on wooden cars, did not allow sufficient side motion of the coupler head in rounding curves. The resultant binding was particularly noticeable upon long cars and to remedy the defect an entirely new arrangement was devised by means of which a lateral motion of 8 in. each side of the center was secured.

The construction and operation of the coupler are shown in the accompanying illustrations. The drawbar at its inner end is connected to the draft gear by a pin and at its outer end is connected to coupler head by another pin. The socket of the coupler head, into which the drawbar enters, is broad enough at its end, to allow considerable rotation of the coupler head with reference to the drawbar about the pin. The helical springs serve the double purpose of centralizing the coupler head with reference to the drawbar and also of centralizing the drawbar with reference to the center sill. In the uncoupling device a large amount of side motion given to coupler head would require considerable slack in a chain connecting with the uncoupling lever upon the platform. To avoid possibility of trouble from this source, bell crank levers coupled by rods have been introduced into the connection with the uncoupling lever. Their form and points of application have been so chosen that any motion of the coupler head will not affect their successful operation.

Due to the large amount of side motion, coupler heads would interfere with steam and air pipe valves in their regular position. A yoke has geen provided, which slides laterally in bearings and to which the ends of these pipes are secured. A helical spring maintains this yoke in its central position and it is moved laterally (when the drawbar moves) by the sides of the drawbar engaging the lugs on the under face of the yoke.

The construction of the all steel postal and surburban cars will be given in the next issue.

Electric Locomotives on the Pennsylvania R. R

A series of experiments are now being conducted by the Pennsylvania Railroad in order to determine the best type of electric locomotives to pull its heavy passenger trains through the New York tunnels. Two heavy direct current locomotives are now in service, each with a different system of driving. One of the locomotives is of 1,400 horse power weighing 174,100 pounds, with motors mounted on the truck frame and driving through single reduction gears. The other locomotive weighs 195,200 pounds and will develop 1,240 horse power, with motors supported on springs over the main journal. The results of these tests will determine which type is adopted for the service designated. In the October issue of the Railway Master Mechanic these locomotives will be described and illustrated.

Cleaning Locomotive Machinery

(Last Installment)

AT THE Du Bois shop of the B. R. & P. Railroad facilities for cleaning locomotive parts are provided by two lye vats located just outside of the locomotive shop and adjacent to a door which provides communication between the locomotive shop and the blacksmith shop. A standard gauge track passes through this door of the locomotive shop and one vat is placed on each side of the track. Each vat is made of 3-16 inch plate steel and is 11 feet 1 inch long by 8 feet ¾ inch wide, inside and is 2 feet high.

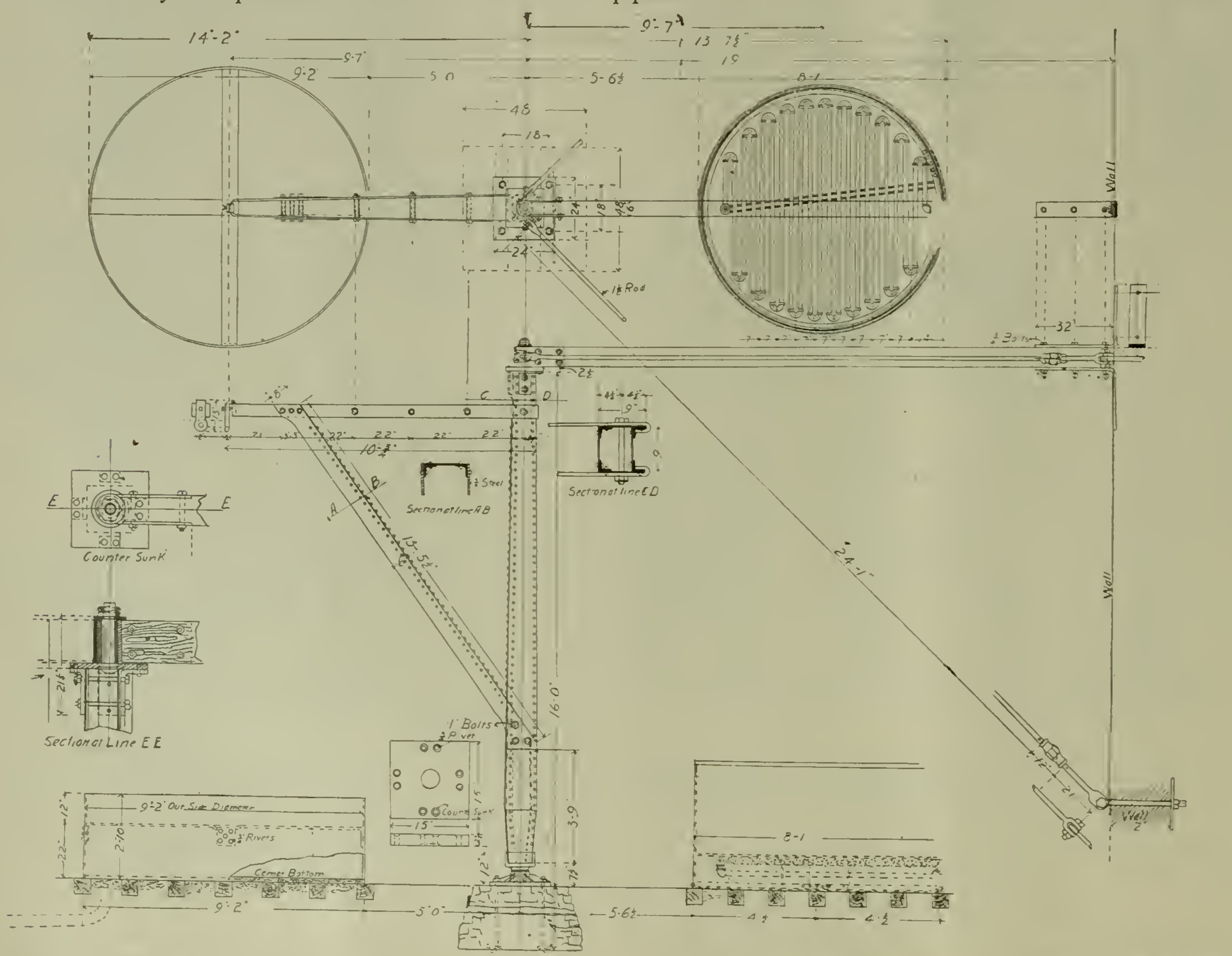
The liquid in each vat is heated by a system of 1½ inch wrought-iron steam pipes placed in the bottom of the vat. Attached to the end of the last length of 1½ inch pipe is a ¾ inch pipe which is so arranged as to extend above one corner of the vat and it terminates in a small globe valve having a connection which directs the discharge toward the interior of the vat.

Both vats are served by a single traveling crane which is made to traverse the crane runways by means of a chain operated from the ground and running over a large wheel attached to the shaft on which the crane wheels are keyed. Both shafts are operated by wheels and the wheels are at opposite ends of the crane in order that the crane may be operated from either end. The crane is carried on 4 wheels and supports a section of a 70-lbs, track rail, 12 feet 8 inches long. Two 8 inch air cylinders, by which the cage is handled, are suspended from this rail.

The crane is carried on two ordinary track rails, each rail being supported by four 5x5 inch oak posts and the top of the crane runway is 10 feet 4½ inches above the standard gauge track entering the locomotive shop. The posts are braced laterally by ¾ inch round iron rods and between the posts the crane runway is trussed by iron trusses, ½ inch by 4 inches carrying brackets, as shown in the accompanying engravings.

One cage is provided for each vat and each cage is made of a framework of ¼ inch plate, 6 inches wide. The framework carries five ½ inch rods which support a grate work of bars placed 1 inch apart and separated along the rods by cast-iron washers 1 inch thick. These bars are 2 inches deep and alternate bars are ¾ inch and ½ inch in width respectively.

To support the cage when within the vat, an angle from 1½ inch by 1½ inch is riveted on the inside of each end of the vat on which the cage rests so that the weight of the cage will not rest upon the steam heating pipes.



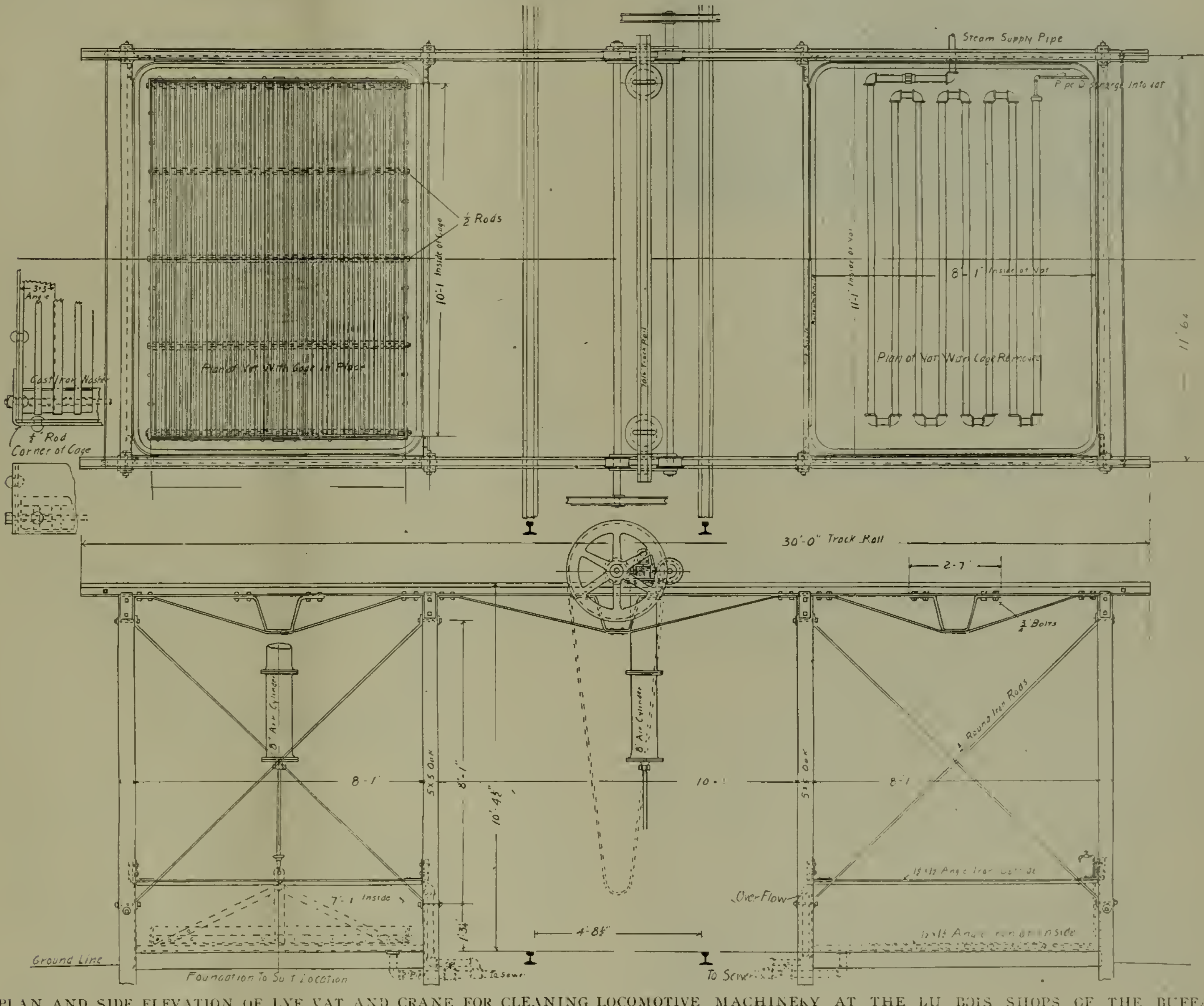
PLAN AND ELEVATION OF LYE VAT AND CRANE FOR CLEANING LOCOMOTIVE MACHINERY AT THE DEPEW SHOPS OF THE NEW YORK CENTRAL & HUDSON RIVER RAILROAD.

In transferring the cage to and from the vat each end of the cage is picked up by one of the air cylinders and the crane is then moved by means of the hand chain to the desired position.

In preparing engine parts to be cleaned, the cage is loaded inside the shop and is delivered by a push car within the range of the crane. After the parts have been cleaned, the cage is transferred from the vat to the handcar by which the parts are delivered in the shop as required. The general arrangement and details of

The cage is 7 feet 2 inches in diameter by 20 inches deep and a number of ½ inch holes disposed in three circles are drilled through the bottom to drain the liquid when the cage is lifted out of the vat.

Within the scope of the jib crane and at the opposite side of the crane foundation is a draining stand 9 feet 2 inches in diameter. With this stand is a skeleton on which the cage is supported while the loose dirt and grease are being washed off. The bottom of this stand is of cement.



PLAN AND SIDE ELEVATION OF LYE VAT AND CRANE FOR CLEANING LOCOMOTIVE MACHINERY AT THE DU BOIS SHOPS OF THE BUFFALO, ROCHESTER & PITTSBURG RAILROAD.

this equipment are shown by the accompanying line drawings.

At the Depew shops of the N. Y. C. & H. R. Railroad locomotive parts are cleaned in a small circular vat, 8 feet 1 inch in diameter by 4 feet 2 inches deep. The vat is placed outside of the building, adjacent to a door leading from the shop and is served by a jib crane operated with a pneumatic hoist having a cylinder 10 inches in diameter and a piston travel of 10 feet 2 inches.

The liquid is heated by a system of pipes placed in the bottom of the vat and in order that the cage in which material is carried shall not disturb the pipes, the cage is made to rest upon a skeleton constructed of bar iron ¾ inch by 6 inches, riveted to the side of the vat and supported at its center by brackets to prevent sagging.

The jib crane is made of angle and plate iron. The column is built up of 4 angle irons, 2½x2½x¼ inches laced with ¼ inch plate, forming a box girder. The boom is a 5 inch plate bent at its center around a 3 inch mandrel with the ends bolted to the column and stayed by six thimbles bound by ¾ inch bolts. The boom brace is constructed of two angle irons 2½x2½x¾ inches laced with a plate ¼ inch thick and reinforced by two plates ⅜ inch thick. The jib crane column is braced from the shop wall by a horizontal wooden beam 6 inches square and supported by two 1⅛ inch rods 28 feet long secured to the wall. While being handled the cage is supported by a cross beam to which the crane hook is attached. The details of the crane, vat, cage, etc., are illustrated by the accompanying drawings.

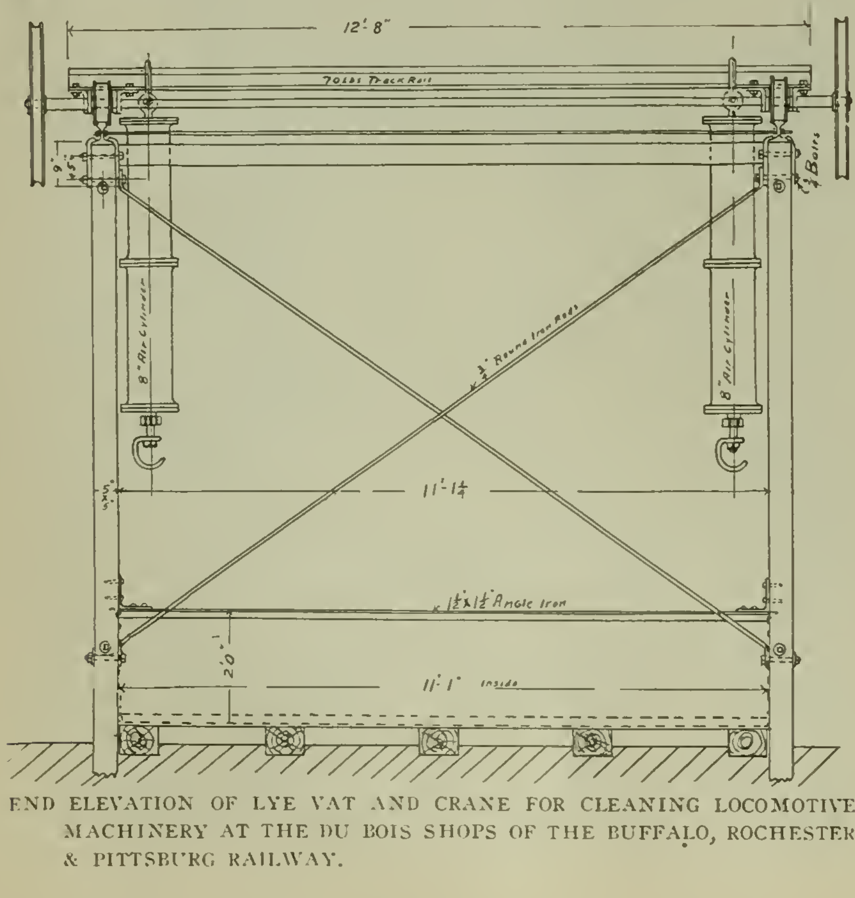
LYE VAT AND CRANE FOR CLEANING LOCOMOTIVE MACHINERY AT THE COLLINWOOD SHOPS OF THE LAKE SHORE AND MICHIGAN SOUTHERN RAILWAY.

Various impromptu cradles are in use at different shops. In one place an old side sheet supported at its four corners by chains, is used as a cradle.

Large pieces are sometimes lowered by chains individually and are later dragged out by hooks. However, the method of handling a number of pieces together is simpler and more economical.

As a means of cleaning more quickly, the idea has been suggested to suspend the cradle by a hoist carried from an eccentric on a shaft supported above the vat and by the motion of the eccentric keep the cradle and parts in continuous motion and thus separate the parts from the dirt and grease as the solution takes effect.

The lye vat which is used by one of the prominent systems for cleaning locomotive machinery is merely a solution of commercial caustic soda. The strength to be employed depends somewhat on the speed which is desired in cleaning. The strength which is used by this



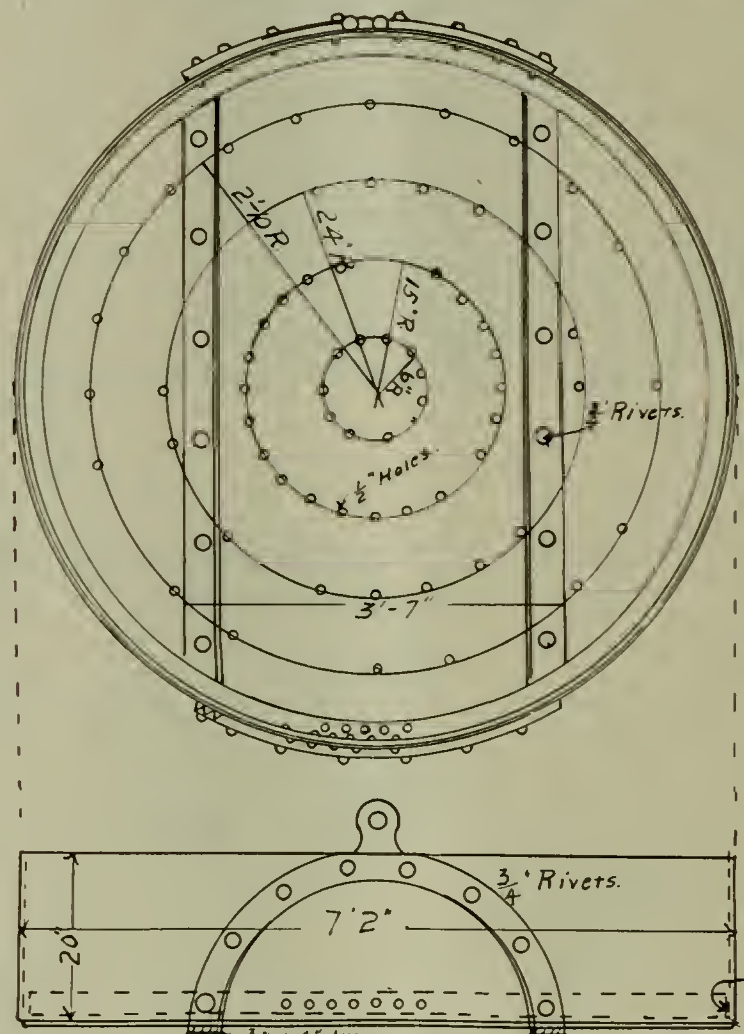
END ELEVATION OF LYE VAT AND CRANE FOR CLEANING LOCOMOTIVE MACHINERY AT THE DU BOIS SHOPS OF THE BUFFALO, ROCHESTER & PITTSBURG RAILWAY.

road is four pounds of caustic soda per cubic foot of liquid. Once a week one of the chemists tests the strength of the solution by means of a hydrometer, and if it is found too weak, more caustic soda is added, while if it is too strong, it is diluted with water.

The caustic soda is the ordinary commercial article known as 72 degree caustic soda, and is received in iron drums, holding about 700 pounds.

On this road the vats are heated by means of a closed steam coil, and about four hours boiling is required for the cleaning. Open steam is not used, in order to prevent dilution of the lye by condensation of the steam.

When a large amount of dirt has accumulated in the vats, the lye is allowed to settle, the clear portion is drawn off and saved, while the sediment is thrown away and the vat is washed out. The clear portion is then re-



BASKET FOR CLEANING LOCOMOTIVE MACHINERY IN LYE VAT AT THE DEPEW SHOPS OF THE NEW YORK CENTRAL & HUDSON RIVER RAILROAD.

turned to the vat, and more water and soda added to bring the solution up to the proper bulk.

An improvement in the design of lye vats would include an auxiliary or storage reservoir into which the clear portion of the solution could be drawn while cleaning the vat. This would provide a means of saving the liquid for further use and would represent a considerable saving.

Car Foremen's Convention

The eighth annual convention of the Chief Joint Car Inspectors and Car Foremen's Association will be held at the Palmer House, Chicago, September 4 and 5. Accommodations in the hotel should be arranged for direct and in advance if possible. D. T. Taylor is secretary of the Association with headquarters at St. Louis,

Personal Mention

Mr. F. W. Dickinson has been appointed master car builder of the Bessemer and Lake Erie Railroad at Greenville, Pa., vice W. J. Buchanan, resigned.

Mr. B. F. Elliott has been appointed assistant master car builder of the Mexican Central, with headquarters at Aguascalientes, Mex.

Mr. W. L. Larry has resigned as division master mechanic of the New York, New Haven & Hartford to become an inspector for the Massachusetts railroad commission.

It is announced that Mr. R. P. C. Sanderson has resigned as superintendent of motive power of the Seaboard Air Line, to accept a similar position with the Virginia Railway.

Mr. W. K. Christie has been appointed master mechanic of the Kalamazoo, Lake Shore & Chicago, with office at South Haven, Mich.

Mr. T. J. Tonge has resigned as superintendent of motive power of the Santa Fe Central to become connected with the El Paso & Southwestern at Santa Rosa, N. M.

Mr. F. E. Doxey, hertofore foreman of shops of the Illinois Central at Waterloo, Ia., has been appointed master mechanic of the Des Moines, Iowa Falls & Northern, with headquarters at Iowa Falls, Ia., to succeed Mr. L. C. Rost, resigned.

Mr. C. B. Gray has been appointed assistant master mechanic of the Pennsylvania Railroad at Ormsby, Pa.

Mr. S. P. Spangler has been appointed master mechanic of the St. Louis, Watkins & Gulf, with office at Lake Charles, La., succeeding Mr. J. C. Ramsey, resigned.

Mr. P. Conniff, heretofore general foreman of the Baltimore & Ohio at Holloway, O., has been appointed master mechanic at Benwood, W. Va., succeeding Mr. F. C. Scott, resigned.

Mr. George W. Wildin, assistant superintendent of motive power of the Lehigh Valley, has been appointed mechanical superintendent of the New York, New Haven & Hartford, with office at New Haven, Conn., to succeed Mr. F. T. Hyndman, resigned.

Mr. W. O. Thompson, division superintendent of motive power of the New York Central & Hudson River at Oswego, N. Y., has been appointed master car builder, with headquarters at East Buffalo, N. Y., succeeding the late Mr. James Macbeth.

Mr. G. A. Baker has been appointed superintendent of motive power of the Santa Fe Central, with office at Estancia, N. M., to succeed Mr. T. J. Tonge, resigned.

Mr. M. A. Kinney has been appointed master mechanic of the Hocking Valley with headquarters at Columbus, O., to succeed Mr. E. J. Powell, resigned. Mr. Kinney has heretofore been roundhouse foreman of the Baltimore & Ohio at Newark, O.

Mr. A. S. Barrows, heretofore chief clerk to the second vice president and general manager of the Buffalo & Susquehanna, has been appointed chief clerk to the general superintendent of motive power of the Rock Island Lines, with office at Chicago.

Mr. M. M. Meyers has been appointed master mechanic of the Missouri Pacific at De Soto, Mo., to succeed Mr. A. S. Grant, resigned.

Mr. E. D. Andrews has been appointed master mechanic of the Sterling division of the Chicago, Burlington & Quincy, with headquarters at Sterling, Colo., to succeed Mr. F. Newton, resigned.

Mr. J. Dietrich has been appointed master mechanic of the Lincoln division of the C., B. & Q. Ry., vice Mr. J. J. Buttery, assigned to other duties.

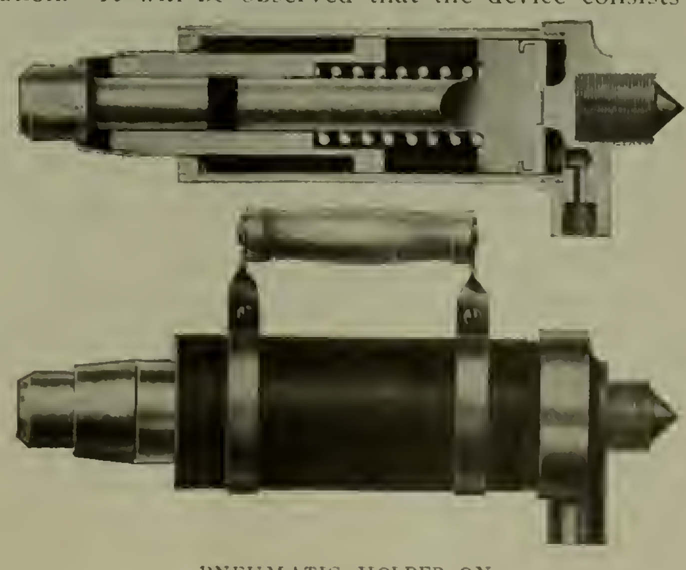
Prof. Charles Henry Benjamin has been appointed dean of the schools of engineering of Purdue University at West Lafayette, Ind., to succeed Prof. W. F. M. Goss who on Sept. 1 takes up the work of dean of the college of engineering and director of the school of railway engineering, of the University of Illinois. Prof. Benjamin goes to Purdue University from the chair of mechanical engineering of the Case School of Applied Science, with which institution he has been connected since 1889. Previous to this he was for three years engaged in engineering practice, and for six years as instructor and professor of mechanical engineering at the University of Maine.

Mr. W. F. Ackerman, formerly supt. of shops of the C., B. & Q. Ry., at Havelock, Neb., has been appointed Asst. Supt. motive power of the Lines West with headquarters at Lincoln, Neb. Mr. Fred Kroehler formerly general foreman at Havelock has been appointed Supt. of the Havelock shops, vice Mr. Ackerman promoted.

Pneumatic Holder On

The advantages of the pneumatic holder on are being gradually recognized. While the pneumatic holder on is used in the usual way, there is a reactive blow struck by the holder on for every blow of the riveting hammer. The action is practically that of a hammer on each end of the rivet, producing tighter rivets than those when the old style holder on is used. The reactive blow of the pneumatic holder on also lays up the head of the rivet, which is an additional advantage in boiler work.

The Gunnell Machine Company, Manitowoc, Wis., are manufacturing an improved pneumatic holder on which is giving satisfactory service. The compact nature of the design and the convenient arrangement for use is shown by the accompanying illustration. It will be observed that the device consists of the



PNEUMATIC HOLDER ON.

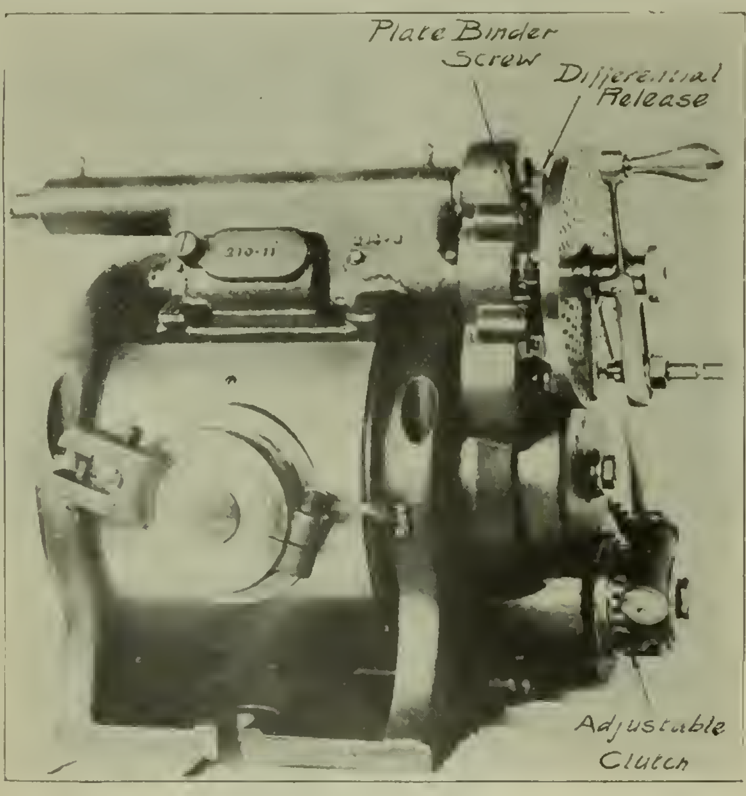
regular air piston with a Rider piston mounted upon it. A blow struck by the riveting hammer is received by the large piston and a corresponding reaction of the Rider piston takes place. As previously stated, this produces a tighter rivet. The reactive effect of the Rider piston is similar to that of a riveting hammer, and so a holder on of this type produces a better quality of work than other types.

New Universal Index and Spiral Head

This head is the result of a desire to fill the need of a spiral head that will answer the requirements of the heavier duty now imposed on the milling machine and still retain the fine points of accuracy expected from such a tool. In designing this head it has been the object to produce a design that would answer the requirements of the wide range of work met with in ordinary practice without sacrificing any of the desirable features of the older heads, and to add those features that good practice shows would greatly increase the usefulness of the head on general work.

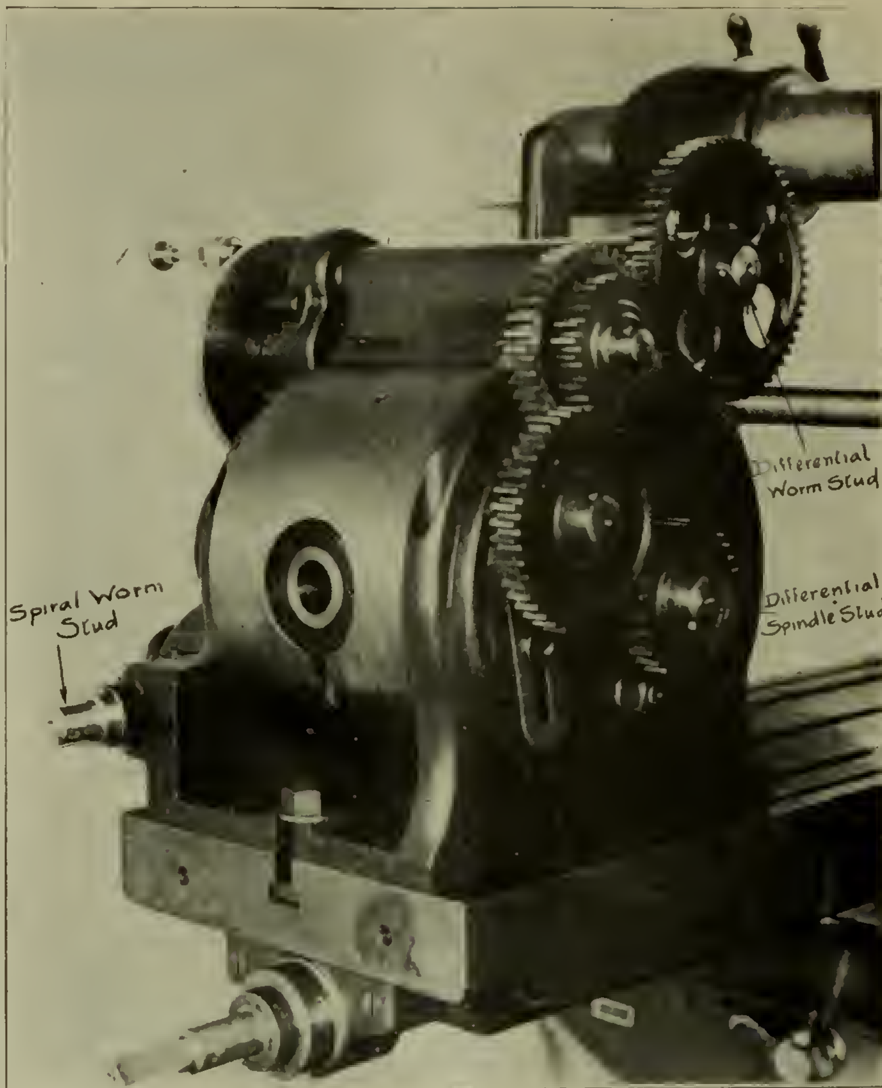
The stiffness and rigidity of the construction is shown plainly in the various views. This increase in strength has in no way impaired the ease of handling nor made the head at all clumsy or awkward to operate. The design is of an approved type having the swivel block house between heavy uprights in which the block swings in a vertical plane. The block is held in any position by means of clamping bolts which draw the outside plates securely against the uprights, making a secure bind, holding the head in position against the heaviest of cuts.

The principal feature of the design is large worm wheel that has been obtained. This gear has been made as large as the respective swing each size head would allow, and by the design followed it has been made much larger than that of any head so far offered. The large diameter and resulting coarse pitch allows of much heavier spiral cuts being taken without the danger of impairing the accuracy or of distorting the teeth in the gear. The increase in stiffness of the head in general makes possible the taking of much heavier cuts at faster feeds and speeds, obtaining the best results with high speed steels.



NEW UNIVERSAL INDEX AND SPIRAL HEAD.

The differential indexing mechanism as a component part of the head has been carried out so that the head may be used as an index or dividing head in any position along the platen with the spindle either parallel with or at right angles to the main spindle of the machine, or in any intermediate position. This has been accomplished by placing the change gears used in differential indexing on the rear side of the head, as shown in the view where the gears are set in position. As seen, the



NEW UNIVERSAL INDEX AND SPIRAL HEAD.

gears have no connection with the table at all, as is the case with the ordinary index head fitted for differential indexing.

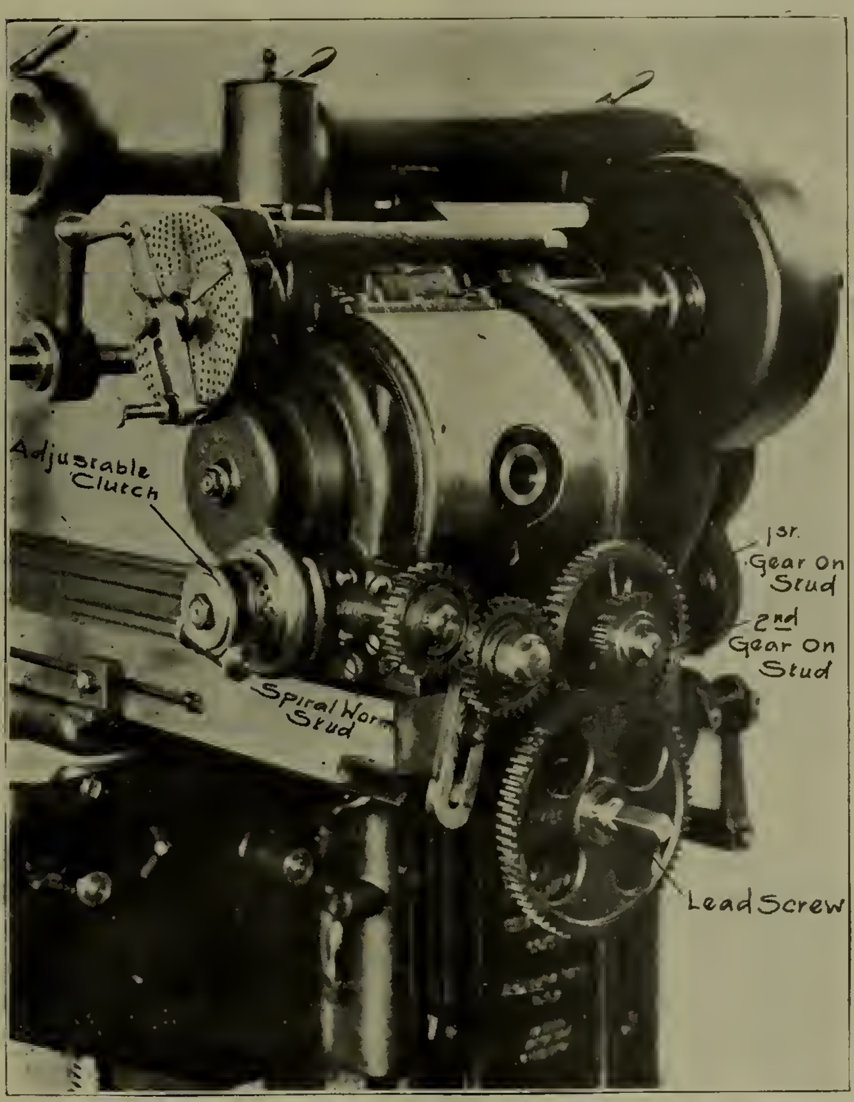
With the gears used in differential indexing arranged on the head, as is done on this head, it is possible to swing the spindle into position for cutting bevel gears or teeth on any conical work. This at once broadens the scope of differential indexing from straight cylindrical work to that which requires the angular setting of the spindle in the vertical plane.

In order that the application of the differential indexing may be universal, it is necessary that it be made available for use in work with helical or spiral grooves, such as spiral gears. In cutting spirals, the plate is geared to the lead screw by suitable change gears. The connection between lead screw and index plate must be broken when making the division in order that the index plate may be free to make the differential movement with the index crank. This breaking of the connection is accomplished by means of an adjustable clutch which is withdrawn during the indexing operation. After the division has been made, the teeth in the clutch will be found to be in such a position in relation to the corresponding spaces that it is impossible to engage same. In order to bring the teeth and spaces opposite each other, one-half of the clutch is made adjustable so that it may be rotated the required amount to bring the two portions in proper position for engagement. This adjustment is accomplished by means of the knurled knobs attached to the clutch.

The connection between the index crank through the worm, worm gear, spindle and change gears of the differential indexing mechanism and the index plate when the index pin is in mesh with a hole in the plate would form a locked train, which must be released during the spiral cutting operation. This release is accomplished by means of the knurled knob back of the index plate which operates a friction clutch.

Frequently it is desired to roll the work on its axis a small amount without shifting the dog or losing the position of the index pin, or the amount of roll over may be so that should it be accomplished by rotating the crank the pin would not come exactly over a hole as would be necessary. Should it be attempted to move both plate and crank in conjunction it would be found that the back pin of the ordinary head would not engage with a back hole. In this head the back pin is done away with and the plate is held in position when resorting to plain indexing by a frictional hold on the hub of the plate gear which is clamped or released by a suitable bolt conveniently located. By this means work may be set regardless of the position of the plate, and the plate can then be securely held in the position it takes when the work is so set. All those who have used the ordinary head will realize the advantage to be gained in doing away with the back pin and substituting the more flexible holding device, as is done in this head.

In work requiring the head to be connected up for spiral cutting the roll over of work is made more convenient by the presence of the adjustable clutch, which, as explained above, allows the disconnection of the spiral cutting train so that the spindle and work may be revolved or rolled over without



NEW UNIVERSAL INDEX AND SPIRAL HEAD.

changing the position in relation to the cutter in a direction parallel with the feed motion.

The index and spiral head is one of the latest products of the Becker Brainard Milling Machine Co., Hyde Park, Mass.

Notes of the Month

Owing to the increase in the business of A. Gilbert & Sons, Brass Foundry Co., St. Louis, they have purchased a site for a new plant, 75 by 180 feet, on Forrest Park Boulevard. The building will have 18,000 sq. ft. and when finished be one of the most up-to-date brass and white metal factories in the West. The company manufactures Velox bronze bearing metal and various grades of Babbitt.

The Sherwin-Williams Co., Paint and Varnish makers, have issued a catalogue of Railway Paints and Varnishes, which is one of the most complete and well gotten up books of the kind ever published. The book is full of excellent illustrations in colors, of paints and varnishes for railroad use, and the pages are crowded with information for the railroad painter. The book is a credit to the Sherwin-Williams Co.

Catalogue No. 8, of the Independent Pneumatic Tool Company, Chicago, descriptive of the Thor pneumatic tools, has just been issued. This catalogue contains a large number of half-tone illustrations, showing the various kinds of work done by the Thor tools. A detailed list of parts, with numbers for ordering, is also included.

The McConway and Torley Co., Pittsburgh, Pa., manufacturers of Couplers, etc., have issued the "Car Repairman's Guide" which in reality is a supplementary catalogue of knuckles, locks and knuckle pins of the couplers manufactured. The corresponding parts of the several couplers are grouped, numbered and indexed in order to simplify the question of ordering these parts. As the M. C. B. Association have urged the necessity of ordering coupler repairs from the manufacturer, the Car Repairman's Guide will be of instant value.

Another very strong confirmation of the efficiency of the Bliss System of Electric Car Lighting, is the fact that The Pullman Company has ordered Bliss Axle Light Equipments to be applied to all Pullman Private Cars. It is well known that only the most modern and approved equipment is used on these cars for the safety, comfort and convenience of their patrons.

Mr. G. N. Sweringen, formerly Chief Clerk to the General Superintendent Motive Power of the Rock Island System, resigned August 1st, to accept a position as Manager of Sales in the Railroad Department of the McMaster-Carr Supply Co., 174-176 E. Lake Street, Chicago.

The Bettendorf Axle Co., Davenport, Ia., have received an order from the C. B. & Q. Ry. for 1,000 all steel gondola cars of 100,000 pounds capacity.

Mr. John Reid, who for several years has been connected with the Consolidated Railway Electric Lighting & Equipment Company, has resigned from that company to accept the position of assistant to the vice-president in charge of sales of the Bliss Electric Car Lighting Company, with headquarters at their New York Office, Night & Day Bank Building.

The Falls Hollow Staybolt Co., Cuyahoga Falls, Ohio, have issued an interesting pamphlet entitled, "Safety, Economy and Reduced Operating Expenses Are Attained by the Following Conditions." Then follows some very interesting data in regard to staybolts in locomotive service.

The following appointments have been made in the organization of the Magnus Metal Co., N. Y.: D. W. Ross, Managing Director, W. H. Croft Manager Sales Department, W. S. Bostwick, General Manager.

The United States Railway Supply Co., Louisville, Ky., has been incorporated with a capital stock of $5,000.

The Memphis Car Manufacturing Co., Memphis, Tenn., have been incorporated with a capital stock of $100,000. The incorporators are: I. F. Peters, W. W. Simmons, C. W. Thompson, Emil Nathan and W. A. McClure.

The Northern Engineering Works, Detroit, Mich., recently installed a 20 tons capacity power station crane for the Toledo Gas & Electric Co., and two of the 20 tons capacity in the Murphy power plant at Detroit, Mich.

Mr. Henry Gulick, Jr., and Mr. J. W. Henderson, of Pittsburgh, Pa., under the firm name of Gulick, Henderson & Co., have taken up the work of general inspection, and will make a specialty of the inspection of railway equipment. The company also operates the Engineers' and Founders' Laboratories, making a specialty of expert foundry work. Mr. Gulick was formerly with Robert W. Hunt & Co. and Mr. Henderson was formerly superintendent of the Central Car Wheel Company, and later built and operated, as manager, the Butler Car Wheel Works.

Mr. C. M. Mileham has been appointed master car builder of the Doud Stock Car Co. The offices of the company are in the Fisher Building, Chicago.

The Falls Hollow Staybolt Company, Cuyahoga Falls, O., is erecting a mill three times the capacity of its present plant. This was made necessary by the company's rapidly increasing business.

The Norton Grinding Company, Worcester, Mass., has found it necessary, on account of a rapidly growing business, to secure larger quarters for its Chicago branch at 48 South Canal street.

The Crawford Locomotive & Car Company, Streator, Ill., has been incorporated to manufacture railway rolling stock and equipment, with a capital stock of $500,000. Incorporators: R. W. Crawford, Alberta Brown and P. J. Lucey.

The Federal Improvement Company, The Rookery, Chicago, has been awarded the contract for the erection of a 5-story warehouse for the International Harvester Company, at Twenty-sixth and Leavitt streets, Chicago.

The Washburn Steel Castings & Coupler Company, Minneapolis, Minn., will build a new plant, but work on it will probably not commence until spring. The plans include a steel foundry, car shops, iron foundry, etc.

Mr. A. C. Woods, assistant to J. P. Ramsey, vice-president and general manager of the Chicago, Peoria & St. Louis Railway, has resigned to enter the coil and elliptic springs sales department of the T. B. Arnold Supply Company, 1422 Missouri Trust building, St. Louis, Mo.

Mr. Schoonmaker, formerly in the purchasing department of the American Bridge Company, has taken a position as western sales manager of the Graham Nut Company, of Pittsburg, Pa., and about September 1 will open an office at 1132 Commercial National Bank building, Chicago, Ill.

The H. F. Vogel Contracting & Railway Supply Company, St. Louis, Mo., western agent for the Danville Car Company, of Danville, Ill., has moved its office and warerooms to 417 Walnut street, where it occupies the entire building.

Mr. F. D. Laughlin, formerly vice-president of the Atlantic Brass Company, has been appointed eastern sales manager of the Pittsburg Pneumatic Company of Canton, O., manufacturer of pneumatic tools, with headquarters at 90 West street, New York City, succeeding Mr. Glenn B. Harris.

The Shourek-Haines Air Brake & Machine Company, Pittsburg, Pa., has been organized to take over the plant, patents and business of the Shourek Air Brake Company. The officers of the company are: James B. Haines, Jr., president; L. C. Sands, vice-president; T. H. Hartley, treasurer; and Grant Hubley, secretary. It is the intention of the company to develop its patents and enlarge the plant.

The Sherwin-Williams Company's western division representatives and managers to the number of 50 dined at the South Shore Country Club, Chicago, on Friday, August 2. The affair, which is an annual occurrence after the salesmen's summer vacations, was attended by Alexander Sclater, district general manager, and George A. Martin of Cleveland.

Mr. W. C. Lawson, until recently sales manager for the Scullin-Gallagher Iron & Steel Company, with headquarters at Chicago, has been appointed sales representative north of the Ohio river for the Southern Saw Mill Company, of Thomasville, Ga., which makes a specialty of long-leaf yellow pine, car lumber and bridge timbers. Mr. Lawson has opened offices at 906 Fisher building, Chicago.

The Curtis Motor Truck Company, Decatur, Ill., has filed articles of incorporation, the capital stock being $250,000. The company expects to begin work at an early date upon the erection of a plant for the manufacture of the Curtis truck. The incorporators of the company are: J. S. Drennan, G. A. Bloen, C. C. Leforgee, J. D. Johnson, F. A. Curtis and Mary A. Curtis.

The Jeffrey Manufacturing Company, of Columbus, O., has appointed Mr. Robert Lucas assistant purchasing agent in place of Mr. J. V. L. Bonney, resigned. Mr. H. S. Van Alyke has been appointed assistant to Mr. R. Grosvenor Hutchins, manager of the mining department, succeeding Mr. Walter C. Floyd. Messrs. Bonney and Floyd severed their connection with the Jeffrey Manufacturing Company to devote their time to a new steel castings plant which they have established at Columbus.

The American Chain & Foundry Company, Detroit, Mich., recently organized with a capital stock of $2,000,000, has elected the following officers: President, S. H. Simpson, president of the Michigan Malleable Iron Company; first vice-president, C. S. Santelroy of Chicago; second vice-president, W. C. Frye of Milwaukee; and secretary and treasurer, A. B. Caldwell of Chicago. It is the intention of the company to build a large plant at Detroit, making a specialty in the manufacture of link belt conveying machinery of all kinds.

The General Compressed Air & Vacuum Machinery Company, St. Louis, Mo., has filed papers for an increase in the capital stock of the company from $120,000 to $750,000, fully paid. About $200,000 of it will be used for the erection of a new factory building in the southern part of St. Louis, Mo. The property on which the building is to be located comprises about 1½ acres, located on Jefferson avenue, which was purchased recently. The building will be 135 by 390 feet and about 300 men will be employed.

The Detroit Graphite Company is the new corporate title of the Detroit Graphite Manufacturing Company of Detroit, Mich. Mr. F. W. Davis, Jr., has been elected vice-president, and T. R. Wyles second vice-president of the company. Mr. A. A. Boutell is president. The company announces that with the extensive additions and improvements that have been made to its building and machinery departments, it is prepared to give prompt attention to all orders.

The Ostermann Manufacturing Company, West Pullman, Ill., built a plant on a comparatively small scale at West Pullman about one year ago for the purpose of repairing nd rebuilding cars. Since that time it has repaired or rebuilt over 3,000 cars and has in its employment 425 men. New buildings and yards have been constructed from time to time until its plant now covers over eight acres of land. Owing to the rapidly increasing business of the firm, it has recently purchased an additional five acres and is putting up new buildings and installing new and improved machinery. The additional trackage facilities are being constructed by the company's forces and in the future the company will do its own switching. A new plant at South Memphis, Tenn., known as the Memphis Car Manufacturing Company, Incorporated, is under construction by the Ostermann Manufacturing Company. This latter plant will cover about fifteen acres, ground for which was broken on June 8. The blacksmith shop and milling plant are in operation and about 150 cars have already been rebuilt at that plant. Additional new buildings equipped with heavy machinery are being added as rapidly as possible. The company is now in a position to repair or rebuild all kinds of railway cars.

Technical Publications

The Marine Steam Turbine, by J. W. Sothern, M. I. E. S. Published by D. Van Nostrand Company, New York. Cloth binding, 163 pages, 5½x8½ ins., illustrated. Price, $2.50 net.

This volume contains practical information in regard to the Parsons marine steam turbine which is of the impulse-reaction type, the one most adaptable to marine practice.

The first section of the book is devoted to definitions of terms used in the theoretical and practical description of steam turbines. Following upon these definitions, the principle of the turbine particularly the Parsons turbine, is outlined. The calculations of velocities, determinations of rotor diameters and number of blades, etc., are given and illustrated by problems.

The second section deals with the practical construction of the turbine. The drawings of the various parts were made from turbines, which were under constructions, and may be depended upon to illustrate the present design of marine turbines. The construction of each part is fully described and such information is given which only practical experience in this line affords.

The third section includes data from practice, a description of the construction of propellers, accompanied by drawings, and also data on the coal, steam and water consumption. The volume is concluded with a description of Denny & Johnson's Patent Torsion Meter and elementary problems, together with solutions, in marine turbine design.

In this volume turbine design and construction is treated in such manner that the book may be used by the student as a text book and by the engineer as a reference book. It is clear in its explanations, not entailing study of the meaning which the writer intends to convey.

Railroad Paint Shop

Edited by
J. H. PITARD
M. C. Painter, M. & O. R. R.

Devoted to the Interests of
Master Car and
Locomotive Painters

Official Organ of the Master Car and Locomotive Painters' Association

Retrospective

Another twelve months' with the usual vicissitudes of life has rolled by since our pleasant meeting in Washington. During that time Fate has dealt kindly with our active members, but in the ranks of our retired members, Brothers Putz and McKeon have fallen, but each have left an honored name. There have been but few changes or transfers among our members, this' fact indicates a satisfactory condition which it is to be hoped will continue. There has been, as usual, perfect harmony among the officials of the association, and everything seems to be working satisfactorily for the best interests of the Association, and there is every indication of a pleasant and profitable meeting at St. Paul. To all who may have the pleasure and privilege of meeting on that occasion, we extend our greeting. and wish them a happy joyful occasion.

Emulsion Cleaners, Their Composition, Use and Abuse

Since the advent of emulsion cleaners for terminal use, to the present time, they have increased in variety and numbers until their name is legion, and their composition has become a matter of much concern and speculation on the part of those intrusted with terminal cleaning.

Experience has taught that the continual and repeated use of water for terminal car cleaning, is injurious to varnish, and that it is impossible by this means to obtain the longest possible service from varnish coatings, hence a change to emulsion cleaners.

This change in some instances has proven in a measure, satisfactory, but quite the contrary in many others. A glance at the composition of many of the emulsion cleaners, on the market, would tend to create the impression that the essential points of such mixtures had been overlooked or ignored.

The essential points of an emulsion cleaner are, effectiveness in removing dirt, ease of application under extremes of temperature, not excessive in abrasive action, not injurious to varnish, not penetrating, not antagonistic to successive coatings of paint or varnish, and imparting a good lustre when the work is completed. When it is considered that so simple a thing as water is injurious to varnish for cleaning purposes, it stands to reason that any substitute for this purpose, in order to possess superior qaulities, must be compounded with mathematical correctness, and, composed of material possessing a special fitness for this purpose, and this fitness should be determined by the application of the laws of chemistry.

In no case should they contain chemicals in which varnish gums are in the least soluble, either in a short or long application of such cleaners, for the reason that such cleaners are often entrusted to inexperienced and careless workmen and in whose hands, unless a thing is nearly automatic, injury is possible and probable.

An emulsion cleaner should possess an affinity for dirt, but not for varnish. It should possess the property of combining quickly with the particular kind of durt produced by coal smoke, the chemical composition of which is surphur Hydrogen and Carbon. It should also possess an oil for feeding and satisfying the thirst of varnish, created by time and wear.

The majority of emulsion cleaners possess either Petroleum, Jewelers Rough, Oxalic Acid, Glycerine, Whiting, Linseed Oil, Soap or other forms of Caustics. Linseed Oil. Wax. Tripoli, etc.

Of all the above mentioned ingredients, the Petroleum and Caustics, are the least desirable and most injurious to varnish.

The Petroleum cleaners usually contain Caustics in some form, but the two do not combine chemically, as it is a well known law of chemistry, that Petroleum is not soluble in any of the Caustics. In the case of such a composition, the two ingredients must necessarily act separately and independently of each other, therefore in such a case there is nothing to counteract the penetrating qualities of kerosene or petroleum, the effect of which is seen when it is attempted to revarnish a car that has long been cleaned at the terminal with a Petroleum-Caustic cleaner.

In attempting to revarnish a car thus treated, it is, in many instances, impossible to effect an adhesion of the varnish; it crawls badly and when dry, presents a sort of miniature, corrugated effect. What is the direct cause of this? The Petroleum and Caustic, acting independently, the Caustic has softened the varnish, and the Petroleum has penetrated the sponge like mass of deadened gum, and when fresh varnish is applied, it repels it on account of its foreign nature.

As varnish is composed of Linseed Oil, gum and turpentine, it will readily be seen that a cleaner containing Linseed Oil, instead of Petroleum would necessarily have a greater affinity for fresh varnish than one containing Petroleum. Fish oil or cottonseed oil or other oil that are foreign to varnish. The use of emulsion cleaners in order to obtain the results aimed at, necessitates systematic application. A hap-hazard, hit or miss, irregular application of such cleaners will in no case prove satisfactory. They should be regularly applied by men trained to perform this part of car cleaning only, but in no case should they be used when the condition of the surface does not demand it.

It is especially important that the face of the varnish in its crystalized form as it leaves the varnish brush, should be retained as long as possible. In this condition, the grime and dirt is easily removed, but as soon as the face becomes roughened by the use of coarse abrasive cleaners, it is readily understood that it in that condition, becomes an inviting field for the lodgment of particles of dirt, from which it is difficult to remove it. On this account, the use of abrasive cleaners is extremely questionable, but some substitute for the abrasive property of the cleaner is desirable, this may be found in the use of curled hair or scrubbing brush, but preferably the former, but in no case should either be used, until that stage is reached when the dirt will not yield to waste alone when used in connection with the cleaner. The face of varnish roughens rapidly under the destructive action of the sulphuric acid gases contained in coal smoke, therefore it is unwise to supplement such deterioration by the use of coarse abrasive cleaners. Another important matter in connection with the use of emulsion cleaners, seems to have been generally neglected, much to the detriment of varnish, that is the fixing of a limit for their use.

The continued use of such cleaners up to the time a car is reshopped for general repairs, is in some cases more injurious than otherwise, as for instance in the case where varnish has become prematurely deadened and porous.

The varnish when in this condition, absorbs and retains the cleaners to a large extent, and if the composition of the cleaner be foreign to that of the composition of the fresh varnish to be applied, it is readily seen that antagonism results, and in some cases to such an extent that burning off is necessary before a satisfactory finish can be obtained. When a car has reached the condition above described, it should be immediately returned to the shop for revarnishing, but if that is not practicable, it would be advisable to discontinue the emulsion cleaner at this stage, and water only used for cleaning until reshopped.

By this means it would enter the shop in a fit condition for the application of either paint or varnish.

Concerning the Convention

Editor Railway Paint Shop:—

That St. Paul will do its share toward making the visit of our membership and association a pleasant one, I am assured. That effort is already being made to have the season perfect for a comfortable and agreeable session I know for have I not heard it said for many times. We hope the weather may be favorable; not too hot, nor too cold. Not too wet nor too dry, simply cool and refreshing. I too do know that the effort to make the session a pleasant one, so that none may have cause for loss of needed rest after healthful recreation, was in the act of the City Fathers applying the lid at the mid-night hour, so that there might be no excuse if the needed was not obtained; certainly effort is being pushed forward apparently without the aid of your committeeman. The city, its business interests, all seem to be exerting themselves to make St. Paul, by the date of our convening, one of the most beautiful and attractive cities anywhere east of the Rockies. Those who met with us nine years ago, well remember St. Paul, but then it was as it were only in its swadling garments. The Capitol building, which was then under construction has been completed, containing in its interior some of the finest works of art, and is now one of the grandest state buildings of our country. The Auditorium, recently completed and dedicated, is considered by all who have beheld its grandeur, capacity and arrangement, as classed among the best, most beautiful and complete building of its kind ever presented to an admiring public. Como Park extensively improved, other additional parks placed at the disposal of the populace, amusements and touring journeys of varying character have been provided, a City Railway system unsurpassed and the "Way of Light"—this must be seen, it cannot be described in cold type; nothing like it east of the Pacific Coast. Many other attractions are under way or in contemplation and I can only think that all this is being provided for the comfort, the entertainment, the pleasure of the members of the association, their families and their friends attending this convention.

The various subjects selected for presentation and discussion, bear, each of them, so much of interest that they should command the attention of every Master Car and Locomotive Painter, it is certain they will of our superiors. That I may myself feel interested and yet not be able to take part in the discussion causes me to make reference thereto in brief. I may thereby advance an idea that may help in the production of a discussion wherely each subject presented shall receive that attention and consideration which shall prove beneficial to all.

Subject No. 1, pertaining to the painting of Steel Passenger Equipment is to many of our members an advancement in the direction of something new, a something which many may not reach upon their lines for many years to come, others perhaps not for some years, while a few have as yet had only a limited experience, only touching as it were upon the skirmish line, not knowing what is possibly just ahead, still this should prove one of the most interesting subjects upon the list and prove a forerunner of information which shall bring about a preparedness essential when the necessity or the demand shall come, as come it will. I notice in No. 4 that the Painting of Locomotive parts and tenders is a part of the program for consideration and this being the painting of iron and steel, I recall that often has this topic been considered and it appears to my mind that the construction of Steel Passenger Equipment will furnish a topic for consideration many years to come. If it were possible to adopt a sure, a perfect method of preparation for this class of painting and it were also possible that a set formula could be adhered to, it appears to me that a short time only would elapse before proper formula for durability would be secured, but we have during the years passed in the painting of locomotives, not only been making an effort to secure good, durable formula, but have had the apparent everlasting demand for cheapness and the rapid results in the output to meet also, thus meeting the required great decrease in cost not always brought about by those in higher authority or official position, but through the effort put forth by the manufacturer to be in the market and do the other fellows by and through the representation of equal product at a reduced cost. You know the result. You know the rest, and I ask will we not have to go through the same process, the same grind year after year, and finally land as many have previous to this date and find the advocacy of painting metal surfaces at a cost from which no good results can be expected. If, as I have recently seen in a written article, and therein recommended that locomotives may as well be painted with graphite, carbon and oil, is the outcome of the effort of practical, experienced men mechanics in their chosen profession, what may we not expect following the effort to produce good, durable surfaces interior and exterior steel constructed passenger equipment, having always believed that the best that could be produced was at all times the cheapest, both in labor and materials, price not considered, it is unnecessary for me to dwell upon my own opinion. Not much good can result from an impractical cheap rate mechanic and those who know, need no introduction. As to Subject No. 2. Our mode is fumigation occasionally, at other times the use of disinfectant properties in water, washing floors, etc. Work referred to in No. 3 while by me somewhat understood, not under my jurisdiction, however, a well known system is used by the Northern Pacific, a good plant provided for excellent results. As regarding No. 5. My experience is that a good substitute for linseed oil may be used to an almost unlimited extent in various combinations, even in formula where the linseed oil would be detrimental, the varied uses therefor being much greater than many are willing to credit thereto. It cannot only be used as a substitute for linseed oil, but properly understood ofttimes is better if substituted for a turpentine substitute at a very marked decrease in cost.

Regarding the queries will say No. 1 will interest many. I am listening. To No. 2, I answer thereto. Denatured alcohol is not a substitute for pure grain alcohol, I am aware that there is, will be and should be, difference of opinion. I admit it may be used and substituted in many places, but there are classes of work under my observation where none but pure grain alcohol is safe. To make reply to No. 3. Two coats color is amply sufficient, unless using the light colors, provided foundation is brought up understandingly to correspond with intended finish. We will listen to Nos. 4 and 5. We being quite well pleased with detergent used in this neck of the woods we await the hearing and shall grasp the better if presented. Thus much have I written in advance of our session in St. Paul, and await the coming of a great host, hoping that this may prove among the best of our annual gatherings.

A. J. BISHOP,
St. Paul, Minn. Master Painter Northern Pacific Ry.

To Make Artificial Gypsum or Plaster

In mixing plaster paris says "Machinery" do not pour the water on the plaster, but turn the plaster gradually into the water, spreading it about in shaking it in and not stirring until all the plaster has been added. If mixed in this manner, a smooth cream or thin dough, without lumps, will result. The proper quantity of gypsum is usually enough to peep out over the surface over the greater part of the area; that is, about equal volumes of each ingredient. The addition of glue water to the mixture retards setting.

This "Druggists Circular" gives the following formula for an ink for writing on glass with a common pen:

Water of Ammonia 26%	1 ounce
Hydrochloric Acid	1 ounce.
Wheat Flour	1 ounce.

Acacia enough to give the desired consistency. Add the acacia last.

The Uses of Compressed Air in the Paint Shop

What is Compressed Air, when put to use in the Paint Shop, a factor for good, an economical labor saving and practical appliance, or does it prove itself of little value, a nuisance and false economy when compared with former methods?

If it is a useful Paint Shop adjunct, when put to certain uses, does it follow that it can be successfully installed, with practical economy, for other work in which it has been employed by some members of the Craft?

Is there not a tendency to over do or go "Air-Crazy?"

Is not the man who is inclined to scepticism, but at the same time willing to experiment with anything new which happens along, especially if it looks good to him, better than the enthusiastic Hobby-rider who goes to extremes?

Is not the conservative, pessimistically inclined one, who nevertheless is anxious to keep apace the times by trying new wrinkles, proving everything, yet retaining only that which is good, to be given preference over the harum-scarum, claim everything individual who is apt to over do matters in his zeal?

A decade or so of years ago, when the "Air-craze" was infesting the country in its most virulent form, the Paint Shop did not escape, but naturally fell a mild victim. Happily, however, the crisis was soon reached and once over with, the uses of air simmered down to a practical basis, the fads and fakes were eliminated, and work on a safe and sane principle, as regards Compressed Air, was slowly substituted. Wild claims made were sifted down found wanting and discarded. Others proved themselves of great value and found a permanent home with us. Some of the bubbles burst rather suddenly, while others retained their form and displayed their irridescent colors for quite awhile, but finally vanished like the others. Some reappeared at regular intervals like Bingo's Ghost, only to fade away again evanescently into nothingness.

Let us consider briefly few of the Paint Shop uses for which Compressed Air has been exploited.

THE PAINT ATOMIZER OR PAINT SPRAYING MACHINE.

This machine, for Railroad use, was swept in on the general tide of Compressed Air agitation some dozen years ago, when "Compressed Air Dementia" throughout the Country was at its height. It took the Country by storm, so to speak, and the wildest claims were made for it.

The Freight Car was the dog it was first tried on but soon there were those who saw fit to advocate its use on Passenger Car Trucks, Inside or Baggage Cars and one Brother even went so far as to experiment with it in the varnishing of exteriors of Car Bodies. Another enthusiast claimed to be successfully stenciling Freight Cars with his machine. It found much favor with some in the painting of certain parts of Locomotives and was largely used in the whitening of shop interiors, where the mess created on the floor, machinery and other contents and portions of the shop was of no consequence, and where the operators' eyes could be induced to stand the mist created. In fact it was experimented with for almost every class of work where the brush had heretofore been employed, with varying success. Ere long, however, its use simmered down to the painting of Fright Cars, underneath of Locomotives and the whitening of Building interiors and it is still used to a considerable extent for these purposes with more or less success.

The induction of moisture through the Air Compressing Process soon eliminated the Spraying Machine from the better classes of work where a protective coating of paint with Linseed Oil as the vehicle was to be used. It is still used by a few Railroads in the painting of Freight Equipment, Passenger Car Trucks and under parts of Locomotives, though discarded by most of them on account of unsatisfactory results obtained.

The excess of material used as compared with brush work, usually more than off-sets any gain made in labor, and few there are who are ready to claim that the machine can equal the brush, quality of work to be the stand-point from which to judge. It is also more or less of a nuisance, unless the work of spraying can be done in an isolated spot where other workmen will not be compelled to submit to the deluge of atomized paint, which necessarily accompanies the operation. However, with a stringent labor market and help difficult to obtain, the Paint Sprayer frequently comes in good stead, permitting a small force to accomplish, under favorable circumstances, a large amount of work. The quality is considered by some good enough for certain classes of work and helps turn it out rapidly with a small complement of men, yet with help obtainable, the brush is to be preferred in nearly all cases.

There is another use to which the Atomizing Machine has of very recent years been put to and which in my haste I came nearly overlooking. I refer to advertising and show card signs, which some artists round up or shade by the use of a minute atomizer, producing really marvelous results. The lettering is done in the usual way with the brush, but the shading is sprayed on, producing beautifully rounded letters, which apparently stick up from the back-ground so prominently as to lead one to believe that they were actually raised. Some beautiful effects are obtained in this way.

FOR BURNING OFF PURPOSES.

Compressed Air used in connection with Gasoline in burning off paint, has proven itself of great value and most shops are now equipped with appliances of this kind. It has almost entirely supplanted the small hand burner and has been instrumental in greatly cheapening the work. No room for argument here. It is a good thing, indispensable almost, and has won a permanent place apparently in the Railroad Paint Shop.

THE SAND BLAST.

Blessed invention! How would we ever get along again in the painting of Locomotives without the Sand Blast. Back to emery and sand stone for the removal of flash and mill scale from tenders and other parts of Locomotives, or lime and lye for taking off old paint when repainting is necessary? No, never! Of all uses to which the Master Painter has attempted to put Compressed Air, the Sand Blast steadfastly holds its own and is probably the least indispensable. Its uses are varied though principally confined to Locomotive work. Tenders, Steel Cabs and smaller appliances of engines are successfuly treated, glass embossing is done with it where formerly acids and emery grinding was resorted to and Car Trimmings are first Sand Blasted when it is the intention to change from a bright finish to a Statuary Bronze effect. "Once used, always used," seems to hold good with this appliance and in fact, when once in successful operation, many uses spring up never before thought of. A little dirty and dusty to be sure, and hard on the operator, too, unless protected properly with goggles and respirator or a helmet yet little complaint is heard on that score. Its good qualities greatly over-balance its bad ones and to be compelled to get along without it would indeed be a hardship and a retrogressive step.

FOR PUMPING AND AGITATING PAINT MATERIALS.

When the craze was at its height, Compressed Air was frequently employed by progressive (?) ones for the pumping of oils, varnishes, in fact all paint liquids and mixed paints were agitated by its use. No more hand-stirring wth a paddle or pumping with an old fashioned Plunger or Rotary pump. But alas, many had not reckoned on the moisture bound to be injected into the material by the continued application of Compressed Air. Bleeding valves with which to draw off the condensation seemed to give but partial relief and gradually the fad (for such it was) fell into disuse.

I remember, ten years ago, of having a large steel tank for Linseed Oil, holding something like a dozen or more barrels of oil, placed under ground and over the man-hole on top, the barrels were rolled and emptied. The tank was perfectly watertight and the pumping was done by Compressed Air. All went well until about six months afterwards, when the oil began to get low in the tank, nearly empty, in fact, all but a barrel or so.

Well we noticed that the oil was a thick milky appearance, something we could not account for. The man-hole was opened and lo! it was found we were pumping about one-half water and one-half oil. There was more than a half barrel of water at the bottom of the tank and for months before we had just simply been pumping the oil off the top, while the water, introduced by the Compressed Air, was gathering below.

On another occasion we were emptying a barrel of Varnish into one of the Stock Room tanks (I shudder to think of the idea), Varnish remember! by the improved (?) Compressed Air Process, when for some reason or another the barrel burst and its entire contents ($150.00 worth) were lost. We emptied no more barrels in that manner. The Rotary pump and over-head Coburn track and trolley arrangement was good enough after that.

Paints, Oils and other liquids for painting purposes should not be pumped or agitated by direct contact with Compressed Air on account of the liability to introduce moisture, a thing to be avoided by all means.

Lubricating oils, if pumped by air, should be stored in a large tank provided with a small auxiliary reservoir, into which alone the air is permitted to enter and from which may be bled the moisture previous to again filling up from the larger tank.

But, above all things, deliver us from the agitating tank operated by Compressed Air. B. E. MILLER,

Master Painter, Delaware, Lackawanna & Western Railroad.

Protecting Piling Against the Ravages of Toredo

Innumerable attempts have been made to devise a paint that will repel the rapacious Teredo from submerged piling, but thus far all such attempts have been more or less failures. The combined effects of both water and Teredo will soon have a telling effect upon any paint that can be devised. In fact, it is about as difficult to get a paint that will long withstand the destructive effects of water, and the attrition of waves, as to devise one that will repel the Teredo. Should an effective paint be devised for this purpose great care would be necessary in getting the piles in position in order to guard against abrasions that would afford an opening or entering place for the worms. After the piles were in position there would also be equal and possibly greater danger of abrasions from floating objects which invite the entrance of the Teredo, of which they are quick to take advantage. Thus it would seem that protective points for this purpose would at most be only partially protective. The cost of piling alone is often insignificant as compared to the superstructures which they are often made to support. On account of this fact any means that seems to promise the desired protection, regardless of a reasonable expense, would seem to be acceptable. For this purpose, in lieu of paint, we offer the following suggestion:

Take galvanized iron wire about the size of that used for telegraphic purposes, or smaller will suffice, and closely wrap the submerged portion of the pile, securely fastening the same at intervals with V-shaped metal fasteners. Next coat the wire with thick coal tar, and while soft sprinkle thickly with sand or pulverized glass. The tar will not only close possible interstices, but will afford protection for the wire from corrosion for considerable time. The sand or glass is also effective in a measure against the Teredo. Wire, for the purpose mentioned, is more effective than jacketing with copper or other metal, as it is not so easily pierced by floating objects, and is less costly than copper.

Seasoning of Telephone and Telegraph Poles

From a circular issued by the U. S. Department of Agriculture, Gifford Pinchot, forester, we present some extracts on the seasoning of timber.

The contents of the circular in question is written with a view to check the rapid depletion of timber available for poles, by prescribing such methods of cutting and seasoning as are best calculated to prolong the life of the timber.

The circular contains much valuable information which we would like very much to reproduce, but space forbids the publication of more than a few of the main points. The following are six questions bearing on this subject and the answers to same:

(1) At what rate does seasoning progress in telegraph poles?

(2) Does the time of year when timber is cut affect its seasoning?

(3) Does the time of year when timber is cut affect its specific gravity?

(4) How much shrinkage occurs in air seasoning?

(5) What are the causes of the checking of poles during air seasoning?

(6) What is the best season for cutting poles?

CONCLUSIONS.

(1) This, the main question involved in the experiments, is answered in tables 1 to 6, which show approximately the rate at which chestnut and cedar poles may be expected to season under similar climatic conditions.

(2) Winter cut wood seasons more regularly than that cut at other seasons, but does not, for many months at least, reach as low weight as spring-cut wood seasoned equally long.

(3) In timber of approximately the same age and growth, that cut in winter will have the greatest specific gravity.

(4) The shrinkage of round timbers in air seasoning is very light and may be disregarded.

(5) If poles are carefully cut, checking during air seasoning is comparatively slight. If split or shaken in felling, however, serious checking may follow.

(6) From the standpoint of seasoning, spring and winter are the best times for cutting. Other considerations such as custom, availability of labor, and susceptibility to decay, make winter cutting preferable.

Drilling Glass

Procure a case hardened drill, slightly twisted at the point, and with a carpenter's brace, proceed to drill the glass as if boring a hole in a piece of wood, the meanwhile keeping the point of the drill moist with turpentine. Drill the glass half way from each side of the glass in order to prevent chipping around the edges of the hole. For a small hole, an ordinary hand saw file will suffice. Break off the front end of the file and grind to a blunt pyramid point.

Whenever convenient to do so, the glass should be lain flat for drilling in order that the turpentine may not flow off from the point of the drill.

Personal Mention

Mr. L. J. Bowers has succeeded Mr. Benson Brown as manager of railway sales department of the Acme White Lead and Color Works, of Detroit, Mich. Mr. Brown recently transferred to the Jas. B. Sipe Co., of Allegheny, Pa.

Mr. I. H. Mumpford, who until recently represented the Flood & Conklin Co., has engaged with the Valentine Varnish Co., of New York, and at this writing is making a business tour of the south.

Mr. J. P. Glass, formerly foreman painter at the Dover, N. J., shops on the D. L. & W. Ry., has accepted a position in the car department of the Hicks Car & Locomotive Company of Chicago.

Through Secretary Dane, we learn that on the 21st of June last, a daughter was born to Mr. and Mrs. F. E. Fornwalt. Mr. Fornwalt is master painter on the Pennsylvania Ry. at Harrisburg, Pa Don't forget to congratulate Bro. Fornwalt on the happy event when you meet him at St. Paul.

In a recent letter from our genial friend, F. C. Macomber, master painter of the Pere Marquette Ry. at Ionia, Mich., he informs us that on the ill-fated excursion train, composed of the Ionia shop employes and their families, in which 31 lives were lost, on July 20th, that his son Edward 12 years of age, was in the party of excursionists, but happily escaped with only a few slight bruises. We congratulate Bro. Macomber and his family on their good fortune.

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Contents

Maintenance of Foot Boards

PERSONAL injuries which might result from failure to inspect and to repair promptly those fixtures on locomotives and cars upon which trainmen depend, emphasize the necessity for the utmost care of all appliances used by men in boarding or alighting from cars and engines while in motion. The liability to injury of switchmen because of a defective foot board on an engine in switching service directs especial attention to the necessity of careful inspection and maintenance of foot boards and hangers, as well as the bolts securing them.

Should an engine be allowed to go out of the roundhouse with the hangers so bent as to allow the foot board to slope out or with the board in defective condition there is grave danger of accident. Pieces are sometimes broken out of a foot board, especially where bolts pass through the wood and this tends to impair the security of the board. All foot boards on the various engines should be maintained at a standard height and care should be taken to observe that the boards are not allowed to run too close to the rail or too high above it. A switchman develops a natural habit in jumping for the footboard and unconsciously feels for it at a usual height. Any great variation from its usual location causes him to misjudge his step.

While it is the duty of the master mechanic to see that those in charge of roundhouses and engine terminals allow no engines to go into switching service with defective foot boards, it is equally the duty of trainmasters and other railway employes concerned, to endeavor to detect such defective equipment and make reports that will lead to repairs being made at the earliest possible moment.

Excessive Rolling of Flues

WITH the increased interest taken in the flue question, great improvement has been made in methods concerning the care and maintenance of flues. It is observed however, that some of the old methods of handling flues are still in vogue. In most cases, this is probably due to neglect, as lack of knowledge can hardly be charged when the subject has been so thoroughly discussed.

There is a practice and a destructive one to flues still followed, even on roads which have given considerable attention to the flue question. This refers to excessive rolling and expanding. Operating conditions have been somewhat responsible for this practice as the shortage of motive power made it necessary to employ every means to turn locomotives rapidly at terminals. But an allowable practice in an emergency becomes an abuse if continued when there is no need for it.

The practice of excessive rolling and expanding flues was born of necessity. When an engine (already ordered out) would arrive at a roundhouse with flues leaking, the flues were worked over hot, with the roller or expander. This stopped the leaking for the time being—long enough to get the engine out of the roundhouse and perhaps over the division. At the next roundhouse the operation was repeated and likewise for successive trips until finally the flues were worked down to a point where they would hold no longer. The engine would then be sent to the shop to have flues taken out which had given perhaps one half of the customary mileage.

While a certain amount of expanding or prossering may be of little detriment to the flues, the use of the roller for tightening flues in the sheet is considered bad practice. Both operations harden the metal and reduce its ductility which is an essential property of flue material. After the flue has been brought in perfect contact with the sheet, the further use of the expander or roller will not make the flue any tighter, but will reduce the thickness of the metal and decrease its ductility. The less work done on a flue the longer it will last.

It is believed that more mileage will be obtained from flues and with fewer failures and less cost of maintenance if greater care is taken to properly set the flues when the engine is in the shop and by a more efficient system of feed water handling and firing on the road, reduce flue leakage and obviate the necessity of frequent expanding. Under the conditions which exist more or less generally, flues are not worn out by service but by the excessive use of the roller or expander.

Coup Side Clearance

ALTHOUGH considerable difference of opinion exists regarding the proper side clearance for couplers on freight cars, it is evident that present practice tends toward the use of greater clearances than were formerly recommended. The more general introduction of the steel car and the addition of definite information on the subject from practical tests, are largely responsible for the change in practice.

With the advent of the steel car it was natural that the coupler clearance be made the same as on the wooden car. Allowances were not made for the difference in construction but later it was thoroughly demonstrated that the original clearance was too small. Practical tests show that coupler clearances of 2½ inches or more are advisable for steel cars. On a prominent road, tests were made which showed that a 4-inch side clearance was more efficient than a 1-inch clearance as the load of the train was decreased over 5 per cent when the cars were equipped with couplers having the larger clearance.

It is evident that all side thrusts and strains from couplers when cars are going around curves will be transmitted to the flanges of the wheels and obviously the proper side clearance will be that which reduces the pressure of the flange against the rail to the smallest amount. In this, the coupler side clearance bears an important relation to broken wheel flanges and economical train operation.

That coupler side clearance is an important factor to consider in connection with the large number of broken flanges on cast iron wheels, under heavy capacity cars is now generally acknowledged. While the most efficient coupler clearance has not yet been determined, experience on a leading railroad shows that with a large number of cars in service two years or less, having coupler clearances of 4 inches, not one case of broken wheel flanges has been reported. This experience is not conclusive but it shows that an important relation exists between coupler clearance and flange breakage of cast iron wheels.

While the opinion still prevails that the wheel flange is relieved of a certain amount of side strain on curves by the under framing of the car, when a limited coupler clearance is used, the conclusion is illogical and not substantiated by facts. It is well known that the side strain on the platform of the car from reduced coupler clearance is considerable—the condition of center sills and carrier irons testifies to this very plainly. The strain thrown on the car body is certain to be transmitted to the flanges. This is one of the causes for broken flanges of cast iron wheels. The proper coupler clearance will reduce the strain on wheel flanges to a minimum amount when cars are passing curves, eliminating a large proportion of flange breakages which constitute one of the most serious mechanical problems in the maintenance of cars.

Length of W ter Glass

FROM the lack of uniform practice in regard to length of water glasses on locomotives it would seem that either this matter has not been considered of much importance or that experience on the subject has been widely different. An investigation of the question, however, shows that it is worthy of careful consideration and that the existing variation in practice is generally unwarranted. Present practice regarding the length of water glasses on different roads varies from eight to sixteen inches.

Primarily a water glass is an indicator for showing the depth of water carried over the crown sheet of the boiler. It was devised as an additional check on the gauge cocks for the protection of the crown sheet against low water and consequent burning. While the determination of the lower level of water carried in the boiler was deemed important, it would seem that the amount of water carried above the safe point was considered of little consequence and a matter of choice with the engineer. Thus water glasses of all lengths are found in service, although little difference in the location of the lower fitting is observed.

The location and length of water glasses is important from the point of safety and economical performance of locomotives. For the protection of the crown sheet the water glass should be located at a standard height above this sheet, so that definite instructions can be issued to engineers that will apply to all locomotives. The custom of not following a uniform practice in locating water glasses on different types of locomotives has resulted in burned crown sheets, which could not be properly charged to neglect of the engineer. Unless the height of the glass above the crown sheet is indicated (which is seldom) the amount of water carried over the crown sheet is purely a matter of guess work to the engineer. He can be guided alone by past experience and that is practically valueless when applied to conditions of which he knows nothing.

The length of the water glass is important as it determines the maximum amount of water that will be carried in the boiler. The average engineer will carry the water as close to the "top nut" as possible. It is readily apparent that the water level maintained in the boiler bears a certain relation to locomotive performance. When too much water is carried the result is generally wet steam and priming, which destroys lubrication in valves and cylinders and reduces the power of the engine. Under certain conditions water is carried over into the cylinders in such quantities as to break out cylinder heads and bend pistons. The practice of carrying a high water level in a locomotive boiler is not productive of economical results.

Present practice tends toward the use of a shorter glass, averaging about eight inches in length. It is believed that this is the most practical length for a water glass on a modern locomotive boiler. As a change from the old practice to the new would entail considerable time and labor, the method followed by one road in shortening water glasses with little expense and delay, is worthy of note. The location of the top fitting was not changed but a nipple of the proper length screwed on this fitting and over the glass, so that only the desired length of glass was visible. In this manner the shorter glass was secured at slight expense and without taking the engine out of service. This practical method could be adopted by other roads to advantage.

Locomotive and Car Repair Shops

Frisco System

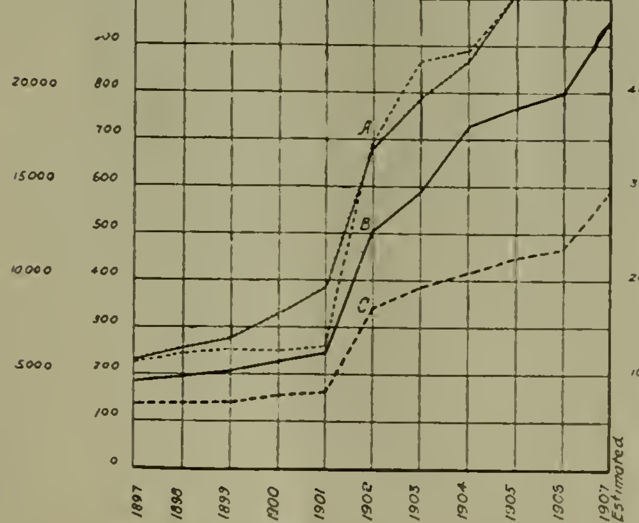
Springfield, Mo.

CONSTRUCTION work has been begun upon a new shop plant at Springfield, Mo., to provide generous and elaborate facilities for repairs of locomotives and cars of the Saint Louis and San Francisco Railway. At this time the work of construction is well under way. Grading has been advanced to a considerable extent, most of the foundations have been built and a portion of the structural steel has been received. With the exception of tracks, the contract for construction has been awarded to The Arnold Company and this company has prepared the plans, acting in co-operation with Mr. W. A. Nettleton, general superintendent of motive power, Mr. G. A. Hancock, superintendent of motive power and Mr. M. C. Byers, engineer of maintenance of way, under the approval of Mr. C. R. Gray, second vice-president.

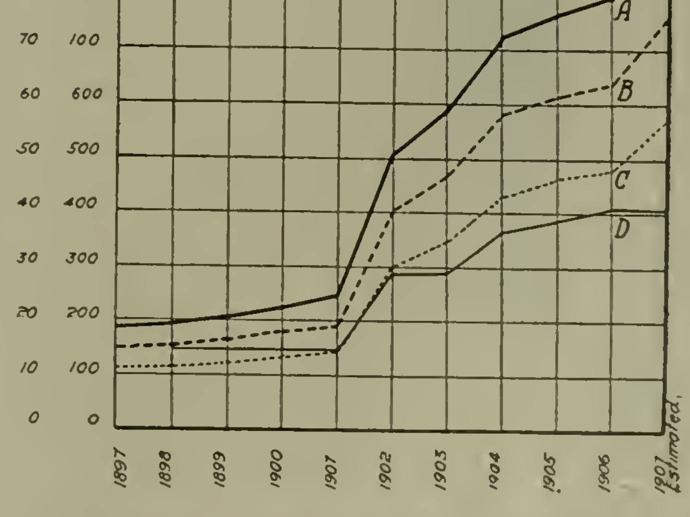
The original features of design noticeable in the plans, the provision for assembling the many buildings of such a large plant in compact form, at the same time providing for future extension of 100 per cent in practically all departments, with ample room for storage and distribution of material; and the careful analysis of governing conditions upon which conclusions concerning the size of the plant were based, renders a consideration of this shop layout unusually interesting. Any description of the plant at this time can be but preliminary and it is expected to present a detailed description later.

GOVERNING CONDITIONS

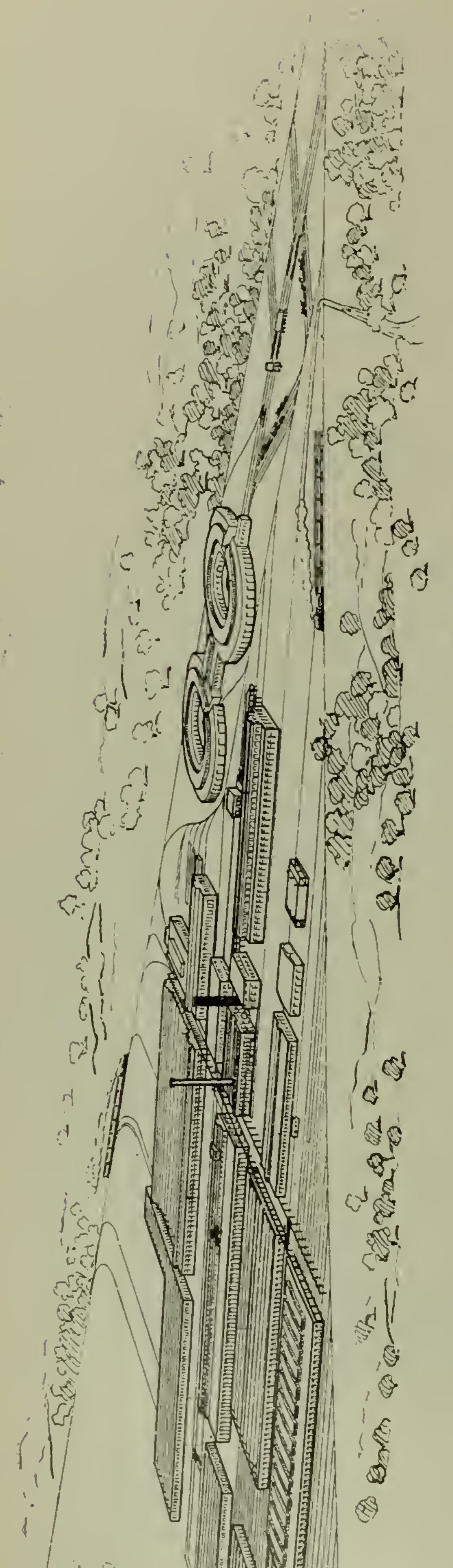
After a careful consideration of the conditions of motive power equipment, rolling stock and repair shops, together with the necessary requirements to maintain the equipment in satisfactory condition, the conclusion was reached that new shop facilities on the system were absolutely necessary. It was deemed inadvisable to handicap the present repair shops by extensive changes as the work of remodeling would interfere with the work of keeping up repairs. The present principal shops of the system situated on the north and south sides, respectively, of the city of Springfield are not adapted to further extension and are now cramped with present facilities. Therefore, in order to give proper consideration to future growth a new site for the shop seemed essential to economical improvements. As Springfield is the approximate



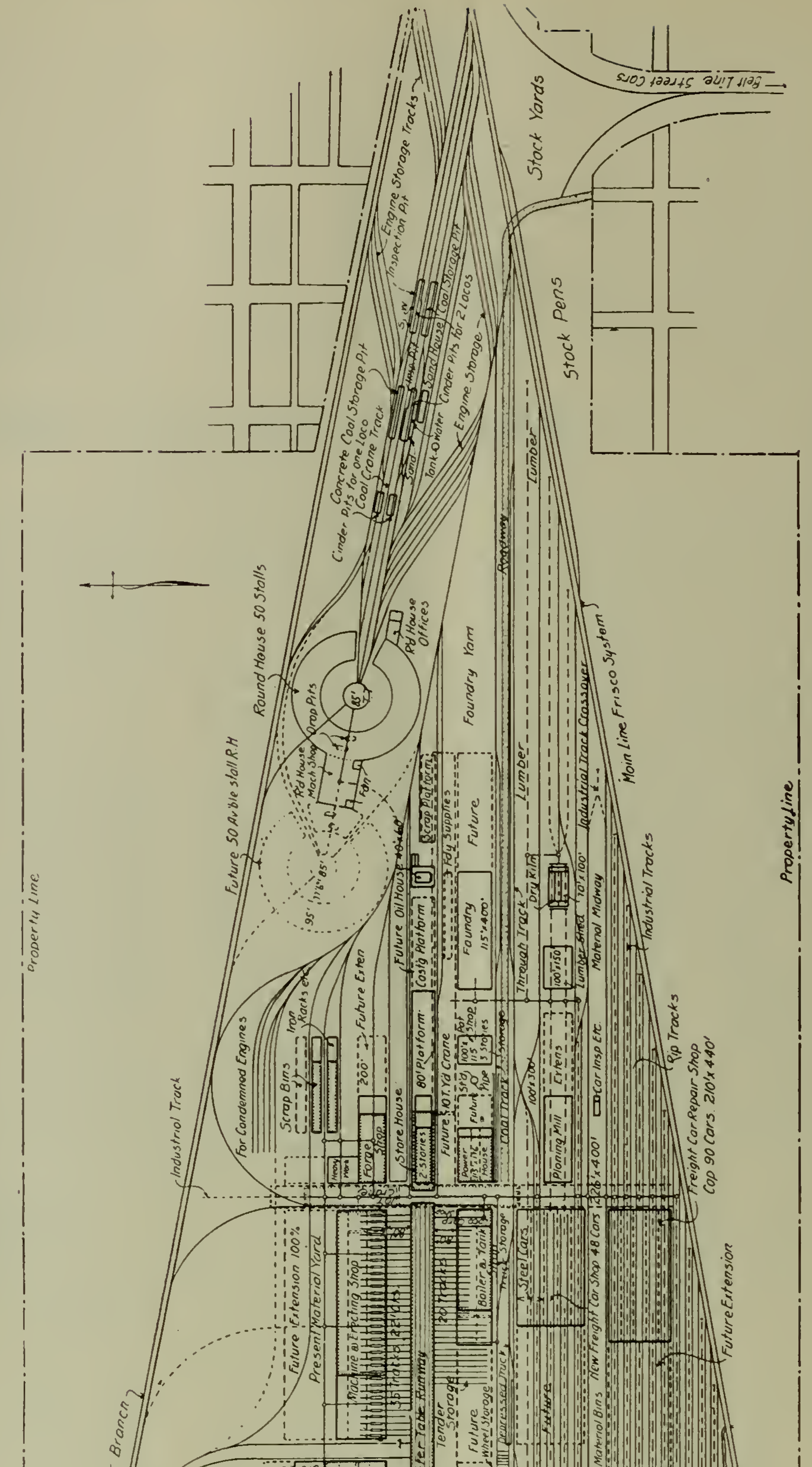
GROWTH IN MILEAGE AND EQUIPMENT OF THE FRISCO SYSTEM IN THE PAST TEN YEARS.



INCREASE IN NUMBER OF LOCOMOTIVES ON THE FRISCO SYSTEM COMPARED WITH THE INCREASE IN REPAIR PITS FOR GENERAL REPAIRS.



GENERAL LAYOUT OF THE NEW LOCOMOTIVE AND CAR REPAIR SHOPS OF THE FRISCO SYSTEM AT SPRINGFIELD, MO.



GENERAL LAYOUT OF THE NEW LOCOMOTIVE AND CAR REPAIR SHOPS OF THE FRISCO SYSTEM AT SPRINGFIELD, MO.

center of the system in regard to both mileage and traffic the logical location of a shop plant for immediate needs is naturally at this point. The advantages of this location are further enhanced by the fact that while the operations of the two shops now at Springfield should not be interfered with by new construction, the new shop will ultimately absorb the equipment of both old shops and the labor now utilized by the existing shops may be readily transferred to the new one.

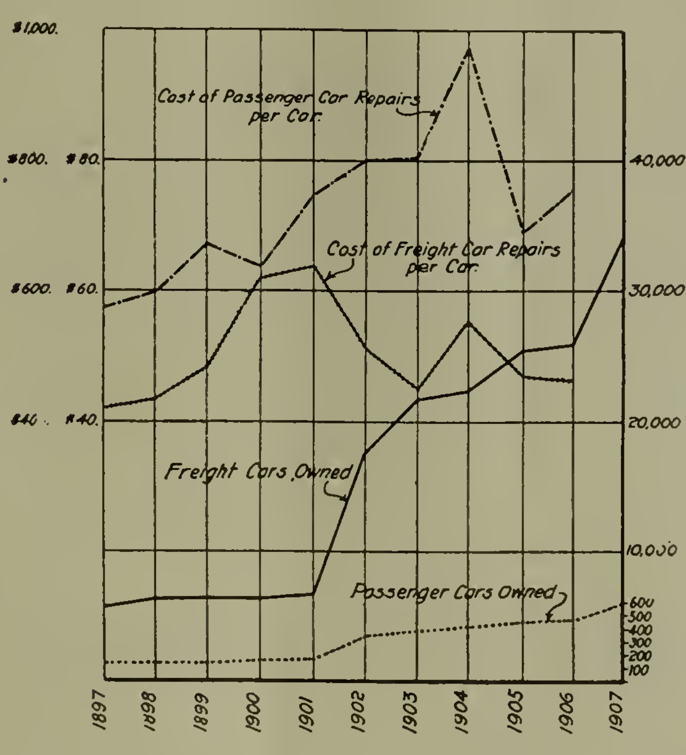
FACILITIES FOR IMMEDIATE NEEDS

The shop plant as now being constructed for immediate needs includes facilities for repairs to locomotives and to passenger cars. The freight car repairs, although increasing rapidly, are distributed over the system to such an extent that improvements for this section of the work at Springfield are not considered urgent at this time. In view of the demands that may be expected to arise at a shop plant situated at the traffic center of a large railway system, the design of the shops provides for additional departments for repairing freight cars and considerable manufacturing facilities for all departments.

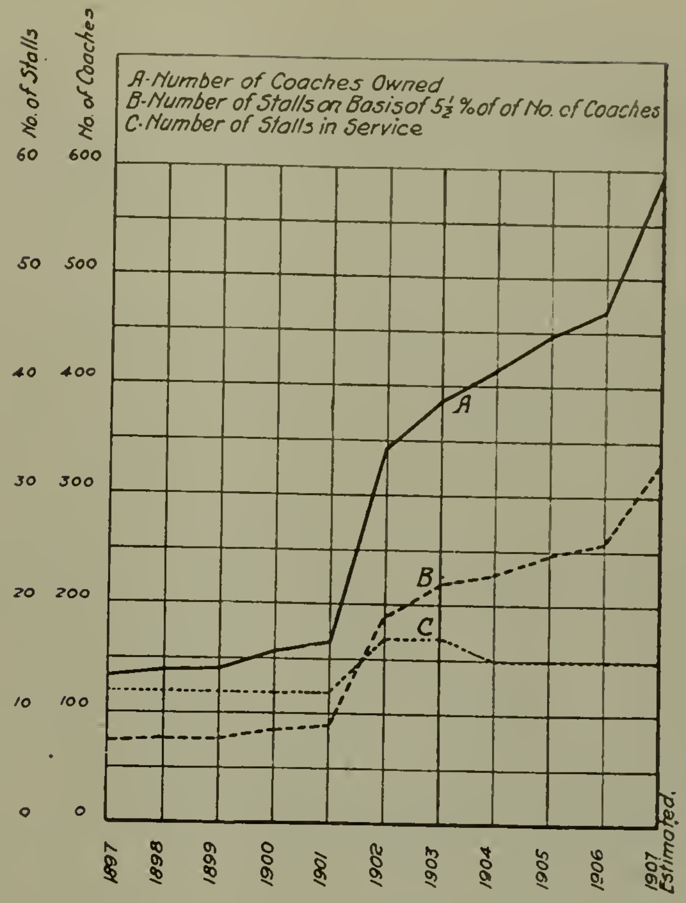
The accompanying engraving illustrating the general layout of the yards and buildings shows the complete plan on the basis of 35 locomotive erecting stalls and 28 passenger car repair stalls, with tributary departments for each in proportion, together with power plant and store house. The car department will include steel freight car shops, with a stall capacity of 48 cars and wooden freight car shops with a capacity for 90 cars, all with ground space adjacent for 100 per cent increase. At present the locomotive shop is to be built with 25 erecting pits and the coach shop with 22 stalls. The freight car department will not be included in the work now under way.

PRELIMINARY STUDY

Preparation of the shop plans resulted from a careful study of the motive power statistics of the system and a thorough analysis of existing conditions. From the data so obtained specifications were made as to the extent of plant required and the sizes of the principal departments were determined.



COST OF PASSENGER AND FREIGHT CAR REPAIRS ON FRISCO SYSTEM, AND INCREASE IN EQUIPMENT FOR THE LAST TEN YEARS.



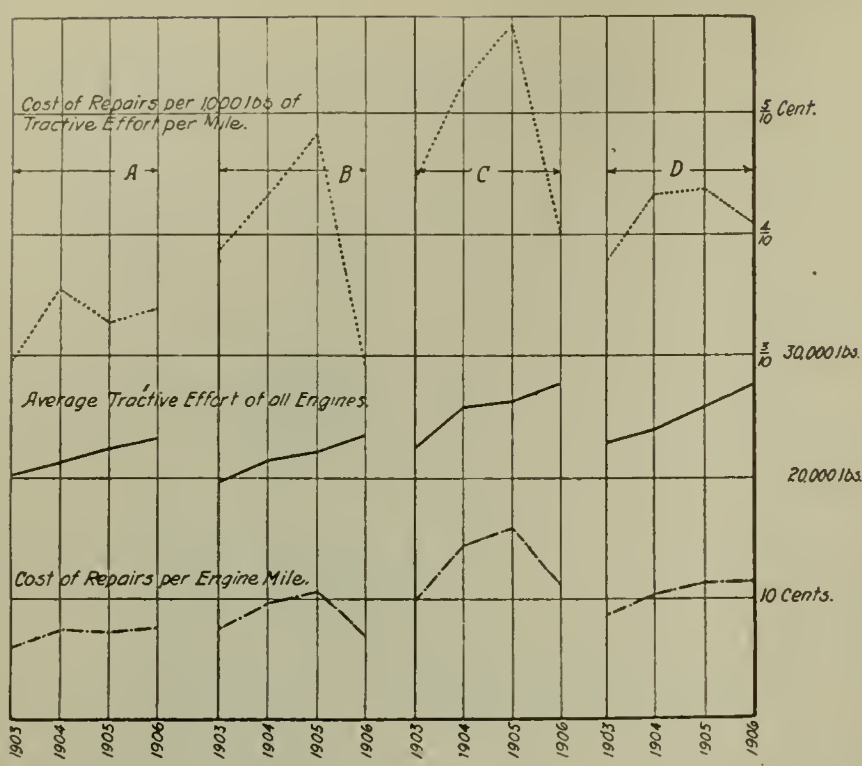
INCREASE IN NUMBER OF PASSENGER CARS ON THE FRISCO SYSTEM COMPARED WITH THE INCREASE IN NUMBER OF COACH REPAIR STALLS.

The growth in mileage and the increase in equipment on the system during a period of ten years, are shown graphically by an accompanying chart. Since September, 1906, when the shop proposition was first taken up, the following equipment has been added: 128 locomotives, 108 passenger cars, 5945 freight cars.

Another chart shows the increase in number of locomotives compared with the increase in number of repair pits during a period of ten years. Curves on this chart also show the number of pits required to maintain repairs on what might be called a maximum and minimum basis, 8 per cent and 6 per cent, respectively, of the total number of locomotives. The former basis is used by several large railroads and the latter is conceded to be very conservative. Curve "D" indicates that shop facilities for repairs have become more and more inadequate since 1902. As a matter of fact, no real facilities for heavy repairs have been added since that date, the engine pits gained being roundhouse stalls and a few coach tracks which were remodeled for locomotive repair service. Curve "D" has been corrected for the period later than 1903 on a basis of approximately 50 per cent efficiency of pits added since that date.

While it has been necessary on the Frisco system to make repairs in various roundhouses that would ordinarily be made to better advantage in repair shops, it is interesting to observe that during the period of the last four years the cost of repairs on this system has been materially below that of three other similar systems among which comparisons have been made. These comparisons are shown graphically on an accompanying chart and the facts illustrated are found to hold good even when the differences in size of locomotives are equalized on the 1,000 lbs. of tractive effort basis.

Careful consideration of the traffic conditions through-



COST OF REPAIRS PER ENGINE MILE AND PER 1000 LBS. OF TRACTIVE FORCE PER MILE AND AVERAGE TRACTING FORCE OF LOCOMOTIVES ON FRISCO AND THREE COMPARABLE RAILWAY SYSTEMS.

out the year indicated the desirability of providing facilities for so maintaining repairs as to keep the maximum number of engines in service at intervals of maximum traffic. Ths necessitates making repairs at a faster rate during certain months of the year than in others and means the requirement of more shop space to take care of congested periods—the shop hours being shortened or new construction undertaken during the period of least repairs. This arrangement would turn out the same number of locomotives for the year as if they were repaired at a uniform rate, but it accomplishes a more beneficial result in providing engines during a busy season by repairing them during the duller season.

METHOD OF DETERMINING NUMBER OF LOCOMOTIVE ERECTING PITS

With statistics in hand representing conditions peculiar to the Frisco system, the number of repair pits for the locomotive shop was decided according to the following method of calculation:

The total number of engines in 1907, 948 + 45 on order = ..	993
Assume for basis number of engines = ...	1,000
From records total working days per year for shops = ...	288
From records average engine mileage between shoppings =	35,000
From records average engine mileage per month = ...	3,000
From data estimated average mileage between shoppings =	30,000
From data estimated average weight in tons may soon be..	80

Method of calculation—	No. of pits.	Per cent of total.
1. 12.5 engines per pit per year (288 days). (Used by an eastern road.) Rate 23 days per engine......	80	8.0
2. 16.66 engines per pit per year (288 days). Rate 17 days per engine	60	6.0
3. If engines were to be repaired in same number of days as above, allowing only 10 months to do the year's work (see chart showing traffic conditions), $\frac{\text{No. eng.} \times \text{days in shop}}{\text{Working days in year}} = \frac{1,000 \times 17}{240} =$	71	7.1
4. With engines now making 35,000 miles between shoppings and 3,000 miles per month requires 11.6 months to make mileage + 1 mo. in shop $= \frac{12}{12.6} = .95 =$ % of total engines to be repaired per year. $\frac{\text{No. engines} \times \text{\% eng. in shop per year} \times \text{No. days in shop}}{\text{working days per year}} =$ $\frac{1,000 \times .95 \times 17}{288} =$ .... Or total number of engines to be repaired per year, 952.	56	5.6
5. Same as above on basis of 240 days as in 3. $\frac{1,000 \times .95 \times 17}{240} =$	67	6.7
6. With 30,000 miles between shoppings, which is fair basis for next year, and 3,000 miles per month, requires 10 months to make mileage + 1 in shop $= \frac{12}{11} = 110\%$ of total engines to be repaired per year. $\frac{1,000 \times 1.10 \times 17}{288} =$ .... Or total number of engines to be repaired per year, 1,091.	65	6.5
7. Same as above on basis of 240 days as in 5 $\frac{1,000 \times 1.10 \times 17}{240} =$	78	7.8
8. With 1,091 engines per year to be repaired and average at 80 tons, repairing at a rate of 5 tons per pit per day (averaged by a large eastern shop $\frac{1,091 \times 80}{5 \times 288} =$ .... Rate 16 days per engine.	61	6.1
9. With 1,091 engines as in 8, and 240 working days, $\frac{1,091 \times 80}{5 \times 240} =$	73	7.3
Average of 9 calculations	68	6.8

Giving the present shops credit for 35 pits, which they have, 68 — 35 = ... 33 pits

Giving the present shops credit for 35 pits at rate of output 1 engine per pit per month, we have 12 × 35 = 420 engines repaired.

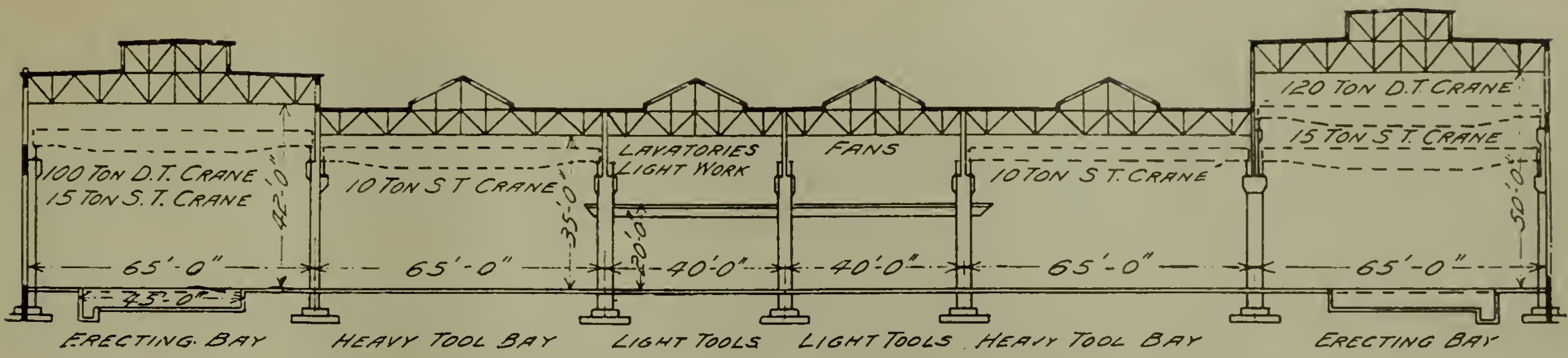
With 952 to be repaired — 420 = 532 for new shop.

With 1,091 to be repaired — 420 = 671 for new shop.

First. $\frac{532 \times 17}{288} =$ .... 31.4 pits

Second. $\frac{671 \times 17}{288} =$ .... 39.6 pits

Average .... 34.7 pits



CROSS-SECTION OF ERECTING AND MACHINE SHOP—LOCOMOTIVE AND CAR REPAIR SHOPS AT SPRINGFIELD, MO., FRISCO SYSTEM.

The conclusion reached is that the proper number of locomotive erecting pits would be 35, with provision for 100 per cent increase to provide for the ultimate absorption of the two present shops at Springfield. The intention at present, as heretofore explained, is to build the shop with 25 pits.

CAR DEPARTMENT REQUIREMENT

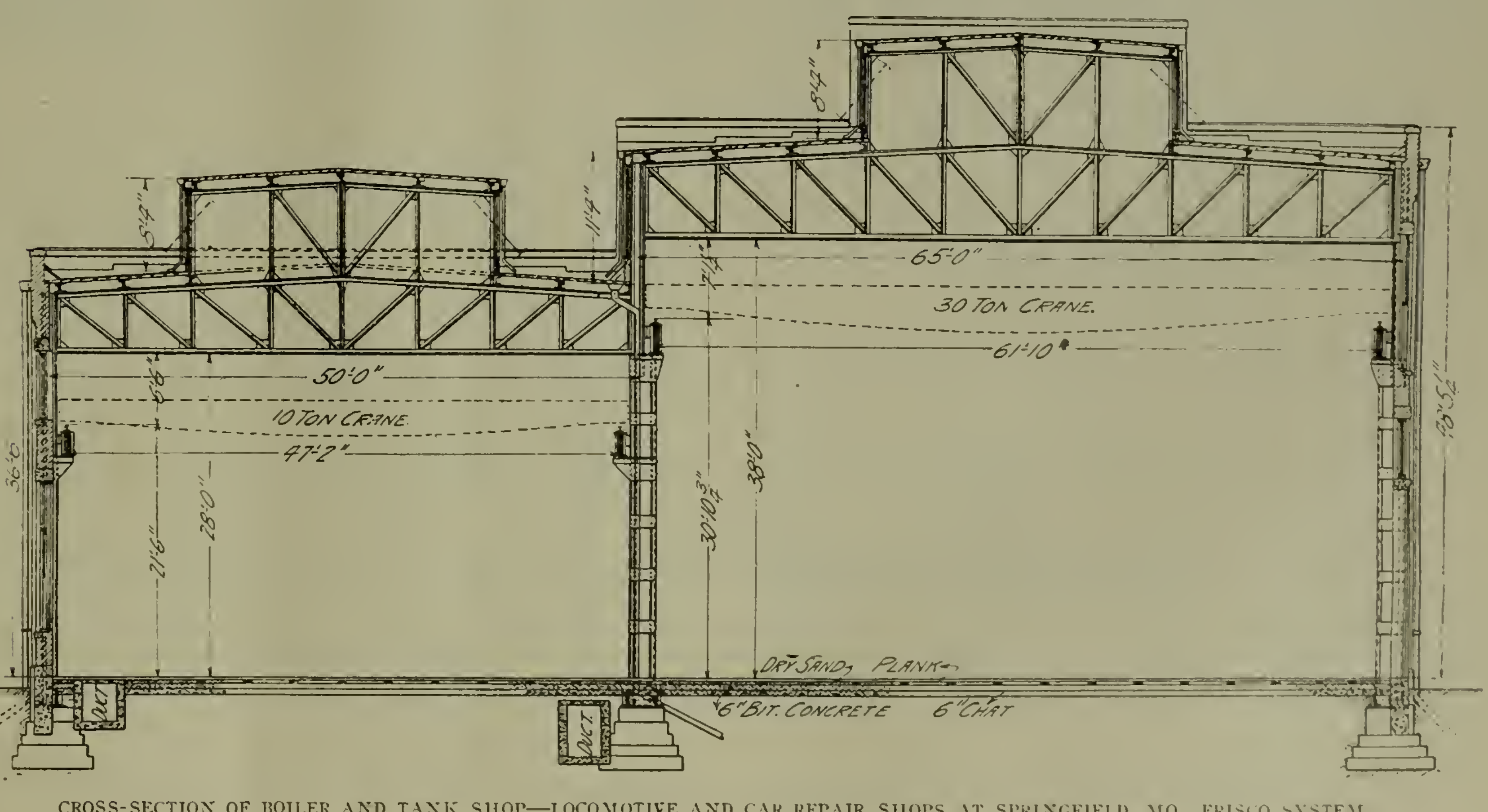
Plans providing for the facilities of the car department were prepared after utilizing data of a nature similar to that indicting the requirements of the locomotive department. The increase in the number of coaches compared with the increase in the number of coach repair stals, during a period of ten years, is illustrated graphically by an accompanying chart.

LAYOUT

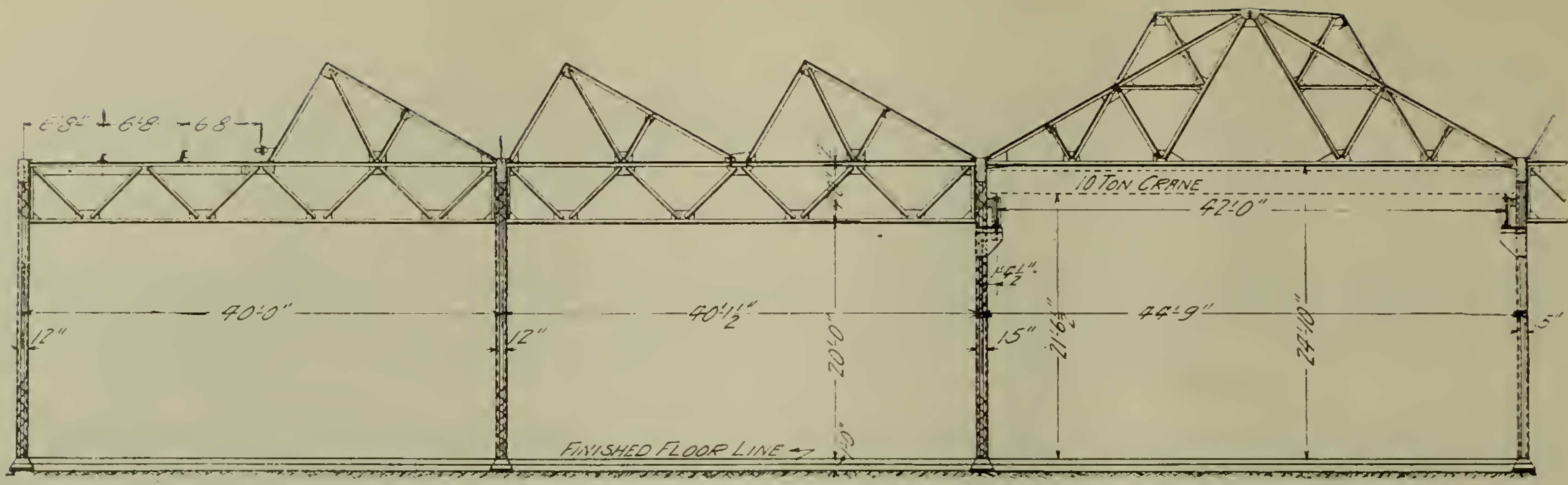
From a careful study of the plans it is apparent that the aim has been to so arrange the buildings and several departments as to group those providing for the same class of work and to provide throughout for intercommunication among the buildings so as to facilitate the movement of material with the least amount of unproductive travel. The disposition of these buildings is such that the addition of future departments will not in any way impair the efficiency of the present arrangement and these additions will be quite as economically located from every standpoint as the original plant.

The principal buildings are located tributary to a crane served midway which traverses the shop plant at about the center of the territory occupied by the buildings. This is connected with the various storage spaces between the buildings providing a generous means of intercommunication. These various thoroughfares and storage spaces, together with an efficient system of industrial tracks conveniently arranged provide for the receiving of material and its rapid distribution. This system of thoroughfares is connected with a wagon road leading from the nearest city street direct to the center of the group of buildings and enters the yards without crossing tracks except at the entrance of the property. This arrangement is particularly convenient for supplies and material from the city or for the entrance of the fire department in case of a conflagration at the shop. The midway is seved by an electric traveling crane of 10 tons capacity, having a span of 78 feet, which traverses its entire length.

The buildings common to all departments are located at the center and comprise the storehouse, power house and forge shop. The storehouse is convenient to the locomotive department, roundhouse and freight car department and by means of the transfer table easy of access to the coach department. The power house is at the center of power requirements being close to the ma-



CROSS-SECTION OF BOILER AND TANK SHOP—LOCOMOTIVE AND CAR REPAIR SHOPS AT SPRINGFIELD, MO., FRISCO SYSTEM.



ONE-HALF SECTION OF COACH SHOP—LOCOMOTIVE AND CAR REPAIR SHOPS AT SPRINGFIELD, MO., FRISCO SYSTEM.

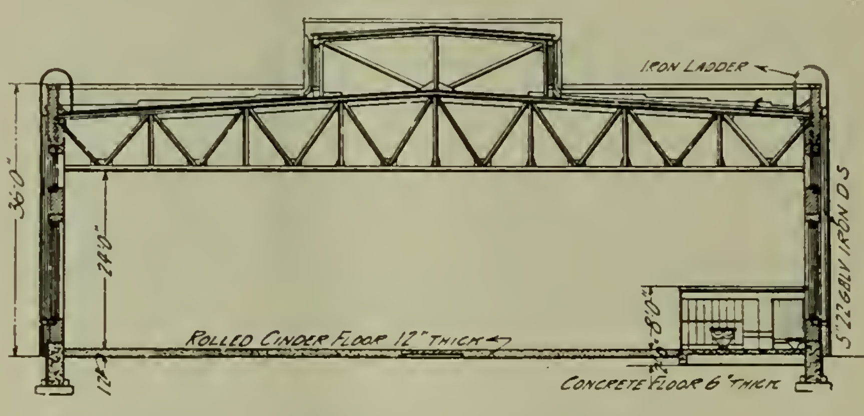
chine and erecting shop and boiler and tank shop and adjacent to the planing mill from which waste material can be delivered direct to the boilers. The forge shop is close to the machine and erecting shop, scrap bins and roundhouses and by means of the yard crane and transfer table or by industrial tracks it is accessible to the coach department where the least output is required. The machine and erecting shop, together with the boiler and tank shop, the coach shop and paint shop are tributary to an 80 foot transfer table which operates in a runway at right angles with the midway. The steel car shop is located adjacent to the new freight car shop making it convenient for composite cars and it is also close to the boiler and tank shop thus bringing all the work of this class close together. The car wheel shop is located as nearly central as possible to the freight car and coach shop. The pattern shop is located close to the planing mill and lumber yard and adjacent to the foundry. The latter is located so that raw material enters from the east and the finished product passes through toward the various departments of the plant where required. A 15-ton locomotive crane running on tracks on each side of the storehouse and casting platform will handle all heavy material in that vicinity from the foundry or the forge shop. The oil house is convenient to the store department and the roundhouse and is not far removed from the forge shop where fuel oil will be used. The roundhouses are convenient to the main line of tracks and also to the shop, and engine handling facilities are conveniently grouped for the rapid movement of locomotives.

LOCOMOTIVE SHOPS

The locomotive department is provided for in two buildings, one including the machine and erecting shop and the other the boiler and tank shop. These shops are on opposite sides of the 80 foot transfer table and the distance from the transfer table to each shop is 80 feet. A "Y" has been provided close to the machine and erecting shop leading from the serving track for the purpose of turning engines which will be useful until the roundhouses are installed. An opportunity for future extension of 100 per cent is provided in the locomotive department without increase in the distance over which material must be moved.

The machine and erecting shop is a modification of the locomotive shop of the Lehigh Valley Railway at Sayre, Pa. The cross section of the shop as illustrated in the accompanying line drawing represents the shop as it is ultimately to be built. The portion now under construction and being built for immediate needs is 170 feet wide. It consists of an erecting bay 65 feet wide, a bay 65 feet wide for heavy tools and a bay 40 feet wide in which light tools are to be located on the first floor, with lavatories and light work on a balcony above. The erecting floor contains 25 locomotive pits each 43 feet long, served by cranes of 100 tons and 15 tons capacity each, operating on the same runways. The heavy tool bay is served by a crane of 10 tons capacity.

The building has a self supporting structural steel frame with brick curtain walls, concrete foundation,



CROSS-SECTION OF BLACKSMITH SHOP-LOCOMOTIVE AND CAR REPAIR SHOPS AT SPRINGFIELD, MO., FRISCO SYSTEM.

wooden floor on bituminous concrete and a composite roof on wooden sheathing. The building is glazed throughout with 1-in. factory ribbed glass. The large doors through which locomotives enter the shop are reinforced with steel. The skylights are of ⅜ in. ribbed wire glass.

The boiler and tank shop is of original design and unusually well equipped with crane service. Its location in a separate building varies somewhat from more general practice but it is thought to give promise of excellent results and is in accordance with the ideas of some railway officials that the noisy work incident to boiler and tank repairs should be in an individual building. The building under present construction will be 344 feet 6 in. long and 117 feet 10 in. wide outside. It is divided into two parallel bays, one of which will contain the boiler and tank erecting stalls and the other the boiler machine tool equipment. The erecting bay is 65 feet wide and is 38 feet from floor to bottom of roof truss. This bay is served by a crane of 30 tons capacity having a span of 68 feet 31 in. The machine tool bay is 50 feet wide and the distance from floor to lower cord of roof truss is 28 feet. This bay is served by a crane of 10 tons capacity having a span of 47 feet 2 in.

COACH AND PAINT SHOPS

The coach shop is tributary to the transfer table common to the locomotive and passenger car departments and the working stalls are arranged transversely. The working tracks are of such length as to accomodate two passenger cars of any class on each track. This building is to contain a central bay 44 feet 9 in. wide, equipped with a 10-ton traveling crane having a span of 42 feet. This bay is to be used for the repair of trucks. On each side of this bay are two bents 50 feet 1½' in. and 40 feet wide respectively. The arrangement is such that trucks from cars on each side of the central bay will be removed and repaired at the center of the building.

The paint shop is on the side of the transfer table opposite to the coach repair shop. This shop is 182 feet 9½ in. by 183 feet 10 in. outside. It is divided into three bays each of 60 foot span. The height from floor to under side of roof truss is 20 feet. The roofs of both the coach and paint shops are of saw tooth construction and both buildings are capable of 100 per cent future extension.

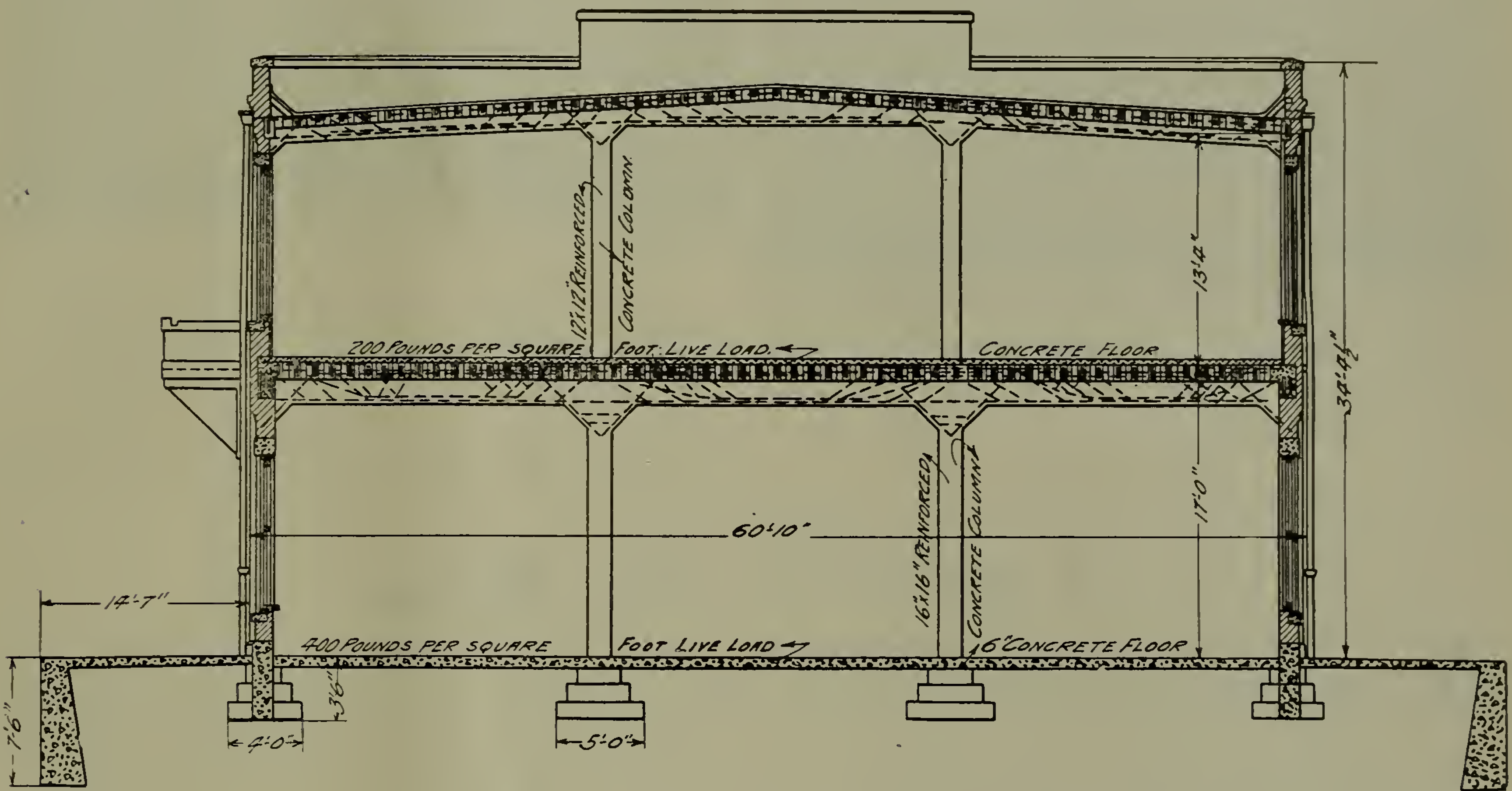
BLACKSMITH SHOP

The blacksmith shop is 102 feet 5 in. wide by 245 feet long and the floor area is covered by a single roof span. The distance from floor to lower edge of roof truss is 24 feet. The building is isolated in order to provide for ample light and ventilation. The roof is provided with an exceptionally large monitor and there is an enormous amount of glass in the side and end walls. As the climate in which the plant is located is such that the majority of the windows can be thrown open during the greater part of the year, the matter of ventilation seems to have been provided for to good advantage. The sliding sashes in the monitor are operated by air cylinders. The floor is of rolled cylinders.

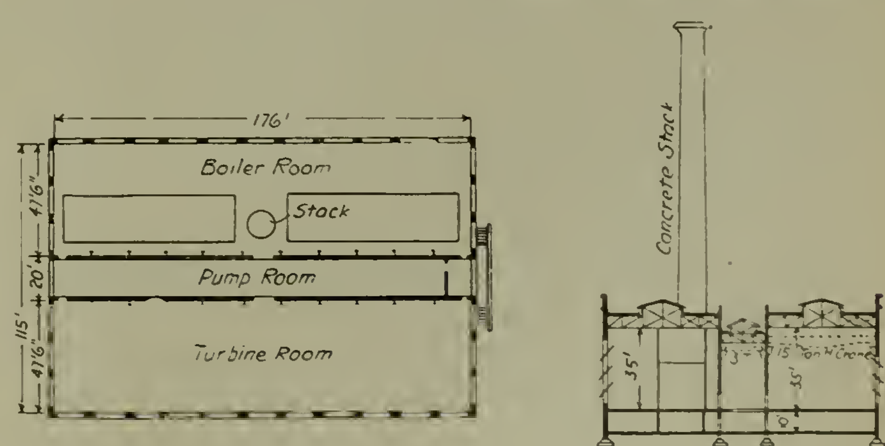
POWER PLANT

The power house is 176 feet long by 115 feet wide and is divided into three sections. The boiler room and turbine room occupy the outer sections and are separated by a narrow section which will include the pump room. The height from floor to lower edge of roof truss in the main sections is 35 feet and there is a 10 foot basement under the entire building. The turbine room is served by a crane of 15 tons capacity. The stack will be of concrete.

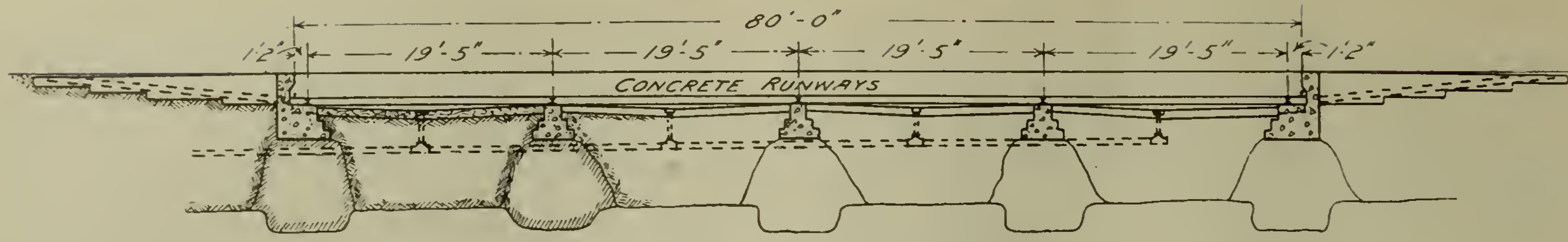
The plans provide for three batteries of water tube boilers, each battery containing two boilers, each of 400 H. P. and space is provided for an additional battery of the same size at the end of the building. The boilers will have mechanical stokers and the boiler room is to be provided with overhead coal bunkers and conveying machinery. In the turbine room provision has been made



CROSS-SECTION OF STOREHOUSE AND OFFICE BUILDING—LOCOMOTIVE AND CAR REPAIR SHOPS AT SPRINGFIELD, MO., FRISCO SYSTEM.



PLAN AND CROSS-SECTION OF POWER HOUSE—LOCOMOTIVE AND CAR REPAIR SHOPS AT SPRINGFIELD, MO., FRISCO SYSTEM.



CROSS-SECTION OF TRANSFER TABLE PIT—LOCOMOTIVE AND CAR REPAIR SHOPS AT SPRINGFIELD, MO., FRISCO SYSTEM.

for three 500 K. W. turbines and one 150 ton K. W. alternator, one motor driven exciter and one steam driven exciter. Space is also provided for an air compressor of 2000 cu. ft. capacity. To provide for future requirements space is also allowed for the installation of one 1,000 K. W. turbine and one air compressor.

STOREHOUSE

The storehouse is a two story structure built entirely of reinforced concrete, 161 feet 6 in. long by 60 feet 10 in. wide. 60 feet of the second story is for drafting room and offices. The office of the general foreman and storekeeper will be on the first floor, while the general office will be on the second floor.

TRANSFER TABLE

An interesting feature in connection with the transfer table is the provision for concrete runways across the pit at intervals of 125 feet. The runways have inclined approaches from the shop floor level to the height of the top of rails. This arrangement provides conveniently for foot passage and light trucking across the pit and to a certain extent removes the ground for objection which has been held by some against the use of transfer tables.

Another feature of this transfer table installation is the use of the third rail. This rail is arranged in a recess in the side wall of the pit and is mounted on paraffined maple blocks.

The maximum speed of the transfer table is 175 feet per minute when loaded and 800 feet per minute when running light.

A Record in Tire Boring

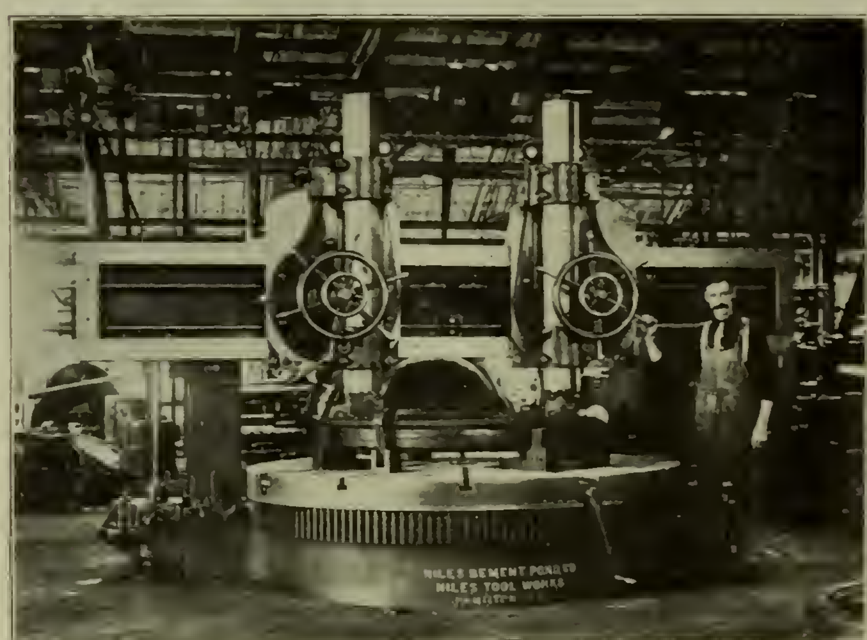
WITH the introduction of modern methods, improved machine tools and high speed steel, the output of the machine shop per unit of floor space has been largely increased over former practice. The output is not determined so much by the floor space allotted to the machine department as by the character of the machine tools and facilities provided and the efficiency obtained from them. Old shops in congested localities with no room for expansion, show increased outputs ranging from 100 to 400 per cent, by the adoption of modern facilities and in a number of cases, shop extension has not been deemed necessary on account of the increased production obtained from old shops equipped with up-to-date machine tools.

An illustration of increased output by the introduction of special machine tools is shown by a new tire boring machine recently installed at the Chicago shops of the Chicago & Northwestern Railway. The machine was built by the Niles-Bement-Pond Co., after designs made in cooperation with Mr. Robert Quayle, superintendent of motive power of the C. & N. W. Ry.

The machine is a double head, 96 inch vertical boring mill with fixed cross rail. The estimated weight of the mill is 60,000 pounds, and as designed, has the largest capacity of any machine for similar service. The table is driven through an outside rack, 94 inches in diameter. A 25 H. P. variable speed motor, with 100 per cent speed range, is mounted on the bed of the machine and direct connected by sprocket gear drive. The machine is mounted on a substantial concrete foundation and when taking the heaviest cuts is free from the slightest chatter. The table is equipped with universal chuck and holding dogs of unique design, which allow the tire to be quickly centered and locked in position.

The location of the machine and arrangement of facilities for obtaining maximum output have been carefully considered. The machine was placed near one of the large shop doors within convenient access to the storage yard, in order to keep down the time and cost of handling material. Two swinging jib cranes with air hoists are arranged at suitable points for handling tires to and from the machine without delay.

The design of the machine and arrangement of facilities are noteworthy as previously stated, but interest centers chiefly in the output which exceeds that of any tire boring machine of which we have record. With one machinist and two helpers, using both cranes, fifty-four, 56 in. tires were bored in 9 hours without running the ma-



NINETY-SIX INCH BORING MILL AT CHICAGO SHOPS OF C. & N. W. RY., ON WHICH 54 TIRES ARE BORED PER DAY OF 9 HOURS. A RECORD IN TIRE BORING.

THE BORING MILL IS SERVED BY 2 JIB CRANES WITH AIR HOISTS FOR FACILITATING MOVEMENT OF MATERIAL IN AND OUT OF THE MACHINE. THE VIEW SHOWS TIRE ON MACHINE READY FOR BORING WITH CRANE FOR DELIVERING TIRES TO THE MACHINE, IN THE BACKGROUND. THE TIRE JUST FINISHED IS SHOWN SUSPENDED FROM CRANE IN FOREGROUND.

REMOVING FINISHED TIRE FROM THE MACHINE. VIEW SHOWS TIRE BEING REMOVED FROM CHUCK. UNFINISHED TIRE IS SHOWN SUSPENDED ON CRANE AT THE RIGHT READY TO BE PLACED ON THE MACHINE.

chine above the usual working speed. This is at the rate of 6 tires per hour and includes all delays incident to shop operation. As the machine has only been in service a short time this performance is especially noteworthy although it probably does not represent the maximum output which will be obtained later.

Two cranes serving one machine of this type is not usual practice, but the value of this arrangement for increasing the output has been demonstrated by a test made under the same conditions as previously outlined, except that one crane was used instead of two. In 9 hours, forty-one, 56 in. tires were bored or 13 less than the number handled in the same period of time with two cranes. Thus, by the addition of one crane the output of the machine was increased 32 per cent, showing the importance of providing ample facilities for modern machines of this kind.

It is believed that the record made by this machine is not only the best to date in regard to tires bored but also the lowest in cost of production. We are indebted to the mechanical officials of the Northwestern for assistance rendered in the preparation of this article.

Traveling Engineers Association

Fifteenth Annual Convention

THE fifteenth annual convention of the Traveling Engineers Association was held in Chicago at the Auditorium hotel, September 3, 4, 5 and 6. The meetings were presided over by president W. J. Hurley, of the New York Central. After the formal opening of the convention by the president, an address of welcome to the City was made by Edward J. Brundage, city corporation counsel, representing Mayor F. A. Busse. Mr. W. A. Gardner, vice-president of the Chicago & Northwestern Railway then delivered an interesting address, which held the attention of all. He mentioned the need for capable men in railroad work and the comparatively limited source of supply from which railroad officers are drawn, emphasizing the opportunity for advancement before every man. The value of co-operation between officers and men was also touched upon and the influence of personality on organization. He continued by bringing out the importance of the work of the traveling engineer. President Hurley then delivered a short address outlining the work to be done by the Convention.

The report of the secretary showed the present membership to be 632 a gain of 25 over the previous year. The treasurers report indicated a satisfactory condition in the financial affairs of the association.

The first subject taken up at the business session of the association was the report of the convention of the Master Mechanics' Association which was presented by Mr. W. G. Wallace. As the Master Mechanics' Convention was not attended by the past president of the Traveling Engineers' Association, Mr. Wallace was requested by the secretary of the Master Mechanics' Association to act as a representative of the Traveling Engineers' Association. As would be expected Mr. Wallace's report was a complete digest of the important work covered by the Master Mechanics' Convention.

HOW TO BEST LOCATE THE FAULT OF AN ENGINE NOT STEAMING WITHOUT MOVING THE DRAFT APPLIANCES.

The second subject presented was the committee report on how best to locate the fault of an engine not steaming, without moving the draft appliances. In the absence of the several members of the committee the report was read by Mr. C. B. Conger who explained that the idea of this report was to develop a discussion on the various methods for locating the cause of an engine not steaming by investigating causes other than the draft appliances. It referred especially to locating such difficulties without adjusting the diaphragm. Following the presentation of the report the remainder of the first day's session was devoted to a discussion of this subject. The subject was very generally discussed and at great length. Mr. Corbett, Michigan Central Railroad, called attention to a number of points which he believed tended toward engine failures, but which he had not noticed to have been mentioned in the report. Among these are the following: Cylinder packing broken and blowing, valves blowing, gasket leaking at base of stack, stack loose, hole in side of petticoat pipe, netting too small or clogged on account of high water in the boiler allowing water to be blown through the stack, blower pipe cut, etc.

As a remedy for the difficulty sometimes caused by the blower pipe being worn by cinders, Mr. Corbett called attention to a method of arranging the blower pipe which has been used on his road. This provides for the pipe entering the smoke box at a point about the height of the center line of the boiler and extending above the diaphragm plate until reaching a position under the stack when the end of the pipe is made to direct upwards. Mr. Corbett mentioned improper pumping and handling of the engines as responsible for difficulties in engines not steaming.

Mr. F. P. Roesch, Southern Railway, discussed the subject of the introduction of ample air beneath the grates and believes that the provision of sufficient air to support combustion is one of the best things to work on in providing for free steaming engines. He also called attention to the necessity of grates being provided with sufficient air space and designed according to the class of fuel to be used.

Mr. J. A. Talty, D. L. & W. R. R., expressed the opinion that the traveling engineer usually feels that when an engine fails to steam it is the place of the traveling engineer to locate the trouble, while mechanical failures are usually to be traced to poor work in the roundhouse and that the mechanics are responsible. Mr. Talty took occasion to corroborate Mr. Corbett's remarks.

Some little discussion followed concerning the anomalies that are sometimes evident in locomotive operation and while engines were known to steam freely under conditions which would be expected to cause an engine failure, illustrations were given wherein engines have been known to steam under conditions wherein a large amount of air was admitted to the smoke box. It was finally conceded, however, that the smoke box should be air tight except for the opening provided by the stack and that all air entering the smoke box should come in through the flues. Mr. J. D. Benjamin, C. & N. W. Railway, placed much of the responsibility upon the engineer and fireman. He said that when an engine comes from the shop the center of the exhaust pipe and the stack are supposed to be in line and the draft appliances properly adjusted. When such conditions exist, he is opposed to rearranging the draft appliances according to the whim of various engineers and he cited instances where a given engine has steamed freely with certain crews while it failed with others.

Following the same line of thought Mr. C. B. Conger went on to say that instead of an engine, it is sometimes the engineer and fireman that are not steaming well. As an example he called attention to a case in which the injector was so arranged that it was difficult for the engineer to reach it from his seat. For this reason the engineer would be inclined to leave the injector working as long as possible and then go as far as possible without applying the injector again. Such treatment is not inducive to proper steaming and when the injector was finally placed in a convenient position, both engine and engineer steamed well.

Mr. Bentley, Rock Island Railroad, asked for a statement as to the cost of hauling one thousand pounds one mile and upon failure to receive a reply, advised that in his experience the cost is from 17 to 18 cents, sometimes running a little higher.

THE WASTE ENERGY IN RAILROAD OPERATION

The first subject to be considered on the second day's session was an individual paper by Mr. D. C. Buell of the International Correspondence Schools, entitled "The Waste Energy in Railroad Operation." The object of the paper is shown in one of the opening paragraphs which reads as follows: "* * * that large amounts of energy are being wasted day by day and that the members desire to know the channels through which this waste occurs and what practical remedies, if any, may be used to wholly or partially stop the leakage." The wastes due to improper management and organization were pointed out in addition to the losses of economy resulting from poor conditions in locomotives. The factors immediately under the jurisdiction of the road foreman were dwelt upon in order to show the personal responsibility of the road foreman in the matter of reducing waste. The discussion was opened by Mr. W. G. Wallace, Ann Arbor Railroad, who called attention to the importance of organization on railroads with the object of reducing waste to a minimum. The discussion was general and various phases of the question were brought out to show where the efficiency of the service was impaired by lack of proper attention. The question of poor workmanship on valves and cylinders with the subsequent loss in steam economy and other uneconomical practices were mentioned. The opinion prevailed that the traveling engineer should have more authority in seeing that work reported is done in the roundhouse before the engine goes out.

THE ADVANTAGE OF THE HOT WATER SYSTEM OF WASHING OUT AND FILLING BOILERS

The report of the Committee on the above subject was read by Mr. M. H. Haig, RAILWAY MASTER MECHANIC. The report is quite complete and as a compilation of data representing the practice followed in various parts of the country, indicates the present status of the hot water method of washing and filling boilers. The advantages of this method in reducing the time of turning locomotives at terminals and overcoming boiler and flue troubles, were clearly presented. It was shown that boilers could be washed in from 2 to 3 hours with no damage to the sheets, as against 6 to 8 hours with the usual method. Figures were quoted from one terminal showing that

$1.52 was saved on every boiler washed by the hot water system, as compared with the cold water method. While the report did not advise the general adoption of the hot water system of washing boilers regardless of conditions, the advisability of using the system in large terminals was strongly recommended.

The discussion of the report was opened by Mr. J. A. Talty, D. L. & W. R. R. who indorsed the findings of the committee. He considered the hot water system of washing boilers to be one of the necessary features of all large locomotive terminals. Mr. F. P. Roesch, Southern Ry. said that boilers could be washed better by cold water and if the washing was properly conducted no harm to the boiler would result. He favored an outside shed for wash out purposes in order to relieve the roundhouse and group all the wash out apparatus in one place. Testimony from one road showed that side sheet and flue failures were reduced 80 per cent by the hot water system of washing out, over the former method of cold water washing. After a general discussion it was voted that the association go on record as favoring the hot water system of washing out wherever practicable.

BEST METHODS OF ELIMINATING THE SMOKE NUISANCE ON SOFT COAL BURNING ENGINES

The committee report on the above subject was presented by Mr. John M. Lynch, Chicago Great Western Ry., and an auxiliary report was read by Martin Whelan. Big Four R. R. The recommendations of the committee are as follows: The preparation of coal before putting it on the tender in order to make the firing easier and more uniform. The single scoop system of firing with the closing of the door after each scoopful to aid the proper mixture of air and the gases of combustion. The standardization of coal for locomotive use, in order to make the draft arrangements more uniform. A more conclusive test of the brick arch as a smoke preventative was deemed advisable. It was also suggested that a wider investigation be made of the pneumatic firebox door closer, mechanical stoker and auxiliary exhaust in order to determine more definitely the merits of these devices as aids in reducing smoke from locomotives.

In discussing the report, Mr. L. M. Carlton, C. & N. W. Ry., said that smoke consumers were largely dependent on the skill and attention of the engine crew. He believed that the condition of the locomotive had much to do with the smoke proposition and emphasized the importance of boring out the flues often, keeping the boilers clean, having a good blower, maintaining brick arches and combustion tubes in the firebox and keeping the fires clean. Mr. W. G. Wallace seconded the remarks of Mr. Carlton and added that the proper organization of the enginemen and co-operation of the management would go a long ways toward reducing the smoke nuisance. In line with what had already been said Mr. Angus Sinclair gave his experience in smoke prevention in England and said that smoke consumers were of little value unless the proper spirit was manifest in the engine crew. The use of the steam jet as a means of reducing smoke was not in general favor although it had given fair results on some roads. The discussion was general and interesting and principally along the lines mentioned.

LUBRICATION OF CYLINDERS AND VALVES OF LOCOMOTIVES USING SATURATED AND SUPERHEATED STEAM.

An individual paper on the subject stated above was read by Mr. J. C. Currie of the Nathan Manufacturing Company. After a brief review of the early history of the hydrostatic lubricator and the subsequent changes made in design due to conditions of locomotive practice. the paper took up the present-day question of lubricating engines using saturated and superheated steam.

The importance of following the recommendations of the manufacturers was emphasized in order to insure the proper operation of the lubricator, under all conditions of service. The specifications for certain size connecting pipes and the maintenance of choke plugs of the proper size were among the principal features mentioned. Straining the oil before putting in lubricator was advised in order to prevent stoppage of the pipes.

Periodical inspection and repair of broken or failing parts were recommended for the prevention of failures and saving of expense. Leaks of valves should not be permitted and the equalizing, oil and water tubes looked after to see that they are sound and tight. The cleaning of bodies and tubes at regular intervals was recommended in order to prevent the development of small defects into more serious ones.

The paper emphatically stated that the hydrostatic lubricator would successfully lubricate the valves and cylinders of superheated engines as shown by exhaustive tests. Mechanically operated devices are not necessary for this purpose. From the present experience, an oil pipe to each cylinder in addition to the ones to the steam chest were recommended.

A great deal of interest was manifest in the paper and the discussion brought out a large number of important points in regard to lubricating locomotives. The opinion generally prevailed that the lubricator should be started at least 20 minutes before the time of leaving. In regard to lubricating superheated locomotives there was a considerable variation in opinion but it was generally admitted that the piston valve was better adapted to superheated practice. On the Michigan Central, hand oilers are provided for use when foaming takes place, in order to place oil directly on the valves and cylinders.

REDUCTION IN COAL CONSUMED AND INCREASED EFFICIENCY OF MEN AND LOCOMOTIVES

A very interesting paper on the above subject was read by Mr. W. G. Wallace, Ann Arbor. The paper recommended the adoption of more up-to-date methods of checking up the performance of both locomotives and employes than are now in force. The common method employed for increasing the efficiency of man and locomotives by means of a performance sheet from 30 to 60 days old was shown to be an unsatisfactory method of obtaining results. The system followed by stationary plants was quoted in order to show the economical results obtained by systematic tests and the prompt remedy of defects.

The gist of the whole paper is contained in the closing paragraphs as follows: "These men are the links in the chain that have not been considered in the performance sheet and an important part of the organization left out entirely in the question of pounds of coal used per 100 ton or car mile when it is used only as a comparison for enginemen and side tracked at a blind siding.

"Why should not the Traveling Engineers Association take this matter up and present it to our superiors in such a way that it will become attractive to them to such an extent that they will have it put into effect, making up a train and checking the speed, tonnage, work of the trainmasters, conductors, trainmen, station agents, overtime delays and so forth, as well as the enginemen and locomotives, on a basis of coal used per ton mile?

"A few trips figured by the traveling engineer showing why the same engine and engine crew used 12 pounds of coal per 100 ton mile one trip and 22 pounds of coal the next, with his explanation proved by the time shown on the train sheet, ought to convince the most skeptical that there is money or coal in it and that indicating men and locomotives by the coal account would develop a higher efficiency of both."

The discussion of the paper was opened by Mr. D. R. McBain, M. C. R. R. by emphasizing the growing importance of the work of the traveling engineer and the necessity of equipping him with facilities for keeping down the coal consumption of locomotives. The discussion was confined principally to the coal question and the main idea brought out was that coal weighing appliances are needed at coal chutes so that engineers will be charged up with the proper amounts of coal taken.

THE ROAD FOREMAN OF ENGINES AND HIS RELATIONSHIP TO ENGINEER AND POOLING SYSTEM

An individual paper entitled the Road Foreman of Engines and His Relationship to Engineer and Pooling System was read by Mr. D. R. McBain, Michigan Central Railroad. The paper defined the important position occupied by the traveling engineer as an official of a railroad company. His relationship to the men was clearly explained and what was expected of him by them as well as the company that employed him. The workings of the pooling system were also taken up and discussed in a broadminded way. This system was justified as an economical, up-to-date method of handling locomotives at terminals.

The paper met with an enthusiastic reception and after a spirited discussion of some length concerning the pooling system it was voted to withhold indorsement of the paper on account of the previous stand taken by the Association which opposed the pooling system, as the best method of handling locomotives at terminals.

ADVANTAGES OF THE AUTOMATIC STOKER AS COMPARED WITH HAND FIRING

An individual paper on the above subject was read by Mr. G. C. Grantier, Erie Railroad. The paper was largely a report of the performance of the Hayden stoker which has been in service on the Erie and some mention is made of the work done by the Monarch stoker. Experience with the stokers mentioned, up to the present time indicate a rapid development in mechanical means for stoking engines. The efficiency of the mechanical stoker was reported as superior to that of hand firing in regard to coal consumption and steam-making power. There was no trouble from flues plugging up or leaking after the stoker was applied. Heat in the cab is reduced and the fireman's duties considerably lightened, giving him more time to watch for signals, etc. A lighter fire is carried and consequently is not in need of such frequent cleaning as required with hand firing.

In conclusion the writer of the paper states that the mechanical stoker is a practical device for firing locomotives and is superior to the hand method of firing on heavy power. With proper care the automatic stoker will give excellent results from every standpoint and is probably the coming method for firing large locomotives.

From the discussion of the paper it was manifest that the subject was attracting wide spread interest. Reports from the roads using experimental stokers were favorable and the opinion was frequently expressed that a properly designed stoker was a better way to fire a large locomotive than by hand. The increased economy of the stoker over the hand method of firing was generally acknowledged. Figures showing this economy varied from 10 to 20 per cent. Exhaust tips were opened up from ½ to ¾ of an inch after the stoker was installed. Taken altogether the opinions expressed were favorable to the stoker. Upon motion to allow representatives of the stoker companies the floor Mr. Crosby of the Crosby stoker and Mr. C. A. Street of the Strause stoker described their stokers and the methods of operation.

WHAT IS REQUIRED OF AIR BRAKES TO PROPERLY CONTROL THE TRAINS OF TO-DAY, AND WHAT HAS BEEN DONE BY RAILROADS AND MANUFACTURERS TO MEET THESE REQUIREMENTS

The Committee's report on the above subject was presented by the chairman, Mr. C. P. Lovell, New York Air Brake Co. The report stated that the requirements of railroad service seemed to require more efficient brakes or improvements in air brake practice to make the standard brake comply more closely with present conditions. That the full efficiency of the standard brake now in use was not realized, is the belief of a number of men who have given the matter considerable attention. A number of recommendations were made to increase the efficiency of brakes. Sufficient air pump capacity was deemed of the first importance. The use of two pumps were not recommended unless each one would furnish enough air to take the train safely to destination in case of a failure of one pump.

In the equipment furnished for different service the following recommendations were made. For passenger service the automatic brake should be applied to drivers, engine truck and tender. Straight air should be applied to the drivers only. For all freight and switching service the locomotive and tender should be equipped throughout with both straight and automatic air. Driver brakes on all locomotives should be equipped with a hand release valve which closes automatically.

The straight air brake as a means for holding the slack when handling long trains and thereby preventing break-in-twos was discussed and its use for this purpose recommended. The size of the standard exhaust part at the engineers brake valve was reported as being too small, failing to reduce the brake pipe pressure fast enough to apply the brakes throughout on long trains causing a very light application of the brakes at the rear of the train or failing to apply at all.

For freight locomotives, main resevoirs with a capacity of not less than 60,000 cu. ins., and for passenger locomotives 40,000 cu. ins., were recommended. The use of two main reservoirs were advised. Recommended practice in regard to percentage of braking power on locomotives based on 50 lbs. cylinder pressure, engine truck from 50 to 55 per cent, drivers from 70 to 75 per cent, trailer from 50 to 55 per cent, tenders 100 per cent of light weight for road engines, 90 per cent for switchers.

The percentage of braking power on cars recommended as follows: passenger cars, 90 per cent of light weight based on 60 lbs. pressure; freight cars, 80 per cent of light weight of car based on 50 lbs. pressure. In regard to brake pipe pressures it was recommended that not less than 90 lbs. or more than 110 lbs. be used in passenger service and 80 lbs. be the minimum pressure in freight service, except on 3 per cent grades where not less than 90 lbs. be used and above 3 per cent grades not less than 100 lbs. be used.

A number of recommendations were made in regard to the air signal whistle equipment in order to avoid failures and improve its efficiency. The report was received after discussion.

SUPERHEATED STEAM AND THE BEST METHOD OF GETTING GOOD RESULTS WHEN ENGINES ARE IN SERVICE ON TRAINS

The report of the Committee on the above subject was presented by Mr. John V. Paul, Canadian Pacific Ry. and a paper on the subject was read by Max Toltz, of the Superheating and Engineering Co. The report described the principal designs of superheaters in use in this country and pointed out the good and bad features of each. Illustrations of the Vaughn-Horsey, Cole, Baldwin, and Schmidt designs were included.

The question of lubricating the valves and cylinders of superheated engines was discussed at some length. It was shown that the hydrostatic lubricator would satisfactorily lubricate valves and cylinders with superheated steam when the proper arrangement of lubricator and oil pipes was used. An independent pipe to the cylinder was deemed advisable.

The successful operation of superheated engines was in large measure dependent on the skill and attention of the engineer. The damper should be kept in working order and a reasonably low water level carried in the boiler. Operating the engine with full throttle was advised in order to keep the circulating tubes full of steam at boiler pressure while the engine was working.

A superheat of from 100 to 200 degrees was considered sufficient to obtain a satisfactory economy in fuel, water and ordinary running repairs. The report was entirely favorable to the superheater for locomotive service.

Mr. Toltz in his paper brought out a number of interesting points concerning the superheater. He stated that although superheating did not increase the pressure, it did increase the velocity of flow of the steam from about 3,000 to 12,000 ft. per minute and the greater blow delivered to the piston by the superheated steam gave the engine a greater starting power. This was equivalent to about 5 or 10 per cent increase in tonnage. He considered a superheat of 600° F. the proper amount to carry in locomotives. At this temperature cylinder condensation was entirely eliminated and entrained water was flashed into steam before reaching the cylinders, thus doing no harm.

Where the superheat was not above 100° F. Mr. Toltz said that a slide valve could be used but above that temperature he advised the use of piston valves. In Germany, poppet valves were just being introduced with some certainty of success.

The discussion of the report was general and interesting, showing the amount of interest taken in the matter. It was shown that the repairs of superheated steam locomotives on Great Northern Ry. were less than the simple and compound locomotives in the same service. On the Canadian Pacific no increase in oil is allowed the engines using superheated steam. In bad water districts there is a great advantage in using superheated steam. The committee's report was received and the committee continued.

ADDRESSES

At the conclusion of the discussion on committee reports a number of short talks were given by Mr. D. R. McBain, W. G. Wallace, L. D. Gillett, J. C. Currie and others.

SUBJECTS

The following list of subjects was announced for the next convention. Committee reports:

1. How much territory should a road foreman of engines cover and how many crews and engines should he have jurisdiction over, so that he may do justice to the service?

2. How can a road foreman of engines interest engineers and fireman in keeping posted on progress in locomotive development including valve gears and steam distribution?

3. What is good practice for traveling engineers relative to coaching and demonstrating to fireman economical methods of firing locomotives and preventing black smoke and the best method of interesting all concerned in coal economy?

4. In what manner can the road foreman of engines best assist in increasing net earnings?

5. Terminal tests of new types of locomotive brakes to locate defects and the remedies of defects.

6. Superheated steam and the best method of getting good results when engines are in service on trains.

Individual papers:

1. Steam reverse gear.

2. Steam heat operation in train service.

3. The air pump exhaust pipe, increasing its size to reduce noise and draft on fire.

4. Electric locomotive operating.

OFFICERS

The following officers were chosen for the ensuing year: President, A. M. Bickel, L. S. & M. S.; first vice-president, J. A. Talty, D. L. & W.; second vice-president, C. F. Richardson, Frisco; third vice-president, F. C. Thayer, Southern; treasurer, C. B. Conger, I. C. S.; secretary, W. O. Thompson, N. Y. C. & H. R. Newly elected members of the executive committee, W. H. Corbett, M. C.; C. F. Schraag, Frisco; W. E. Preston, Southern, with G. C. Grantier, Erie, to serve the unexpired term of F. C. Thayer.

NEXT PLACE OF MEETING

Detroit was selected as the meeting place for the convention in 1908.

VISIT TO FORTY-NINTH ST. ROUNDHOUSE OF C. & W. I. R. R.

Immediately after the close of the convention the members of the Traveling Engineers' Association were tendered a banquet at the Auditorium Hotel by Julian L. Yale & Company, manufacturers of the Miller hot water system of washing and filling locomotive boilers. After the banquet a large number of representatives were conveyed on a special train of the Chicago & Western Indiana Railroad to the 49th Street roundhouse of this railroad where they were given an opportunity of examining the Miller system and of seeing it in operation. In addition to the interest manifest in the washing system, much interest was evidenced in the new roundhouse recently placed in operation.

During the return trip votes of thanks were tendered to the officers of the railroad for their courtesy in providing the train, to Mr. Peter H. Peck, master mechanic of the Chicago & Western Indiana for his kindness in entertaining the delegates and to the representatives of Julian L. Yale & Company for the opportunity of inspecting their appliances.

AMONG THE SUPPLY MEN

The following were among the companies represented at the Convention:

American Brake Shoe & Foundry Co., Mahwah, N. J.—C. C. Higgins, L. R. Dewey.

American Steam Gauge and Valve Mfg. Co., Boston, Mass.—C. C. Kilander.

American Locomotive Equipment Co., Chicago—C. B. Moore, F. G. Boomer, L. S. Allen, J. L. Nickolson.

Ashton Valve Co., Boston, Mass.—J. N. Motherwell.

Ball Watch Co., Cleveland, Ohio.—J. I. Minteen.

Baldwin Locomotive Works, Philadelphia, Pa.—C. H. Peterson.

Bowser & Co., Ft. Wayne, Ind.—W. J. Simpson, W. A. Pitcher.

Chicago Pneumatic Tool Co., Chicago.—C. E. Walker, W. O. Duntley.

Cleveland Metallic Packing Co., Cleveland, Ohio.—Dalton Risley.

Coatsville Rolling Mills, New York.—Chas. Shultz.

Crerar, Adams & Co., Chicago.—G. D. Bassett.

Crandall Packing Co.—B. M. Knobel.

Crane Co., Chicago.—F. O. Fenn.

Dearborn Drug & Chemical Co., Chicago.—Paul Payne, J. F. Roddy, Geo. R. Carr, R. F. Carr, J. D. Purcell.

Detroit Seamless Tube Co., Detroit, Mich.—R. B. Owen.

Detroit Lubricator Co., Detroit, Mich.—A. D. Howard.

Dixon Crucible Co., Jersey City, N. J.—F. R. Beardon

Franklin Railway Supply Co., Franklin, Pa.—A. G. Elvin.

Franklin Mfg. Co., Franklin, Pa.—Geo. S. Stewart.

Galena Signal Oil Co., Franklin, Pa.—R. E. Webb, W. O. Taylor, Wm. Holmes, D. J. Justice, Alex Turner, C. B. Royal, W. J. Vance.

Garlock Packing Co., Palmyra, N. Y.—E. A. Smith, F. A. Ebert, Wm. Smith.

Green, Tweed & Co., New York.—F. E. Ransley.

Grip Nut Co., New York.—E. F. De Garmo.

Hancock Inspirator Co.—C. L. Bran.

Jenkins Bros., New York.—H. B. McLelland.

Johns-Manville Co., New York.—J. C. Younglare, F. M. Gilmore.

John Davis Co., Chicago.—G. H. Reynold.

Julian L. Yale Co., Chicago.—F. J. Cooledge, H. L. Winslow.

Locomotive Appliance Co., Chicago.—G. M. Bean, W. H. England.

Locomotive Stoker Co.—Chas. A. Street, W. H. Strouse, M. D. Johnson.

Marvin Mfg. Co.—F. G. Averill.

McCord & Co., New York.—H. H. Newsom, W. Dietz.

Michigan Lubricator Co, Detroit.—W. E. Bryant.

Nathan Mfg. Co., New York.—Sanford Keeler, L. Kassander, G. A. Bischoff, J. C. Curry.

New York Air Brake Co., New York.—C. P. Lovell, Wm. Dueono, B. Pratt, M. Loquay, L. W. Sawyer, H. E. Tucker, R. G. Parker.

Ohio Injector Co., Chicago.—W. S. Furry, F. W. Furry.

Otis Steel Co.—W. H. Colye, Geo. E. Devey.

Peerless Rubber Mfg. Co.—L. S. Hungerford, Jr.

Pyle National Headlight Co., Chicago.—J. M. Leary, M. A. Ross, F. E. Pyle.

Revere Rubber Co., Cleveland.—W. R. Pearce.

Sellers Wm., & Co., Philadelphia.—C. Conlish.

Star Brass Mfg. Co., Boston.—H. J. Starr.

Storrs Mica Co., Owego, N. Y.—C. P. Storrs.

Talmage Mfg. Co., Cleveland, Ohio.—J. G. Talmage, E. H. James, J. F. Walken.

Westinghouse Air Brake Co., Pittsburg.—I. H. Brown, J. P. Kelly, E. G. Down, S. D. Hutchins, C. P. Cass, W. V. Turner.

Zephon Chemical Co.—F. H. Price.

Ganz Steam Motor Car—Intercolonial Ry.

THE Railway Auto Car Company of New York has just delivered to the Intercolonial Railway of Canada a 120 H. P. steam motor car of the Ganz type. This car was imported direct from the European works of the above company. The car has seats for 40 passengers including 8 in a smoking compartment. A baggage room 7 ft. long is also provided. At the forward end of the car is a compartment 7 ft. long which contains the steam generator, control levers and all accessory apparatus. The rear end of the car is vestibuled.

GANZ STEAM MOTOR CAR FOR INTERCOLONIAL RY., HORSE POWER OF MOTOR 120, SPEED, 30 MILES PER HOUR ON 1 PER CENT GRADE.

The car is handsomely finished in hard wood and the seats are upholstered in leather. The car is heated by steam and lighted by acetylene.

The car is propelled by a 120 H.P. steam motor which is mounted in the forward truck of the car and which drives on the rear axle thereof. This motor is of the Ganz enclosed type so that all parts thereof are free from external influence. The working parts operate in an oil bath thus insuring continuous and perfect lubrication.

The steam generator which is mounted in the motorman's compartment above referred to is of exceedingly light and compact construction, yet very powerful. This steam generator is only 42 inches in diameter and about 4 ft. high. Its construction is such that all parts in contact with fire and water can be quickly and expeditiously exposed for cleaning and repairs.

Before this car was accepted by the Intercolonial a number of severe trials were made. The official test was from Moncton to Harcourt and return, the car covering a distance of 75 miles. The run from Moncton to Harcourt, a distance of 37 miles, was made in 62 minutes or at the rate of about 37 miles an hour. The maximum speed was 43 miles an hour. The total coal burned in the 75 miles was 925 lbs. which is equivalent to 12.03 lbs. per mile. The guarantee called for 16½ lbs. per mile so that a better performance by 4.2 than that guaranteed was obtained. On a 1 per cent grade one mile long from Moncton to Berry Mills a speed of 30 miles an hour was obtained.

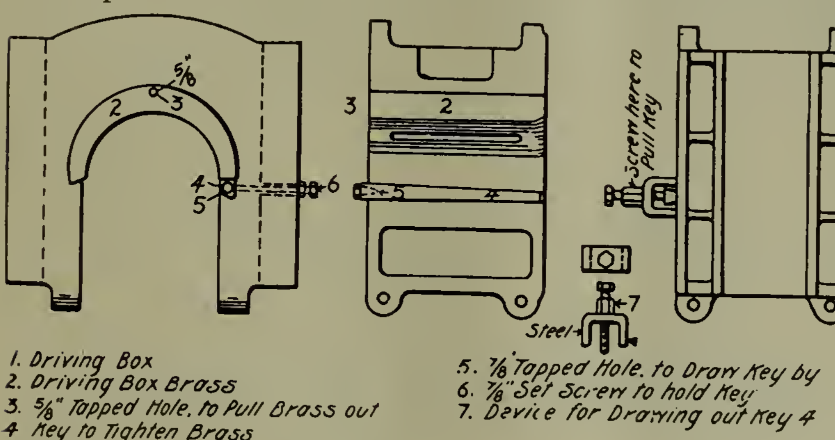
In another test over a distancce of 26 miles the car carried along with it a trailer car weighing 24 tons. The average speed for the 26 miles was 31 miles an hour.

The outside of the car is of all steel construction and presents a very handsome appearance.

Removable Driving Box Brass

An improvement of considerable value, in the usual method of fitting brasses to driving boxes has been recently patented by Mr. Chas. Markel, machine shop foreman of the Chicago and Northwestern Railway at Clinton, Iowa. The patent covers what is termed a "removable driving box brass."

As shown by the illustrations, the brass is held in the box by a taper key, instead of by the usual method, making it possible to readily remove the brass or tighten it in the box without removing the box from the engine. This feature commends itself to every railroad mechanical officer, who is familiar with the large amount of time that engines are out of service on account of driving box repairs.



GENERAL VIEWS OF REMOVABLE DRIVING BOX BRASS, SHOWING METHOD OF APPLICATION TO DRIVING BOX AND VARIOUS PARTS.

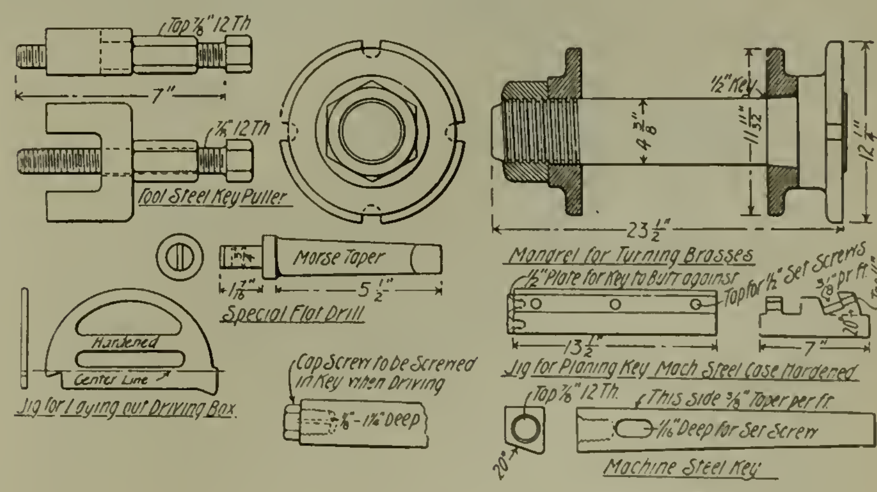
The design and construction of the improved box and brass are shown in the accompanying illustrations. Under one extremity of the brass a slot is cut in the box of suitable size and shape to receive a wedge, which is driven in one and three-eights inches, and so tightens the brass as to require 40 tons pressure under hydraulic press to start it. The wedge extends through the entire width of brass and has a tapped hole in the larger end to receive the device for pulling the wedge, when the brass is to be removed. A similar hole is also tapped out in the brass to receive a bolt for removing the brass.

The method of holding the brass is shown so clearly by the illustrations that further description of it is unnecessary. There are a number of advantages in this arrangement, the principal ones as follows:

First of all, the wedge secures a perfect fit of the brass in the box. When a brass is pressed in, it goes in at 30, 40 or 50 tons pressure, but no one can tell just where it is binding. After the engine is put in service, the brass is soon pounded out to fit the box, and becomes loose. By the improved method, the brass is turned 1/32nd of an inch smaller than box fit, and when the wedge is driven, the brass is forced to an absolutely solid bearing on the outside, and the brass in solid contact with the box.

If through heating, or any other cause, the brass becomes loose, all that is necessary is to drive the wedge a little more, and tighten the brass sufficiently. In case it is desirable to remove the brass to shim it, or put in a new brass, it is only necessary to lift the weight of the one box from the axle, pull the wedge and the brass, slip in a new brass, drive the wedge back to place, and engine is ready for service without resorting to a drop pit. The work can be done in 4 hours which clearly demonstrates the value of the method over the present system which requires two to four days to change brasses and costs from $50.00 to $150.00 in labor and material besides loss of the service of the engine.

Loose driving box brasses contribute materially to



JIGS USED IN CONNECTION WITH MACHINING AND FITTING UP THE REMOVABLE DRIVING BOX BRASS.

broken frames, cross heads, straps and pins, so it is important that they be avoided as much as possible. Owing to the shortage of motive power, locomotives are frequently required to remain in service with loose driving box brasses, with consequent damage to the machinery. With the removable brass, this defect could be remedied at once without taking the engine out of service and other expensive damage avoided. In the general use of this device, the openings in the boxes can all be made to a certain standard for certain classes of engines, and brasses and wedges kept in stock turned to fit the boxes, so that the only machine work necessary for putting in a new brass would be the fitting of the brass to the journal. It is generally admitted poor practice to shim a brass, as the shim buckles when pressing the brass in the box and a poor fit results, or the shim works out and the brass becomes loose. This practice is entirely avoided when using the improved method.

As previously stated, it is desirable to make all boxes, brasses and wedges duplicates and interchangeable for different classes of engines, so that they can be fitted up and kept in stock. For this purpose Mr. Markel has designed jigs that make brasses and keys exact duplicates without any measuring or guess work. The construction and method of using these jigs for finishing up the wedges and brasses will be readily understood from the illustrations.

The boxes are laid out for slotting by first placing square line across face of box and then placing two lines on iron template to correspond with the line on face of box; then scratch line around outside edge of template, and slot the box in the usual manner, until this template will enter the box. All slotting for brass fit in the box is straight slotting, as the taper for key is on one lug of brass only.

The brass is turned 1/32nd inch smaller than box fit on mandrel, as shown, by placing the lathe tool against the hardened washer of the mandrel.

The keys are tapped out on large end ⅞ inch, 12 thread, and hexagon head bolt screwed in loosely. This bolt is used to drive on, which prevents upsetting the end of key. This bolt, also the set screw, has ⅛ inch hole drilled in end, which hole is used to back out the bolt or set screw in case they should become broken. If all parts are made to jigs as shown by blue prints, they will be absolutely duplicate, and brasses can be kept in stock, finished complete, except the bore for axle fit.

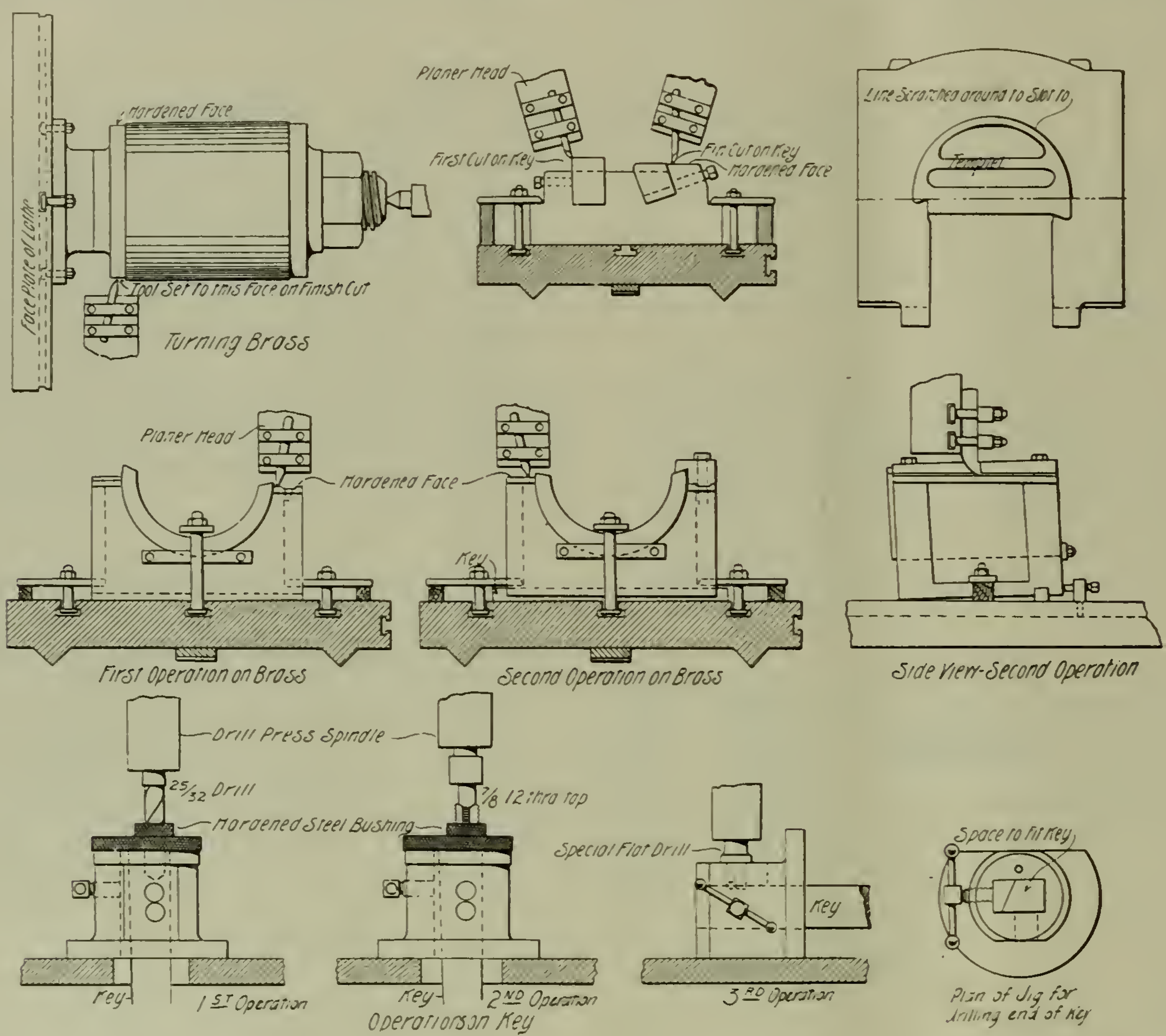


DIAGRAM SHOWING METHOD OF USING JIGS FOR THE EXACT DUPLICATION OF PARTS OF THE REMOVABLE DRIVING BOX BRASS.

The practicability of these boxes has been thoroughly demonstrated in service on the C. & N.-W. Railway, the first one being placed on an Atlantic type passenger engine, in fast passenger service on a 200 mile division, April 9th, 1906, being in service now 17 months, and is in perfect order, never having given any trouble whatever. July 4th, 1906, an engine of the same type, service, and division, was turned out of the shop with all boxes using this brass, and after one year and two months boxes are in perfect order, and have given no trouble whatever. Another engine of the same type, on a 210 mile division, equipped with these boxes January 1st, 1907, has given perfect satisfaction.

The Duluth, Massaba & Northern fitted up one box under an engine in extremely heavy service from blue prints furnished, May 14th, 1906, and it has given the most perfect satisfaction after 16 months' service. The simplicity of the device is shown as the box was fitted up from the blue prints and without special instructions There are now 36 of these boxes in service. There has been a company incorporated under the laws of Iowa, at Clinton, Iowa, called the "Locomotive Improvement Company," for the purpose of putting this box on the market. They do not intend to manufacture boxes and brasses at present, as it is not necessary to cast new boxes, as almost all of those now in use are so constructed that they can be slotted and the wedge used under the brass. The present intention of the company is to license the roads to use the Removable Brass on a royalty basis.

All Steel Passenger Cars

Pennsylvania Railroad

(Third Installment)

70 FOOT STEEL MAIL CAR

IN general arrangement and appearance the 70 foot steel mail car resembles the standard wooden car now in service on the Pennsylvania. The steel car is made 10 feet longer than former mail cars in order to provide storage space at each end of the car to avoid the necessity of turning the car around at terminals. The underframe is similar to that used on the 70 ft. passenger coach ; except four side bearing plates are provided for each truck, and the ends modified on account of the omission of the vestibule and side steps.

The end castings of the center sill are of such shape as to provide rigid support for the door posts of 12 in. I beams. These I beams are relied upon to prevent the car from sweeping away the superstructure of the next, if its underframe should rise above the floor level during collision. Their upper ends are securely framed into the roof structure so that an end shock to the car would be well distributed and not cause serious damage.

The roof construction is practically the same as that used in the passenger coach with the exception that the upper deck sash are of wood arranged to open for ventilation.

The belt rail is of a flat bar instead of the formed section used on the passenger coach and between posts it is re-enforced by a T section.

The window sash are of wood, the lower one is stationary and the upper one slides down. The upper sash is about twice the height of the opening it covers and its upper half is covered with a wire screen. When in the lowest position it affords ventilation through the screen, and in the upper position, glass closes the opening.

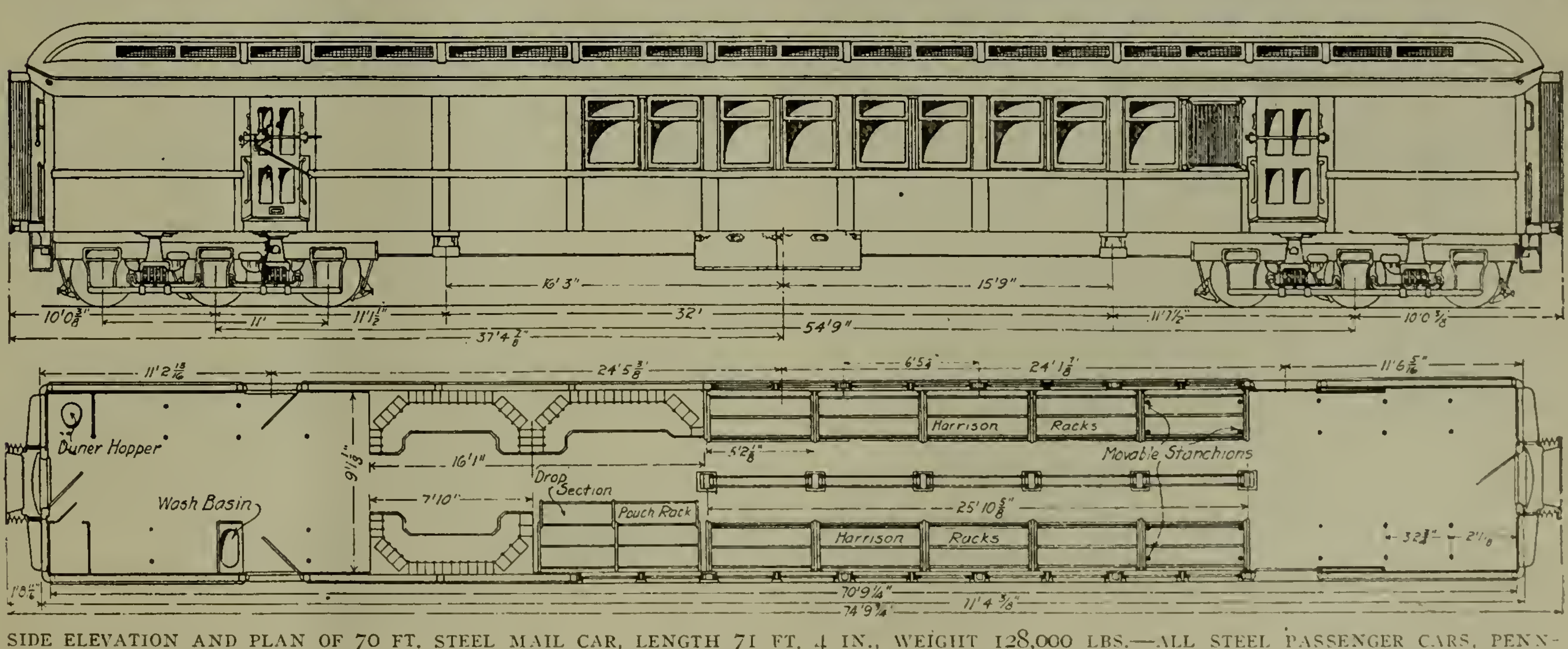
All the interior furniture is of steel, conforming in dimensions to the requirements of the Post Office Department. The letter cases are built up with vertical partitions of steel plate and horizontal partitions formed by wires passing through holes in the verticals. Short horizontal plates are inserted between the verticals and secured to the horizontal wires to form the bottoms and tops of the pigeon-holes. Large and small paper cases are made of 1/16 in. sheet steel, re-inforced at the edges and similar in appearance to the cases used in wooden cars.

The car contains but 370 lbs. of wood, and is lighted by electricity and heated by steam.

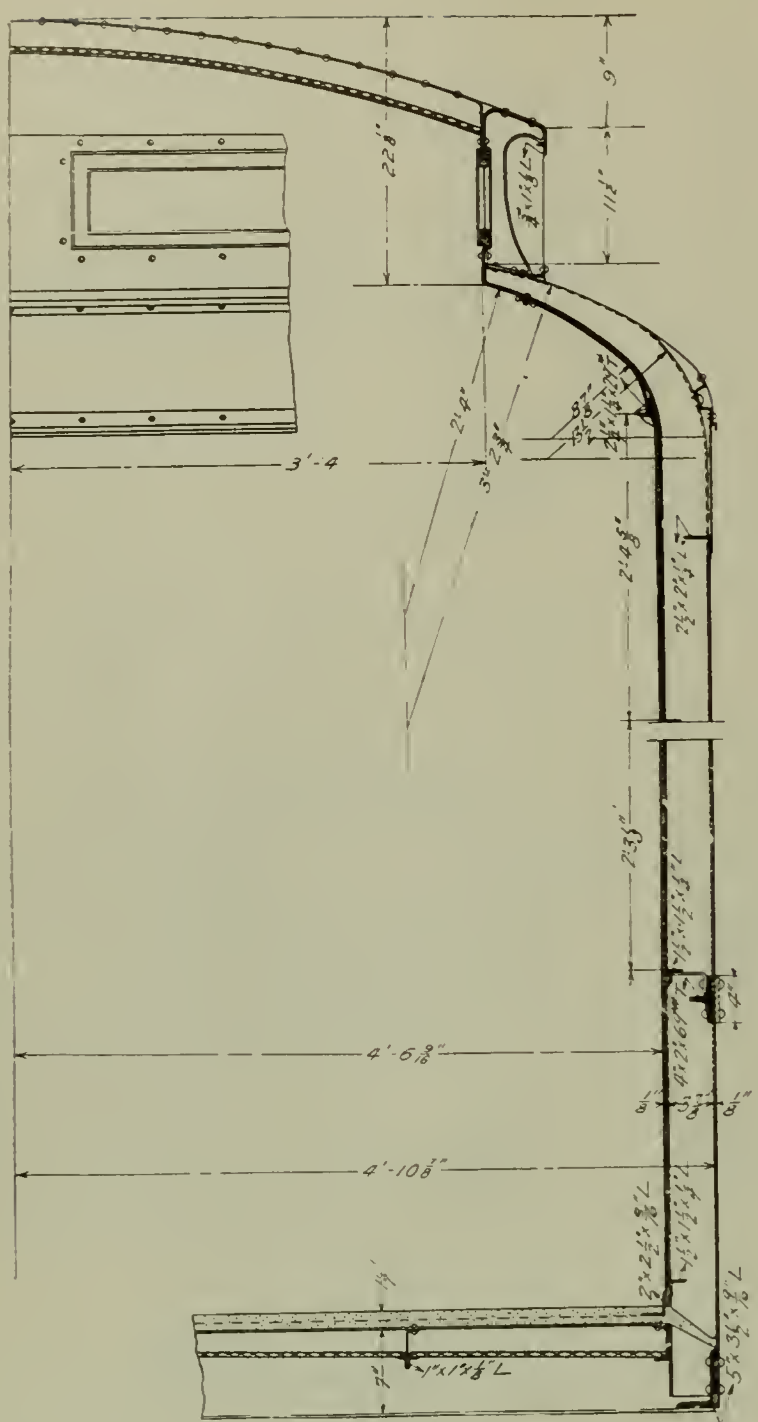
54 FOOT STEEL SUBURBAN CAR

The general arrangement and appearance of this car is similar to the heavy type equipment, but the car is lower, shorter and the space allowed each passenger is less than in the larger cars. The arrangement of seats will be modified to suit the traffic and the saloon omitted if occasion warrants it.

Underframe construction closely resembles the heavy type car, but in order to provide sufficient space for motors the center sill is made more shallow. It is formed of two



SIDE ELEVATION AND PLAN OF 70 FT. STEEL MAIL CAR, LENGTH 71 FT. 4 IN., WEIGHT 128,000 LBS.—ALL STEEL PASSENGER CARS, PENNSYLVANIA R. R.



SIDE WALL CONSTRUCTION OF 70 FT. STEEL MAIL CAR—ALL STEEL PASSENGER CARS, PENNSYLVANIA R. R.

10 inch channels with a single ¼ inch cover plate on top and two ⅜ inch cover plates upon the bottom. This form of section keeps the center of gravity low and decreases the bending moment brought about by the fact that the drawbar is below the center sill entirely. The center plate is of special form adapted to reach the same trucks used on heavy type equipment, and the casting enclosing the coupler and draft gear is attached to the under side of the center sill instead of being placed within it as in the heavy type car.

Framing of the body is similar to that used in the heavy type coach. the main posts being identical except in the matter of length and shape at the top. There are three windows between each pair of main posts instead of two as in the heavy type coach.

STEEL SLEEPING CAR

In order to complete its equipment of steel cars for passenger trains, the Pennsylvania Railroad has arranged with the Pullman Company to design and build all-steel parlor and sleeping-car equipment. A sample sleeping car has recently been completed and is now at the Jamestown Exposition.

In both exterior and interior appearance it closely resembles the standard wooden car. except perhaps in the delicate pearl gray interior finish, which replaces the highly polished natural wood.

Inside sheathing is of sheet steel, backed by asbestos board, to act as a non-conductor of sound and heat. Seat frames and berth fronts are of sheet steel, and window sash are of brass provided with automatic spring balances.

Trucks are of standard Pullman type supplied with cast steel frames and bolsters, in place of the usual wooden members.

The principal dimensions of the car are as follows:

Length over end sills	72 ft. 6 in.
Length over platforms coupled	80 ft. 6 in.
Width over side sills	9 ft. 9¼ in.
Width over eaves	10 ft. 0 in.
Height over all	14 ft. 7 in.

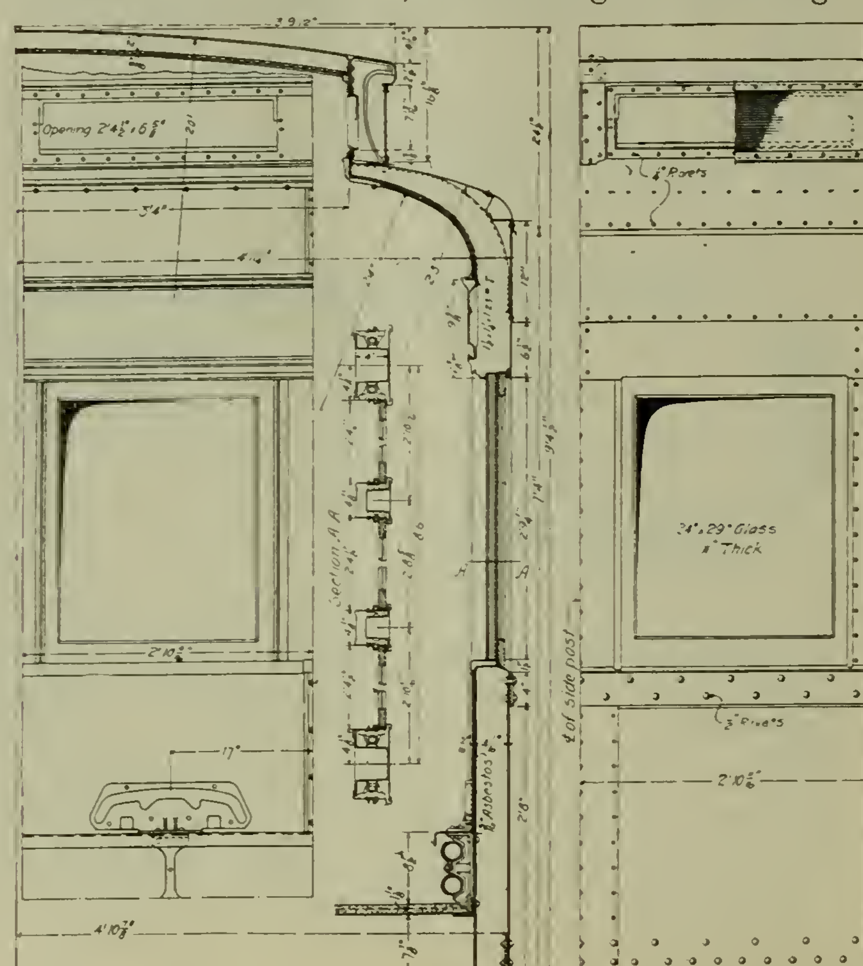
STEEL BAGGAGE AND DINING CARS

The baggage and dining cars complete the list of steel equipment, but as their construction is identical with the cars previously described so far as the design will allow, detailed descriptions are omitted. The baggage cars have a length of 60 feet, 10⅜ inches, weight of 91,000 pounds and a capacity of 40,000 pounds. The dining cars are 71 feet, 11¾ inches long, weight 140,000 pounds and have a capacity of 30 people.

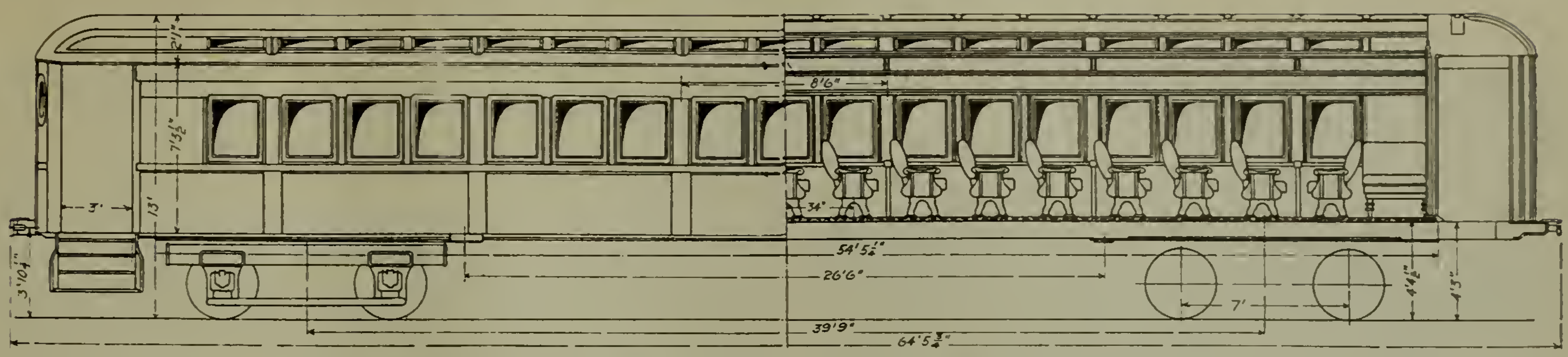
CAR HEATING AND VENTILATING SYSTEM

Passenger coaches will be equipped with a ventilating system by which, with all windows and doors closed, each passenger will be supplied with 1,000 cubic feet of fresh air per hour, which is equivalent to a complete change of air in the car every four minutes,

Air is taken in by two hoods situated on diagonally opposite corners of the car roof. From each hood a vertical duct leads down, within the side of the car, to a horizontal duct which runs the entire length of the car, between the floor and the sub-floor next to the side sill. Above the floor of the car, and running its entire length



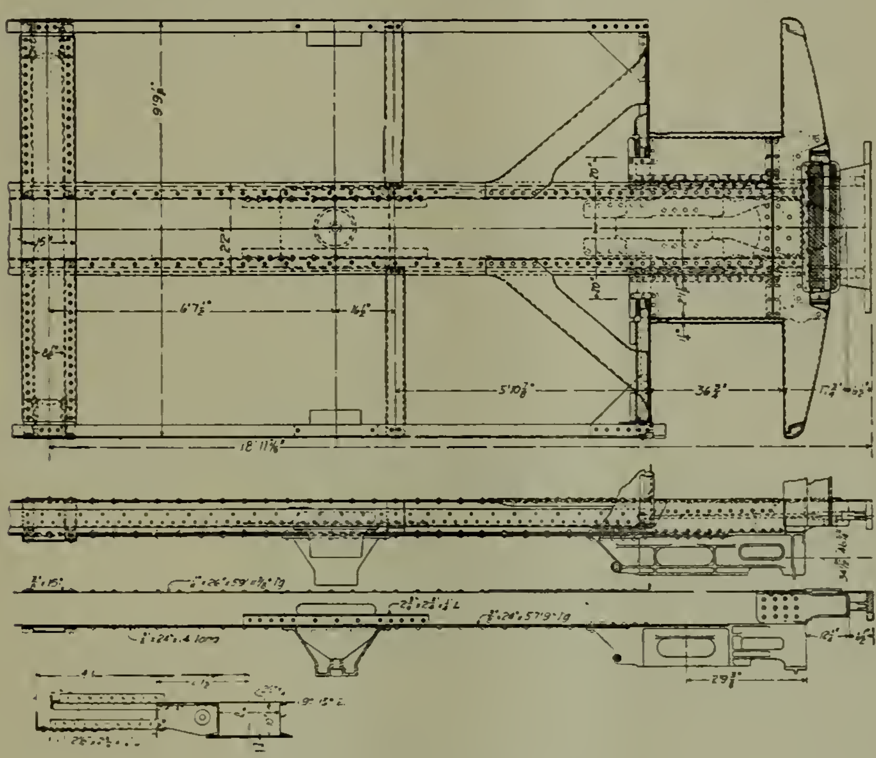
SIDE WALL CONSTRUCTION. 54 FT. SUBURBAN CAR—ALL STEEL PASSENGER CARS, PENNSYLVANIA R. R.



SIDE ELEVATION AND SECTION OF 54 FT. STEEL SUBURBAN CAR, LENGTH 54 FT. 4 IN., WEIGHT 75,000 LBS.—ALL STEEL PASSENGER CARS. PENNSYLVANIA R. R.

along the sides, are rectangular ducts containing the steam heating pipes. Air entering the hood passes down to the duct beneath floor and along this to openings into the duct containing the heating pipes. After circulating about the heating pipes and becoming thoroughly warmed it is delivered into the aisle of the car through tubular outlets beneath each seat.

Air is discharged from the car through ventilators in the roof, which are provided with valves to limit the



PLAN AND SIDE ELEVATION OF UNDERFRAME 54 FT. SUBURBAN CAR—ALL STEEL PASSENGER CARS, PENNSYLVANIA R. R.

amount of air passing. Movement of the car forces the air into the car under slight pressure, limiting the discharge maintains the pressure and prevents the entrance of cold air through cracks about the doors and windows. The ventilation system works equally well in either winter or summer, but the warming of so much fresh air requires considerably more steam than would be needed by the usual methods of heating without much if any ventilation.

CAR LIGHTING

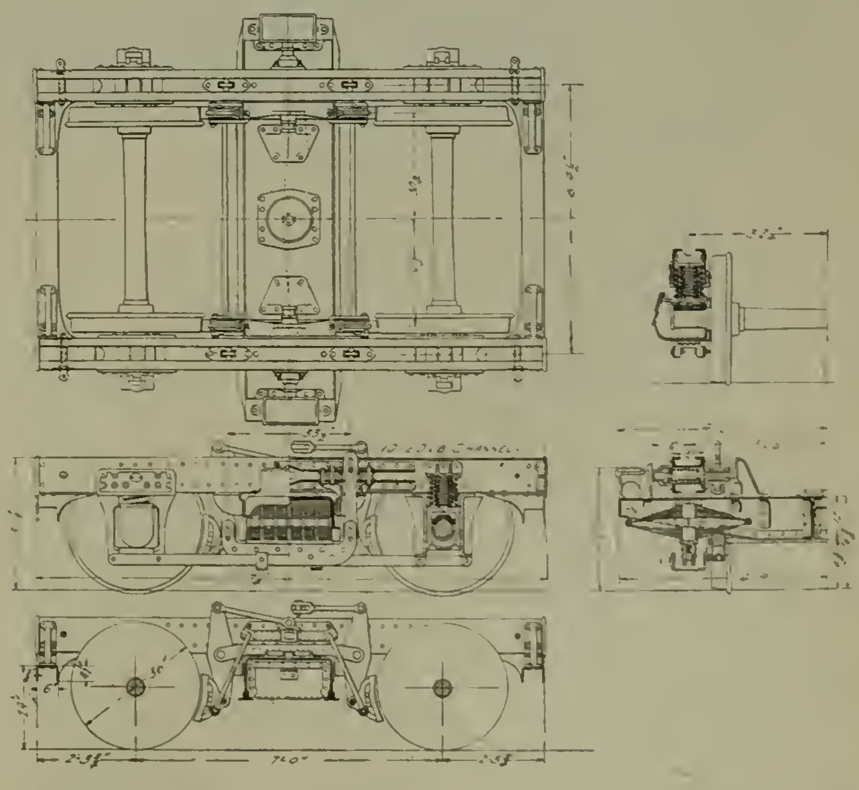
The steel cars will be lighted entirely by electricity, current being furnished by storage battery, trolley connection, axle generators, or train generators as the conditions may require. Incandescent lamps will be used for side lights and in the toilet rooms, while in the body of the car special lamps and reflectors will be employed.

SIX WHEEL TRUCK

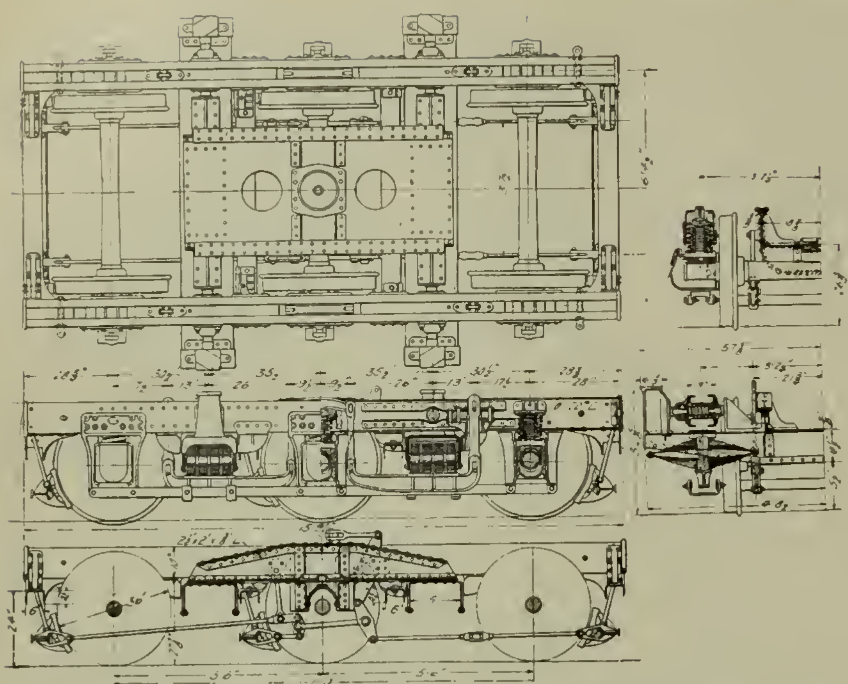
An entirely new form of truck was required for the steel cars, owing to the fact, that the deep center sill of the underframe lowered the center plate until it just cleared the middle axle of a 6 wheel truck. Advantage was taken of the opportunity offered for re-design, and a truck based upon new principle was evolved, which is applicable either to motor cars, or those drawn by locomotives. The new truck utilizes to the best advantage the valuable properties of steel as a structural material, and although it is designed to carry a load equivalent to the maximum capacity of the 5 in. by 9 in. axle it weighs only 19,500 lbs., while the wooden truck, which was not as strong, weighed 21,700 lbs. Transoms, spring planks and equalizers, though important parts in former truck designs, are not required, as their functions are covered by other elements in the new principle of design.

The truck, as shown by the illustrations is of unusual design. The center plate is carried by a short girder of channel section, with the lower flanges spanning the center axle. The girder is supported by two short girders resting upon the truck bolsters. A heavy steel plate binds this structure together. The weight on the truck is carried on 16 elliptic springs, four at the end of each bolster. The side frames are built up of two 10 in. channels with flanges turned inward. Four pressed steel cross bars are riveted to the side frames and hold them in position.

The load on the truck is distributed to the wheels as follows: The two outer pairs of wheels receive their load direct from the side frames through a nest of coiled springs above each journal box. The center pair of



PLAN, ELEVATIONS AND SECTIONS OF 4 WHEEL TRUCK—ALL STEEL PASSENGER CARS, PENNSYLVANIA R. R.



PLAN, ELEVATION AND SECTIONS OF 6 WHEELED TRUCK—ALL STEEL PASSENGER CARS, PENNSYLVANIA R. R.

wheels is provided with a similar nest of springs but the load is received through the equalizing system. The main equalizer rests upon the spring pocket of the center pair of wheels and the shorter arm of the outside 2 to 1 equalizers is attached to the side frame. This arrangement distributes the load equally upon all the journals.

The bolsters are provided with a spring centering device. The lower side bearing members are placed at the extreme ends of the bolsters. In re-designing the truck careful consideration was given to the brake rigging, and a system was devised embodying the principle of an independent set of triple brakes for each side of the truck, which apply their braking force to the brake-beams adjacent to the brake heads, thereby avoiding heavy bending strains usually present in brake beams.

Water for Use in Boilers

A ATER contains two classes of mineral salts, the incrusting and the alkali salts, the amount of which determine its fitness or unfitness for use in locomotive boilers. The sum of these would represent the total solids dissolved in the water and would be the residue left on evaporation.

Total dissolved solids

1. Incrusting matter or total hardness.
   a. Temporary hardness or carbonates of lime and magnesium.
   b. Permanent hardness or sulphate of lime.
2. Alkali salts.
   a. Sodium Sulphate.
   b. Sodum chloride.
   c. Sodium carbonate.

INCRUSTING SALTS

The incrusting salts or total hardness consist of the carbonates and sulphates of lime and magnesia and may be divided into temporary hardness and permanent hardness. Temporary hardness represents the carbonates of lime and magnesia. These salts, when the water is boiled at atmospheric pressure, are precipitated in the form of a soft scale or as a mud, which if allowed to accumulate, results in a dirty boiler and a tendency to foam. Permanent hardness is sulphate of lime.

When the water is boiled at pressures below sixty pounds this remains in solution and for this reason has been called "permanent" hardness. At pressures above this it separates as a hard scale on the flues, the result of which is continual trouble from leaky flues due to overheating of the metal.

ALKALI SALTS

The difference between the total dissolved solids and the total hardness would represent the "alkali" salts or the sulphates, chlorides and carbonates of sodium. These salts remain in solution after the water has been boiled, their total amount increasing up to a certain concentration when foaming results. Waters high in alkali salts are, on account of the tendency to foam, unfit for boiler purposes.

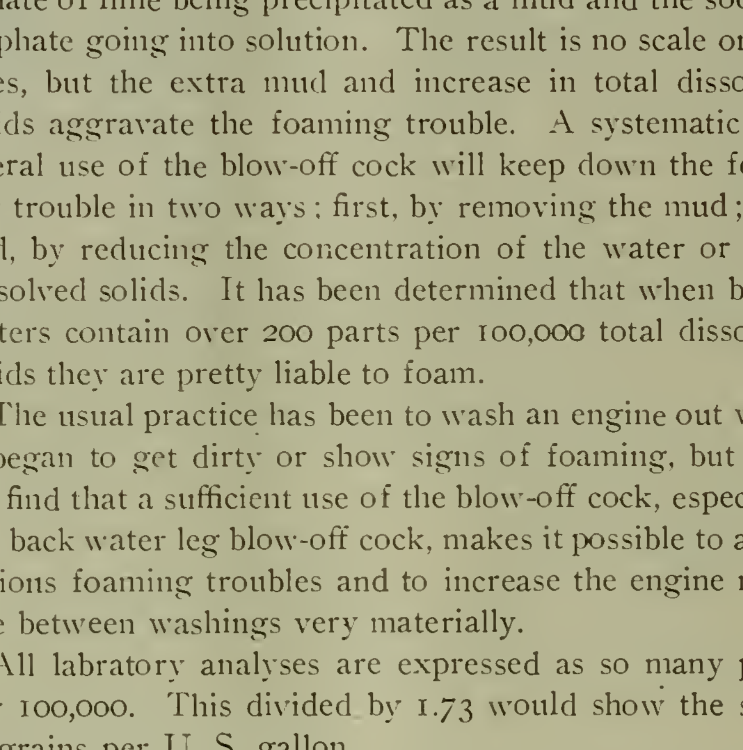
TREATMENT

There are, then, two evils that must be counteracted in a boiler water, the tendency to form scale and the tendency to foam. The scale forming evil is remedied by the use of sodium carbonate, or as it is commonly called "soda ash." This is one of the alkali salts that exists in some waters, but it cannot exist in the same water with sulphate of lime as the two would react to form sodium sulphate and carbonate of lime. Now if a water containing permanent hardness or sulphate of lime be treated with soda ash this same reaction takes place within the boiler, the carbonate of lime being precipitated as a mud and the sodium sulphate going into solution. The result is no scale on the flues, but the extra mud and increase in total dissolved solids aggravate the foaming trouble. A systematic and liberal use of the blow-off cock will keep down the forming trouble in two ways; first, by removing the mud; second, by reducing the concentration of the water or total dissolved solids. It has been determined that when boiler waters contain over 200 parts per 100,000 total dissolved solids they are pretty liable to foam.

The usual practice has been to wash an engine out when it began to get dirty or show signs of foaming, but now we find that a sufficient use of the blow-off cock, especially the back water leg blow-off cock, makes it possible to avoid serious foaming troubles and to increase the engine mileage between washings very materially.

All labratory analyses are expressed as so many parts per 100,000. This divided by 1.73 would show the same in grains per U. S. gallon.

Below is shown explanation of analyses represented graphically:



GRAPHICAL REPRESENTATION OF WATER ANALYSES.

The above was prepared as a bulletin by Mr. M. H. Wickhorst, engineer of tests, C. B. & Q. R. R., for the instruction of employes of the road on the boiler water question.

Heavy Electric Traction

New York, New Haven and Hartford R. R.

Second Insallment)

IN the previous issue the general features of the electrification of the New York terminals of the N. Y. N. H. & H. R. R. and a detailed description of the overhead line construction were given. The followng article deals with the construction and operation of the single phase electric locomotives and the principal features of the Cos Cob power generating plant. As an important step in the electrification of steam railroads it is believed that this installation of the N. Y. N. H. & H. R. R. is of direct interest to progressive railroad men.

LOCOMOTIVES

The specifications under which the locomotives were sold require that each of them shall be able to handle a 200-ton train in the most severe schedule on the present time-table, corresponding to the local express which stops about every 2.2 miles and operates on a schedule speed of over 26 miles per hour. This service requires a maximum speed of about 45 miles per hour. The locomotive is also to haul this weight of train at 65 to 70 miles per hour and a 250-ton train at 60 miles per hour in the long runs. Three hundred-ton, or even heavier, trains may also be handled on the long runs at reduced speeds. Heavy trains may be operated at high speeds by coupling two or more of the locomotives together and operating them on the multiple-unit system.

The design of the locomotives was largely dictated by certain requirements: (a) gearless motors having a flexible drive and with all the weight carried on springs were desired and finally adopted as the most desirable form, and (b) operation on 600 volts direct-current necessitated the use of four motors in order that they might be operated in the usual series-parallel relation.

Having these two requirements in view, the mechanical design of the locomotive follows as a natural consequence. The bogie truck type was adopted after very careful consideration as the one best adapted to meet the conditions imposed. It is well-known that its riding qualities are of the best and it offers the least resistance in taking the curves in the line.

The mechanical parts of the locomotives are built entirely of steel, measure 36 ft. 4 ins. over bumpers and weigh approximately 90 tons.

The mechanical parts of the locomotive were built by the Baldwin Locomotive Company from designs developed with the co-operation of the Westinghouse Electric & Manufacturing Company and the New York, New Haven & Hartford Railroad Company engineers.

The longitudinal members of the frame consist of deep plate girders reinforced at the top by channels and at the bottom by heavy angles and plates. To these frames are riveted plate cross members, one over each truck, forming the transoms for the transmission of weight to the center-pin. The side girders are placed outside the wheels as low down as the wheels and drawhead will permit and are braced and squared by substantial steel flooring plates which are riveted to the top flanges. The draw-bar effort is transmitted to the side frame through deep box girders joining the frames at the ends of the locomotive.

SINGLE PHASE ELECTRIC LOCOMOTIVE, LENGTH 36 FT. 4 IN., WEIGHT 90 TONS, HORSE POWER 1,000, NEW YORK, NEW HAVEN & HARTFORD R. R.

The cab is built up on a framework of Z-bars which are riveted to the side girders. This whole design forms a very light but extremely strong construction, able not only to transmit large draw-bar pulls but to resist heavy shocks in bumping.

The running gear consists of two trucks, each mounted on four 62-in. driving wheels. The trucks have side frames of cast steel to which are bolted and riveted pressed steel bolsters which carry the center plates. A very strong construction is secured without excessive weight by the use of bolsters 30 ins. wide at the center plate and extended to nearly double that width at the ends which are bolted to the side frames. Center bearings are 18 ins. in diameter. The weight on the journal boxes is carried by semi-elliptic springs. Under the ends of the equalizer bars are small spiral springs to assist in restoring equilibrium. The distance between truck centers is 14 ft. 6 ins.

Mechanically considered, the motors are of the gearless type, and interest in the equipment is naturally centered in the methods employed for suspending the motors and for transmitting the torque to the drivers. Special precautions are taken to insure that both the gravitational force of the motor on the axle and the torsional force of the armature on the drivers should be transmitted through elastic mediums, on account of the effect which the great weight of the motor equipment would produce on the track at high speeds.

On each end of the locomotive axle is mounted a 62-in. driving wheel in the hub of which are formed seven circular pockets which contain helical springs for assisting in carrying the weight of the motor and for transmitting the torque from the armature.

The weight of the motor is suspended from a steel frame which rests lugs of the field structure. The adjustment of the tension on these springs detemines what portion of the weight of the motor is carried by them and just how much weight is carried through the pins on the armature quill.

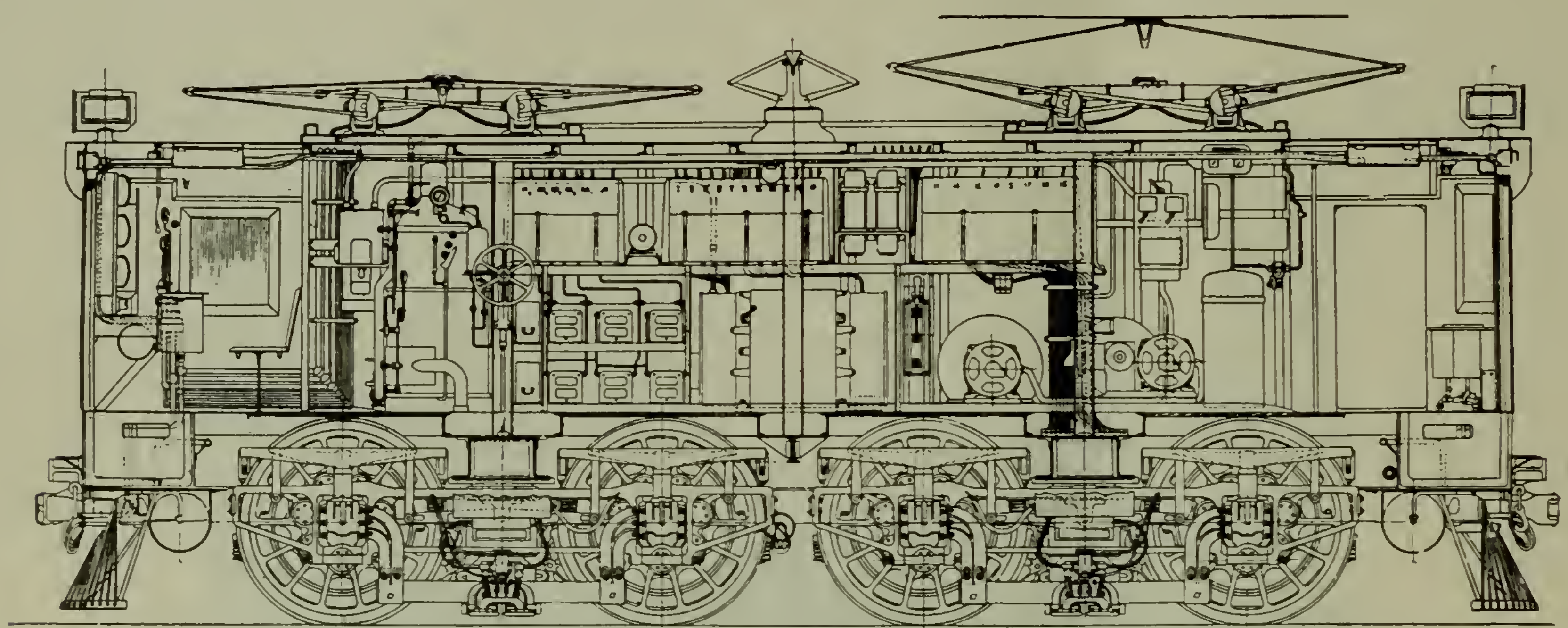
The active armature winding is one of the well-known direct-current types. However, the winding is closed on itself and is not directly connected to the commutator, but is indirectly connected to it through the preventive leads which are a feature of the Westinghouse design of single-phase motor.

The field winding, which is of the compensated type, is arranged in two circuits, namely, the main field coils which are placed around projecting poles on the field core and produce the active field flux, and the compensating field coils which are placed in slots in the projecting pole faces and serve for opposing the armature magnetomotive force and thus of neutralizing the reactance of the armature.

The armatures on each truck with their corresponding compensating field coils are joined permanently in series and are operated at all times as a unit. For direct-current work the two-motor units of each locomotive are connected in series at starting and in parallel at full speed, while for alternating-current work the two units are operated separately from the secondaries of the step-down transformers at variable voltage so that they are practically joined in parallel at all times.

The locomotive may be controlled from either end by means of a master controller which is of the usual type except that its handle is somewhat different from those heretofore used. The handle resembles somewhat the throttle lever of a steam locomotive.

There are two pantagraph bow trolleys for collecting the current from the 11,000-volt overhead conductor system. The upward pressure against the wire is supplied by springs in the base of the pantagraph equipment. Compressed air is admitted to a cylinder when it is desired to lower the collector. For use over the New York Central portion of the route there have been provided both a second and lower overhead direct-current pantagraph trolley and a system of third-rail contact shoes.


LONGTITUDINAL SECTION OF SINGLE PHASE ELECTRIC LOCOMOTIVE—NEW YORK, NEW HAVEN & HARTFORD R. R.

All of the controlling mechanism of the locomotive is placed within the cab. In addition to the various switch groups and the two main transformers referred to above, the cab contains two air compressors driven by compensated motors of the same general type as the main driving motors.

COS COB POWER STATION

The power house is located adjacent to the main line of the railroad and on the bank of the Mianus River at a point on the river about one mile from Long Island Sound. The location is such that coal can be delivered either by water or rail, and an unlimited amount of salt water for condensing purposes is available from the Mianus River. By the erection of a dam in this river at a point about a mile up-stream from the power house an abundant supply of exceptionally pure boiler feed water is also readily obtained.

The general style of architecture of the power house building is Spanish Mission; the walls being constructed

POWER HOUSE AND COAL UNLOADING STATION AND CONVEYOR AT COS COB, CONN., THE MAIN GENERATING STATION FOR THE ELECTRIFIED LINES OF THE NEW YORK, NEW HAVEN & HARTFORD R. R. OUT OF NEW YORK CITY.

of plain-faced concrete blocks, the color of which forms a pleasing contrast with the red Spanish tile roof.

The building walls, below the water-table, and the machinery foundations are monolithic concrete. The water table and the walls above it, including the window arches and coping, are of concrete blocks. The interior columns in the boiler room are of structural steel, but all other columns required in the building are of concrete blocks. The steel roof trusses over the turbine room are supported on concrete block pilasters formed in the building walls while over the boiler room they are carried by the pilastered building walls and by the interior steel columns, which also support the boilers, the mechanical draft equipment and the stack.

A self-supporting steel stack 13 ft. 6 ins. in diameter extending to a height of 100 ft. from the engine room floor, is carried by the steel columns which support the fan room floor, leaving the space below, on the boiler room floor, entirely clear.

The building is exceptionally well lighted by large windows glazed with wire glass set in cast iron sash.

The turbine room is 60 ft. wide by 112 ft. long, and the switchboard occupies a space next the turbine room which is 25 ft. wide by 110 ft. long. The boiler room is 160 ft. long and 110 ft. wide.

The initial generating equipment of the power house consists of three multiple expansion parallel flow Parsons steam turbines direct-connected to single-phase Westinghouse generators. Provision has been made for the installation of a fourth unit of corresponding size. The turbines are rated at 4500 brake horse power each and the generators at 3000 Kw. each, at 80 per cent. power factor.

As the requirements necessitated the generation of three-phase current for delivery to the New York Central system as well as single-phase current for the operation of the electric locomotives over the New Haven Railroad, the generators are wound for three-phase current but are arranged for the delivery of both three-phase and single-current.

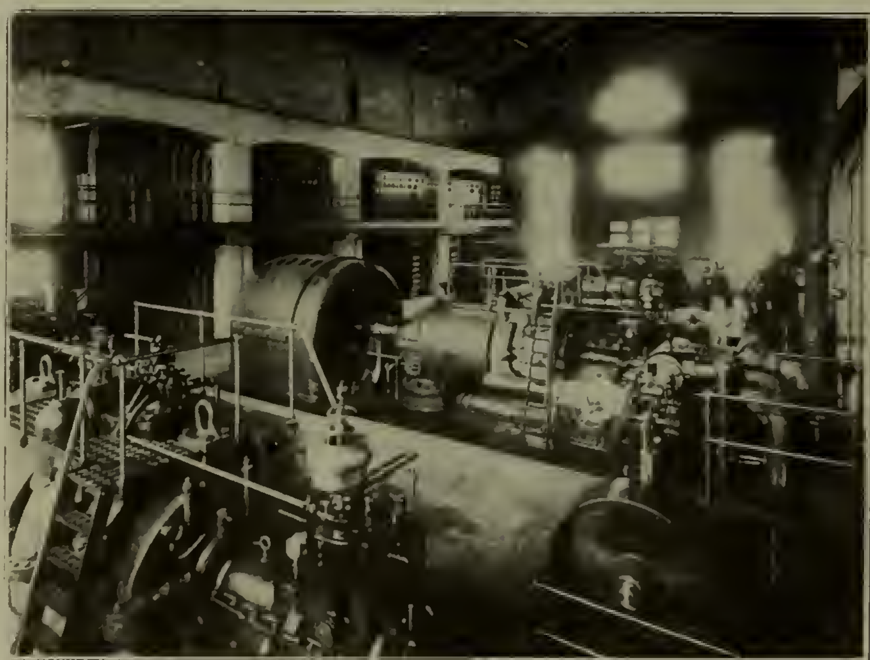
The turbines are operated at 1500 revolutions per minute by steam at 200 lbs. pressure and 100 deg. superheat. The continuous overload capacity of the units is 50 per cent., and momentary overloads of 100 per cent. can be taken care of when operating condensing.

The excitation of the generator fields is provided for by two 125 Kw. direct current generators, direct connected to Westinghouse engines; and one motor driven exciter.

A separate condensing outfit is provided for each turbine consisting of an Alberger three-phase counter-current surface condenser, a two-stage dry air pump, a centrifugal circulating pump direct-connected to a Westinghouse engine, and a Monitor hot well pump, the speed of which is automatically controlled by a float.

The initial boiler installation consists of 12-525 H.P. Babcock & Wilcox water-tube boilers set in batteries of two boilers each, and arranged with 8 boilers on one side and 4 boilers on the other side of the boiler room separated by a 21 ft. firing floor. Provision is made for 4 additional boilers to take care of the fourth turbo-generator unit when it is installed. These boilers are equipped with Roney mechanical stokers and Babcock & Wilcox superheaters and deliver steam at 200 pounds gauge pressure and 125 deg. superheat.

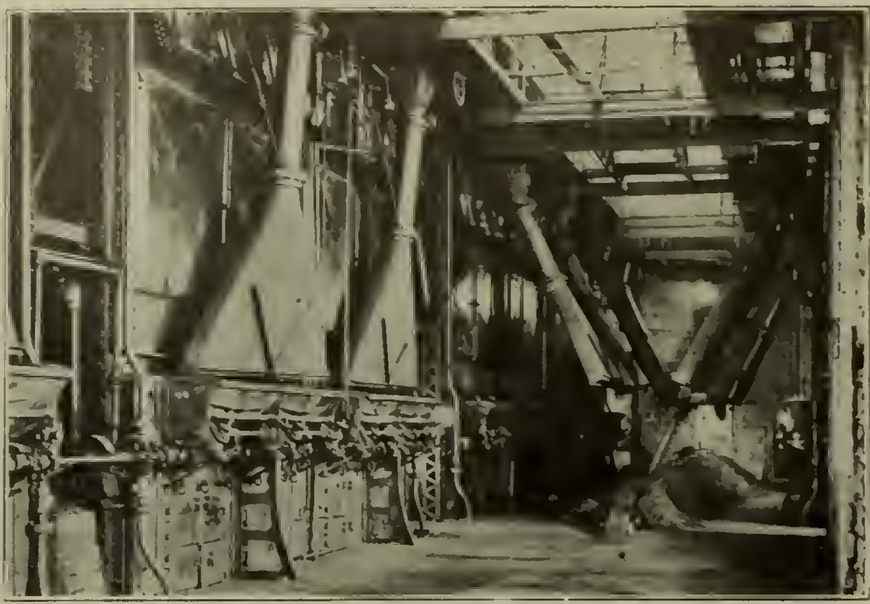
A novel feature of the boiler settings is the installation of an external steel casing entirely enclosing the brickwork, thus rendering the settings impervious to air leaks. Three Green fuel economizers are provided. After leaving the economizers, the flue gases pass through sheet iron flues to the fan chamber over the center of the boiler room. Here, four, 14-ft. fans, direct connected to horizontal high speed engines, deliver the flue gases to the stack, which is only sufficient height to carry the gases away from the building. The speed of the fans is adjusted to the demand on the boiler by automatic regulating valves controlling the fan engines.



INTERIOR OF ENGINE ROOM OF THE COS COB POWER STATION, NEW YORK, NEW HAVEN & HARTFORD R. R.

All coal received by water is unloaded from the barges by a steel derrick operating a clam shell bucket and delivered into a hopper of fifteen tons capacity at a height of 55 ft. above the dock. This bucket is operated by an engine on the dock, supplied with steam from the power house. From this hopper the coal is fed by gravity into a coal crusher and from the crusher it drops into steel cars where it is weighed. The cars are then drawn by cable up an inclined single-track railway of 13 per cent. grade and into the boiler room through an opening near the roof. Coal received by rail is dumped from the car directly into a chute leading to this same storage bin.

A continuous circulation oiling system for the turbine and generator bearings is installed. The oil is elevated by a small steam pump into a tank situated in the fan room



INTERIOR OF BOILER ROOM OF THE COS COB POWER STATION, NEW YORK, NEW HAVEN & HARTFORD R. R.

and flows from this tank by gravity to the various bearings. After passing through the bearings, it is discharged into a filter, from which the filtered oil passes to a receiving tank in the engine room basement to which the suction of the oil pump is connected.

The turbine room is equipped with an electric traveling crane, provided with two 37½ ton trolleys operated from the exciter circuit.

The main switchboard is made up of marble slabs carrying Westinghouse instruments and switching apparatus. It contains four panels for the operation of the generators, three panels for the control of the exciters, two panels for the Tirrill Regulators, one load panel, one inclined station panel for the synchroscope, and A. C. voltmeters, and five panels for the apparatus controlling the outgoing feeder system and the local high tension circuits.

The main cables from each generator are run in the air chamber under the turbine room floor, up to the switchboard gallery and thence through selector oil circuit brakers down to the high tension buses under the switchboard gallery. These circuit brakers are electrically interlocked so that the buses cannot be paralleled. The two high tension buses, with their accompanying switching equipment are interchangeable and are arranged so that each can be used separately: one supplying 3-phase current to the Port Morris feeders, and the other supplying principally single-phase current for propulsion.

Communications

Wages of the Special Apprentice

Editor Railway Master Mechanic:

AT THE present time it is customary on the majority of railroads to pay the technical graduate, who has taken up the course of special apprentice in the motive power department, a salary which exceeds that of the regular apprentice by two or three cents per hour.

The regular apprentice is usually a young man with a home. He has his room-rent, his board, and his laundry paid for by his parents or guardian. His remuneration is very nearly a clear profit.

On the other hand, the average technical graduate who has chosen railroading for his life's work will almost always find it necessary to leave home and support himself. Do the railroads pay such a man enough in order that he may live in clean and respectable surroundings and pay his bills?

To the writer this question seems to be of the utmost importance not only to the young men who are contemplating the taking of such a step, but also to the railroads themselves.

The operating officials of our lines both east and west complain of the fact that technical graduates are not only difficulty to secure, but having once secured them they do not stay.

Is it at all surprising? The technical graduate who will leave home and friends, who will in many cases sacrifice a good salary in order that he may start at the bottom with the grease and grime that he may become valuable to the railroad with which he has become a part means "business" every time. The motive power officials should realize this fact and encourage him not only for his future welfare but for the future welfare of the railroad itself. And if they will pay him a salary consistent with his absolute needs he will be more encouraegd in his work, his interest will be quickened, and he will "stick."

There is nothing that will detract more from one's zeal than the constant worrying about how to make ends meet. And a young man who is earnest and industrious should not be placed in such circumstances.

The technical graduate of today is a good investment to any concern who needs such men. He would receive in the average office from $50.00 to $60.00 per month. And yet in the locomotive shops where his work in the long run counts for more, he does not receive enough to pay his bare expenses. No wonder he can be discouraged and become disinterested.

He must not only exist, he must live. Is this not a subject that requires some serious thought and attention?

Yours truly,

J. I. D.,
Special Apprentice.

Transmission of Heat Through Scale

THE Engineering Experiment Station of the University of Illinois has recently issued Bulletin No. 11, "The Effect of Scale on the Transmission of Heat through Locomotive Boiler Tubes" by Edward C. Schmidt, M.E. and John H. Snodgrass, B.S. This bulletin describes a series of experiments begun in 1900 by the railway engineering department of the University of Illinois to determine the relation of the heat loss due to scale to the scale thickness. The experiments comprise tests on single tubes as well as tests of the entire locomotive boiler.

The results of all the tests, plotted with reference to scale thickness, show great divergence in the heat loss, which is ascribed to differences in scale structure. The bulletin is of interest to all who have to do with the operation of steam boilers in localities where pure feed water is not available. The conclusions derived from the tests are summarized as follows:

1. That for scale of thickness up to 1/8-inch, the heat loss may vary in individual cases from insignificant amounts to as much as 10 or 12 per cent.

2. That the heat loss does increase with thickness in an undetermined ratio.

3. That mechanical structure of the scale is of as much or more importance than thickness in producing this loss.

4. That chemical composition, except in so far as it affects the structure of the scale, has no direct influence on heat transmission.

Master Car and Locomotive Painters Association

Thirty-eight Annual Convention

THE thirty-eighth annual convention of the Master Car and Locomotive Painters' Association of the United States and Canada was held at Bowlby Hall, St. Paul, Minn., Sept. 10, 11, 12 and 13. The convention headquarters were at the Ryan hotel nearby. The meetings were presided over by Mr. John W. Houser, master painter of the Cumberland Valley Railway at Chambersburg, president of the association.

During the usual opening exercises addresses were delivered by Mr. John A. Johnson, governor of Minnesota, and by Mr. Louis Betts, city comptroller of St. Paul.

The first report of standing committees was that on The Best Method of Applying and Painting Canvas Roofs. The committee members on this subject were J. D. Wright, chairman, B. & O. R. R.; H. M. Butts, N. Y. C. Lines; B. E. Miller, D. L. & W. R. R.; W. J. Orr, Erie R. R.; D. L. Paulus, Barney & Smith Car Co.

Testing Paint Stock was the next subject considered and during the discussion of the report exhibitions were given of practical results of several materials exposed under test conditions during the past few years. The members of the committee handling this subject were W. O. Quest, chairman, P. & L. E. R. R.; George Warlick, C. R. I. & P. Ry.; W. J. Russell, G. R. & I.; S. H. McCracken, L. H. & St. L. Ry.; J. S. Johnson, Pressed Steel Car Co., and G. J. Ginther, Wabash R. R.

A report on The Apprenticeship System was present by the following committee: B. E. Miller, chairman, D. L. & W. R. R.; W. O. Quest, P. & L. E. R. R.; F. S. Ball, P. R. R.; F. A. Weis, C. R. R. of N. J.; T. J. Hutchinson, G. T. Ry.

A composite paper on Painting of Steel Passenger Cars, delivered before the association, was prepared by John D. Wright, B. & O. R. R.; H. M. Butts, N. Y. C. Lines; R. J. Kelly, L. I. Ry.

A number of interesting papers on various subjects were presented before the convention by several members. Among these were the following:

Cleaning, Coloring and Lacquering Metal Trimmings, Lamps, Etc., by B. E. Miller.

Cleaning and Coloring Metal Trimmings by Charles A. Cook, P. B. & W. Ry.

Three papers were presented on the subject of Painting Locomotives and Tenders. These were presented by John H. Kahler, Erie R. R.; E. G. Daly, C. C. C. & St. L. Ry., and W. A. Buchanan, D. L. & W. R. R.

Papers discussing To What Extent May the Various Linseed Oil Substitutes and Drying Oils be Used in the Painting of Cars and Locomotives were read by W. O. Quest, P. & L. E. R. R., and by W. H. Smith, Southern Ry.

An essay was read by Charles E. Copp, B. & M. Ry., on The Present Tendency Toward Severe Plainness in Car Painting and in which he touched upon some of the general problems confronting the foreman painter.

Several other papers were presented concerning:

The Painting of Steel Passenger Equipment: (a) How Should the Interior be Treated? (b) How Should the Exterior be Treated?

Disinfecting Passenger Cars at Terminals.

Painting Locomotives and Tenders: (a) What Parts Should be Varnished? (b) What Parts Can be Treated with Enamel to Advantage? (c) Is It Advisable to Use Asphaltum or Oil Paints?

The officers elected to serve during the ensuing year are:

President—B. E. Miller, Delaware, Lackawanna & Western, Kingsland, N. Y.

First Vice-President—George A. Warlick, Chicago, Rock Island & Pacific, Chicago, Ill.

Second Vice-President—John D. Wright, Baltimore & Ohio, Baltimore, Md.

Secretary-Treasurer—A. P. Dane, Boston & Maine, Boston, Mass.

The secretary's report showed a total membership of 197 active, 25 associate and 19 honorary members. There were present at the convention over 200 members, of which about 175 were active.

AMONG THE SUPPLY MEN

Representatives of fifty-four supply companies were in attendance at the convention. The following is a list of the companies with their several representatives:

Acme White Lead & Color Company, Detroit, Mich.—C. F. Elliott, K. G. Bowers, H. N. Turner.

Akron Mining, Milling & Mfg. Co., Aurora, Ill.—F. L. Hackness.

Aquart Mfg. Co., St. Louis, Mo.—A. D. Aquart, C. H. Close.

Anglo-American Varnish Co., Newark, N. J.—Wm. Marshall.

Beckwith, Chandler Co., New York, N. Y.—W. L. Crossman.

Berry Brothers, Detroit, Mich.—T. J. Lawler.

Buffalo Oil, Paint & Varnish Co., Buffalo, N. Y.—D. B. Nail, R. M. Walker.

John Boyle & Co., New York, N. Y.—E. L. Dayton.

Ball Chemical Co., Pittsburg, Pa.—C. O. Taylor, H. G. Taylor.

Clarence Brooks & Co., Newark, N. J.—Jacob E. Cope.

W. H. Coe Mfg. Co., Providence, R. I.—Charles H. Bowers, Fred Taylor, C. C. Smith.

Chicago Varnish Co., Chicago, Ill.—G. S. Bigelow, W. A. Dressler, H. J. Green.

Cleanola Co., Allegheny, Pa.—Jas. Gohen.

Columbia Refining Co., New York, N. Y.—W. B. Whitworth.

Detroit Graphite Co., Detroit, Mich.—T. R. Wyles, L. D. Mitchell.

Dixon Silica-Graphite Co., Jersey City, N. J.—E. R. Smith.

Detroit White Lead Works, Detroit, Mich.—D. W. H. Mooreland.

F. W. Devoe & C. T. Raynolds Co., New York, N. Y.—A. R. Jettser, W. C. Raynolds.

Elaterite Paint & Mfg. Co., Des Moines, Ia.—C. N. Thulin, F. M. Carrell, G. M. Kenyon.

Flood & Conklin Co., Newark, N. J.—H. J. Kuhn, H. S. Shields, D. J. Gilliord, L. A. Williams.

S. E. Frost & Co., Minneapolis, Minn.—S. E. Frost.

Glidden Varnish Co., Cleveland, O.—R. T. Walbank.

Heath & Milligan Co., Chicago, Ill.—H. C. Quest, W. Parker, O. W. Klewer.

Hildreth Varnish Co., New York N. Y.—C. C. Castle, J. G. McGee.

Imperial Car Cleaner Co., Newark, N. J.—A. V. Locke.

Ideal Mfg. Co., Chicago, Ill—J. T. Hartnagel.

Kay & Ess Co., Dayton, O.—W. L. Klinger, D. O. Klinger, H. G. Kittridge.

Keystone Varnish Co., Long Island City, N. Y.—W. A. Kelly.

Chas. R. Long, Jr., Co., Louisville, Ky.—L. E. Butler.

Lowe Brothers, Dayton, O.—Chas. Shannon, Chas. H. Lowe, J. D. Ristine, T. J. Wright.

The Lino Paint Co., Collinwood, O.—W. A. Smith.

Murphy Varnish Co., Newark, N. J.—G. F. Kissom, F. O. Brazier, C. M. Baker.

The Modoc Soap Co., Philadelphia, Pa.—Henry Roever.

Minnesota Linseed Oil Co., Minneapolis, Minn.—Edward T. Jones.

Minnesota Linseed Oil Co., Cincinnati, O.—C. D. Falsee.

National Lead Co., St. Paul & Minneapolis, Minn.—Geo. E. O'Neil.

National Paint Works, Williamsport, Pa.—W. B. Parker.

Pratt & Lambert, New York, N. Y.—Jas. Maycock, J. P. Gowing. N. B. McNulty.

The Patton Paint Co., Milwaukee, Wis.—J. G. Mowry, E. C. Hyland, E. J. Artein.

Patterson, Sargeant Co, New York, N. Y.—W. R. Stowell.

Proteetus Co., Philadelphia, Pa.—T. M. Murray.

Peerless Car Cleaner Co., Buffalo, N. Y.—H. F. Morlock.

St. Louis Surfacer Co., St. Louis, Mo.—Chas. E. Koon.

Sipe & Co., Pittsburg, Pa.—B. E. Brown, J. G. Sanborn.

Edward Smith & Co., New York, N. Y.—J. N. Burwell, S. H. Huntington.

Sherwin-Williams Paint Co., Cleveland, Ohio.—W. B. Albright. E. M. Richardson, F. M. Elmquist, M. L. Sims, J. H. Eames, Thos. Modill.

Toch Brothers, New York, N. Y.—M. McGloin, H. E. Baer.

The Tower Varnish & Dryer Co., Dayton, Ohio.—E. Carter.

Towsey Varnish Co., Chicago, Ill.—W. Woodruff.

United States Graphite Co., Saginaw, Mich.—C. S. Schenck. Gordon Douglas.

Valentine & Co., New York, N. Y.—I. H. Munford, W. P. Mellon.

Wadsworth-Howland Co., Chicago, Ill.—E. T. Brydon.

C. A. Willey Co., Hunters Point, N. Y.—J. B. Hicks, W. E. Orr, W. M. Hackett.

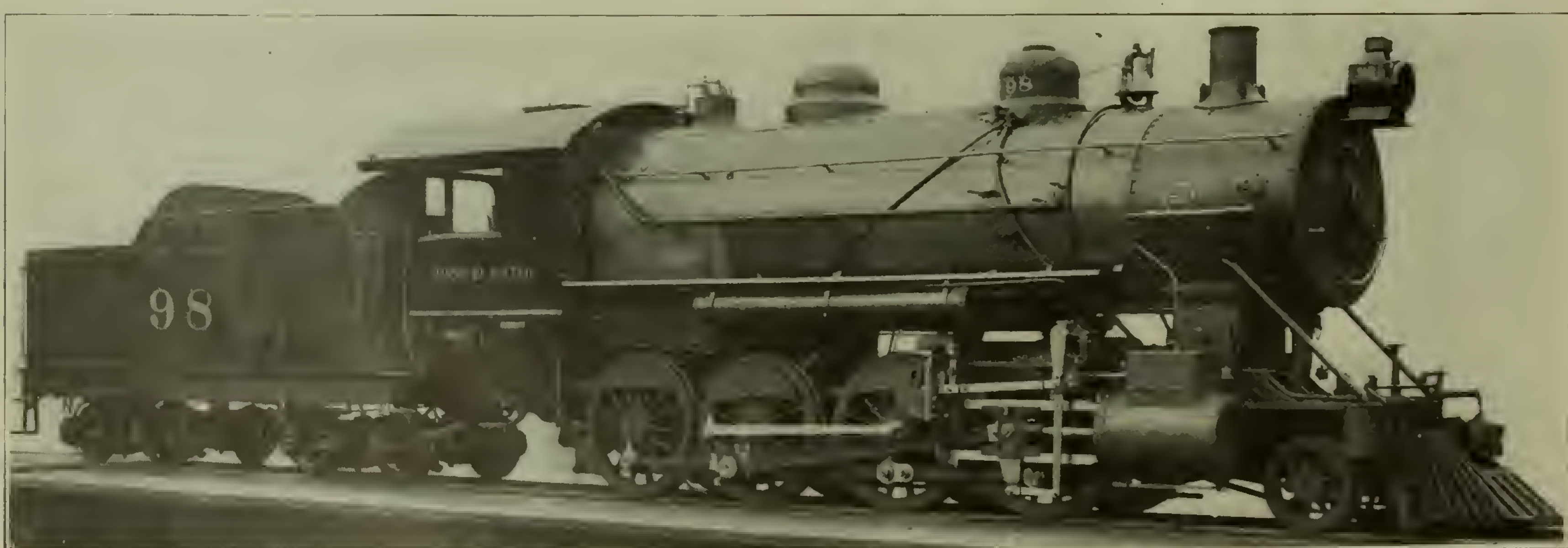
Wolfe Brush Co., Pittsburg, Pa.—John H. Hults.

Consolidation Locomotive With Large Drivers

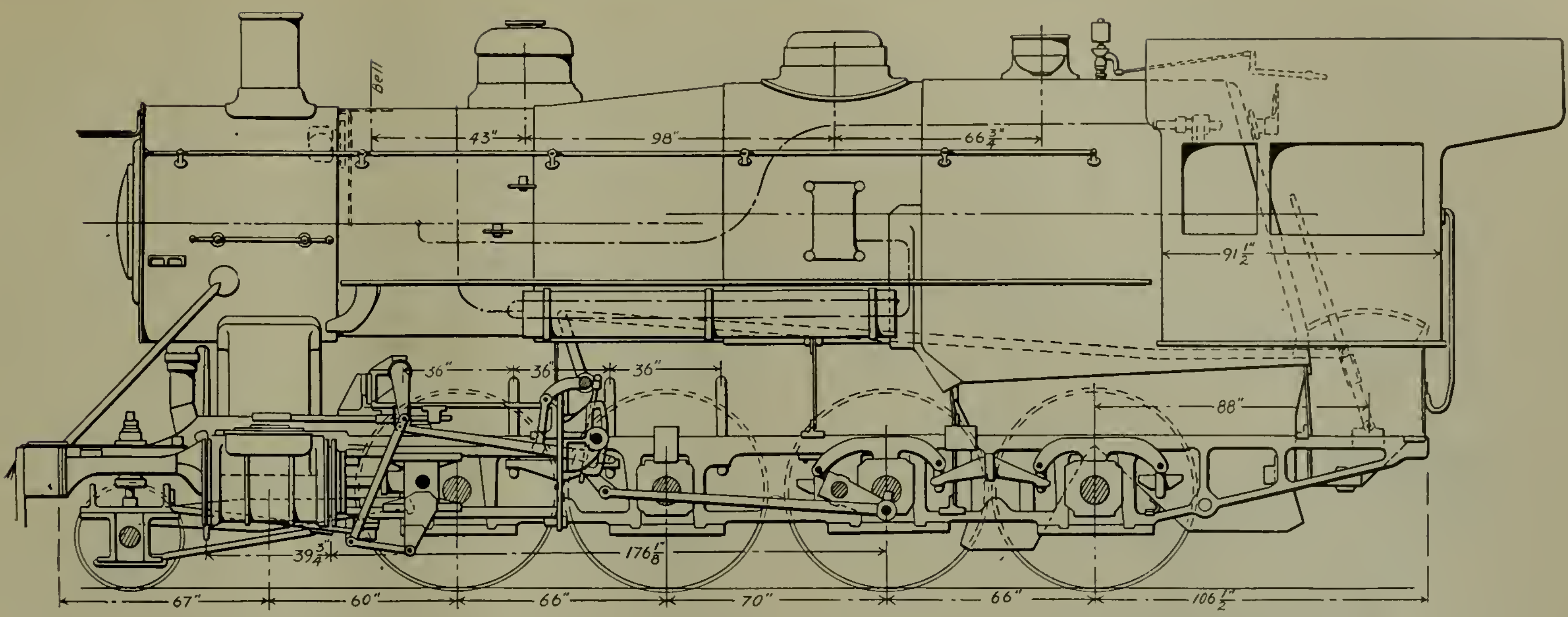
Missouri Pacific Railway

AN order of 50 consolidation locomotives recently delivered by the Baldwin Locomotive Works to the Missouri Pacific Railway, is worthy of mention, as it illustrates the present tendency to use larger driving wheels under locomotives for freight service. By referring to the accompanying illustrations, it will be observed that the driving wheels are 63 inches in diameter, which is an increase of 6 inches over the 57 inch wheel, the size most frequently specified for the consolidation type of locomotive.

A tractive force of 39,200 pounds is developed, which is 4,100 pounds less than would be obtained from the locomotive if 57 inch wheels were used. This reduction in starting power is more than compensated for by the adaptability of the locomotive to fast freight service, especially on lines where heavy grades are encountered. The slightly increased factor of adhesion of .5 per cent, which results from the use of the larger wheel is an advantage to the locomotive on a bad rail as the liability of slipping is reduced. Experience with this design of locomotive will, in all probability, demonstrate that more ton miles can be made per month on a less amount of fuel than is possible from the same type of locomotives having a smaller driver.



CONSOLIDATION LOCOMOTIVE WITH LARGE DRIVERS, MISSOURI PACIFIC RY.



SIDE ELEVATION OF CONSOLIDATION LOCOMOTIVE WITH LARGE DRIVERS—MISSOURI PACIFIC RY.

The total weight of the locomotive is about 340,000 pounds with 181,500 pounds on the drivers, cylinders 22 by 30 inches, steam pressure 200 pounds. The boiler is of the wagon top type with a total heating surface of 2,916.8 square feet. The main frames are of cast steel with double front rails of wrought iron.

The principal dimensions and specifications are as follows:

Type of engine....................Consolidation
Service....................Freight
Fuel....................Bit. Coal
Tractive force....................39,200 lbs.
Gauge....................4 ft. 8½ ins.
Cylinders....................22x30 ins.
Valve gear, type....................Stevenson Link
Valves, kind....................Balanced Slide

RATIOS.

Weight on drivers, ÷ tractive force....................
Tractive force, diam., drivers, ÷ heating surface....................
Total heating surface, ÷ grate area....................
Tube heating surface, ÷ firebox heating surface....................
Weight on drivers, ÷ total heating surface....................
Volume of cylinders....................
Total heating surface, ÷ volume of cylinders....................
Grate area, ÷ volume of cylinders....................

BOILER.

Type....................Wagon Top
Working pressure....................200 lbs.
Diameter first ring....................74 ins.
Staying....................Radial

FIRE BOX.

Length 108 ins. Width....................66 ins.
Depth, front, 69½ ins. Back....................60½ ins.
Thickness of sheet, sides ⅜ ins. Back....................⅜ ins.
Thickness of sheets, crown ⅜ ins. Tube....................½ in.
Water space, front 4½ ins. Sides 4½ ins. Back....................4 ins.

TUBES.

Material....................Iron
Wire gauge....................No. 11
Number....................340
Diameter 2 ins. Length....................15 ft. 6 ins.

HEATING SURFACE.

Fire box....................173.0 sq. ft.
Tubes....................2743.8 sq. ft.
Total....................2916.8 sq. ft.
Grate area....................49.5 sq. ft.

DRIVING WHEELS.

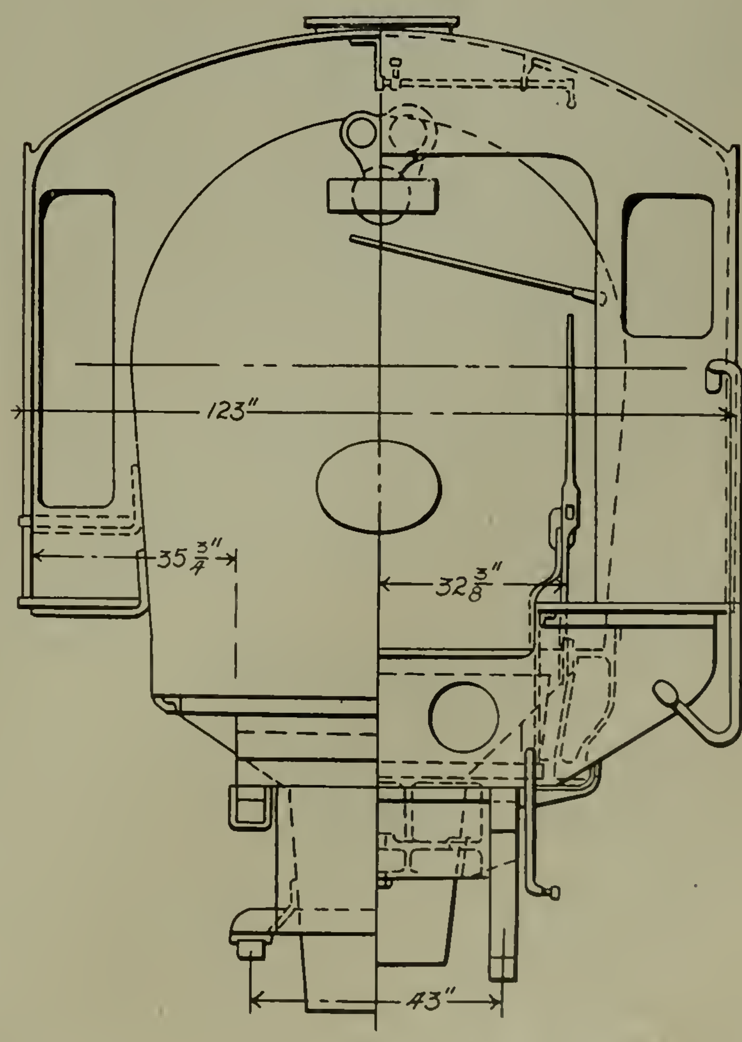
Diameter, over tires....................63 ins.
Diameter, wheel centers....................56 ins.
Journals, main, diameter and length....................10x12 ins.
Journals, others, diameter and length....................9x12 ins.

ENGINE TRUCK WHEELS.

Diameter, engine truck....................33 ins.
Journals, engine truck, diameter and length....................6x10 ins.

WHEEL BASE.

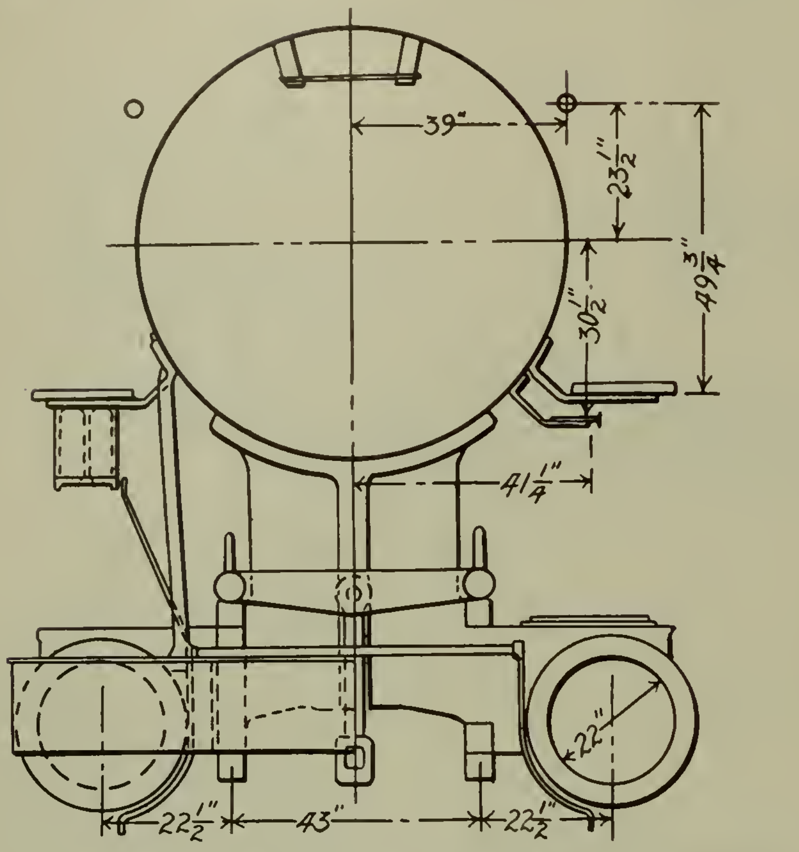
Driving....................16 ft. 10 ins.
Total engine....................25 ft. 6 ins.
Total engine and tender....................60 ft. 5½ ins.



END ELEVATIONS OF CONSOLIDATION LOCOMOTIVE WITH LARGE DRIVERS—MISSOURI PACIFIC RY.

WEIGHT.

On driving wheels....................................181,550 lbs.
On engine truck......................................23,350 lbs.



FRONT ELEVATIONS OF CONSOLIDATION LOCOMOTIVE WITH LARGE DRIVERS—MISSOURI PACIFIC RY.

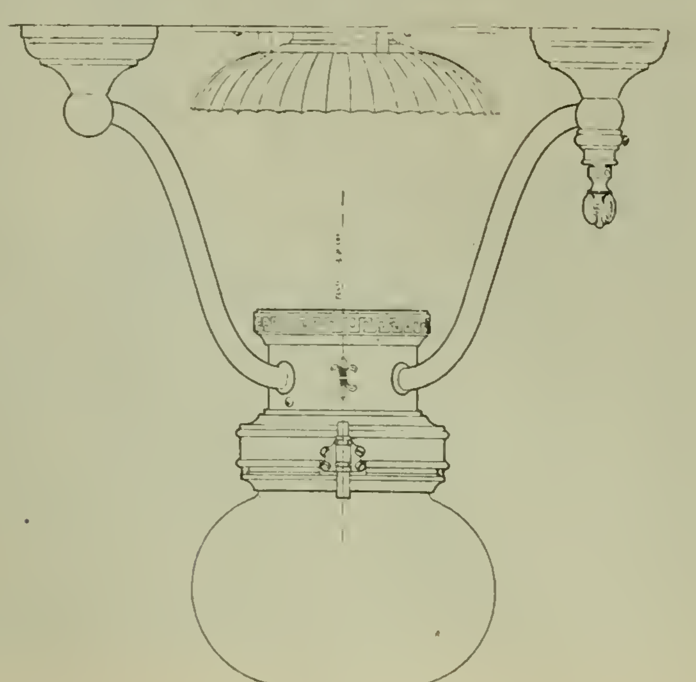
Total engine ....204,900 lbs.
Total engine and tender..............................340,000 lbs.

TENDER.

Wheels, diameter ....33 ins.
Journals, diameter and length........................5½x10 ins.
Water, capacity ....7,000 gals.
Coal, capacity ....14 tons

Single Mantle Pintsch Gas Coach Lamp

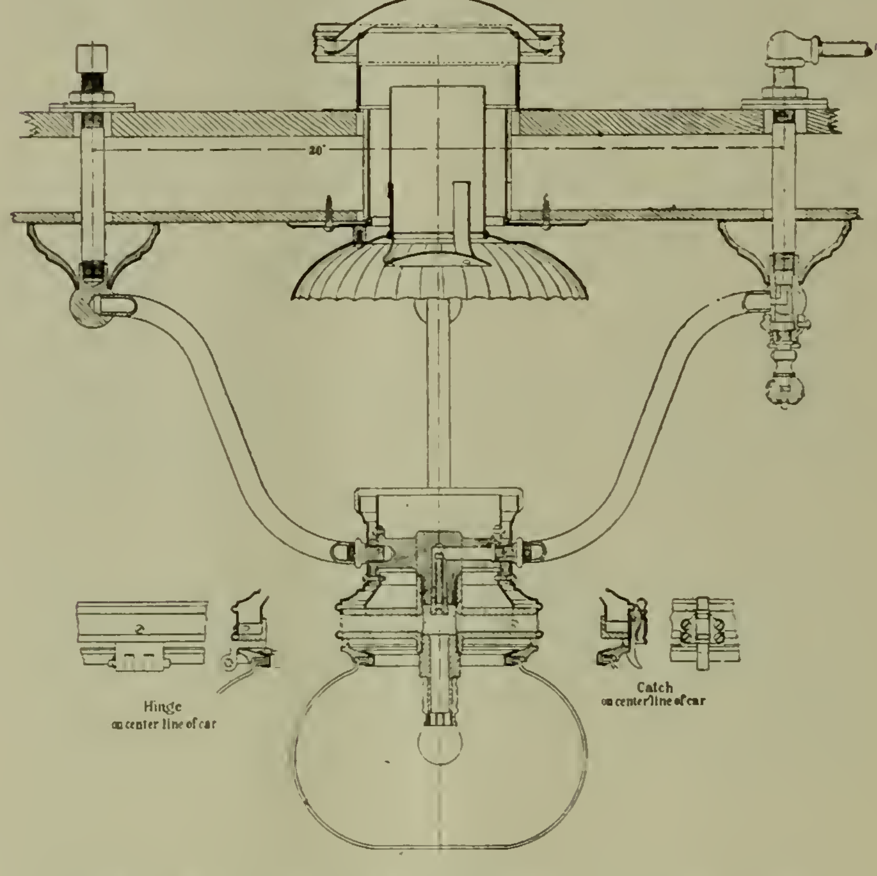
THERE are now over 200,000 Pintsch gas lamps of the flat flame type in service. The flat flame is a most efficient lamp and greatly eclipsed anything developed prior to its introduction, being an absolutely shadowless fixture, embodying very excellent regenerative principles and capable of producing 33 c. p. illumination with a consumption of about 3 cu. ft. of gas per hour. However, with the advent of the Pintsch inverted mantle it was possible to offer the railroad managements in America a lamp which has increased the illumination three-fold with use of the same amount of gas, or in other words, supplying 100 c. p. light without any increase whatever in the cost for the Pintsch gas. This certainly marked a further and decided revolution in the lighting of railroad cars, for this new system retained all the good, the tried and true features of the old and added economy by elimination of many repair parts.



ELEVATION OF NEW, SINGLE MANTLE, PINTSCH GAS, COACH LAMP.

The mantle lamp first designed was fitted with four of the small inverted lamps, each enclosed in an opal globe, and these in turn suspended as separate pendants from a center fixture has been a very popular design.

The management of the Safety Car Lighting & Heater Co., New York City, announced in June that efforts, following immediately upon the development just cited, had enabled it to carry the mantle lamp improvement into a much wider field, viz., that by the use of a single specially designed mantle (about three times as large as the first one patented) in each fixture or center lamp, it was able



SECTION OF NEW, SINGLE MANTLE, PINTSCH GAS, COACH LAMP.

to produce 99.5 c. p. illumination with the consumption of only 2.12 cu. ft. of gas per hour, according to an official test conducted by J. G. Denton, Professor Engineering Practice, Stevens Institute, Hoboken, N. J.

Now aside from this remarkable increase in illumination and reduction in the cost of gas, this new lamp still further simplifies the repair problem, makes possible economy in the railroad storehouse, in the labor of making repairs and in the general care of the lamp.

The success of the inverted mantle on rairoad cars is made possible only by the reliability which can be placed on the Pintsch gas equipment, for these lamps must have steady and certain flow of gas if the incandescence is to be even, and hence the practicability of the lamp.

The necessary heat units to bring about the incandescence of the mantle are produced by the well-known Bunsen burner placed in an inverted position. By this device the Pintsch illuminating gas is so freely mixed with air as to pass through the mantle a gas of high caloric value and, when used with the mantle, will produce a steady and brilliant white light, so brilliant, in fact, that opal glassware is interposed on all the new mantle lamps to reduce and distribute the illumination. In the short time that the mantle lamps have been on the market over 10,000 of them have been sold and they are now in use on 1,700 cars.

Briquettes as Fuel for Locomotives

IN DETERMINING the best method of preventing the waste of our fuel supply, the United States Geological Survey has found that a valuable aid to this end will consist of the briquetting of fuel.

"Briquette" is the name given to a prepared fuel made of slack or waste coal, of peat or of lignite, held together by a bonding material, such as pitch, the mixture being pressed into a compact mass, of a size and shape suitable for use as a fuel. Briquetting is the latest and most satisfactory method yet devised for utilizing the waste from mines.

The tests which have been conducted at the Government Fuel Testing Plant at St. Louis, Mo., during the last two years have proved so satisfactory, that they are to be continued with even more vigor this year at the new plant at Norfolk, Va., where the briquettes will be burned in naval vessels in order further to demonstrate their efficiency, not only as steam producers, but as an admirable smokeless fuel.

While the primary object of the United States Geological Survey has been to find the best utilization of the fuels used by the government, the entire country cannot help but profit by the results of the investigations. These tests have enlisted the interest of manufacturers and others for they have resulted in the opening to the commercial world of a hitherto unknown field which it is thought is destined to become an important factor in the production of fuels.

Within the last six months, eastern and western capitalists have begun the erection of briquetting plants in North Dakota, Washington, Michigan and Missouri, their purpose being to manufacture briquettes from coal waste, lignites and peat.

The successful developing of the coal-briquetting industry in the United States depends upon a number of conditions that are expected to work out well in the future tests. The present drawback to such an industry is the low price of bituminous coal and especially the small difference between the prices of lump coal and that of slack or fine coal.

With anthracite and semi-anthracite coals, the difference between the price of lump coal and that of slack is often more than sufficient to cover the cost of manufacturing briquettes. There can be no question that the manufacture of briquettes from some of these coals will be successful commercially. Concerning still other coals, it is claimed that the difference between the price of lump and that of slack is either just sufficient or scarcely so, to cover the cost of briquette manufacture, but the fact that briquettes present certain advantages over the lump coal may enable them to command a sufficiently higher price to afford a margin of profit.

The most favorable outlook at the present time for the development of this industry is in connection with the use of briquettes in locomotives and in domestic furnaces and stoves. It has not yet been demonstrated that, at anything approximating existing prices, briquettes can be manufactured for successful use in the ordinary power plants of the country.

The results of recent investigations have shown that on boilers requiring forced draft, like locomotive boilers, briquetting so increases the efficiency of the fuel as to more than cover the increased cost of making.

Another advantage claimed for this fuel in locomotives, and one that will appeal to the great masses of the people, is that the briquette is practically smokeless. When it is realized that the smoke from locomotives in railroad yards constitutes a large part of the smoke nuisance of the great cities, the importance of this fuel will be seen at once. For the purpose of speedily solving this problem the Government will conduct a number of tests in co-operation with the railroads of the country.

The Missouri Pacific Railroad, the Rock Island, the Illinois Central, the Burlington, the Pennsylvania and other railroads have been testing briquettes for some time with excellent results. The Missouri Pacific officials have reported that briquettes were used satisfactorily as fuel for locomotives in two tests made on runs out of St. Louis. The data obtained showed that the advantages gained were more than sufficient to cover the cost of manufacture. Although at the present time definite statements cannot be made in regard to the practicability of this fuel for locomotives use, it would seem that briquettes are suitable for fast passenger trains and where high speed is necessary in express service, or in any difficult work, such as climbing hills, where the efficiency from coal is demanded.

It is claimed that briquettes burn with a higher efficiency and with less smoke than coal, because they allow a better circulation of air that the combustion is more complete and uniform, and they burn with more flame (owing to the added combustible material) and at higher temperature.

Perhaps the most important of the tests to be made at the Government Plant at Norfolk this summer will be in connection with the burning of briquettes under the boilers of naval vessels. Briquettes have been used successfully in the navies of France and Germany for many years, and our own ships often when on cruise in the Mediterranean, have used them with uniformly good results.

One reason for the increased efficiency is that the briquette retains its shape until completely consumed.

Briquettes made from Indiana coal were used on an Indiana railroad last year in order to compare the efficiency with lump coal from the same mines. These briquettes showed an increased efficiency over the lump coal from twenty-five to forty-five per cent.

Briquettes were also made from West Virginia coke breeze (waste) with and without the addition of a small amount of raw coal. The briquettes made by both methods were hard and burned well, and doubtless would make a good substitute for anthracite coal. It would seem from these tests that this might open up an important industry which would utilize a waste product and produce a valuable fuel.

Some experiments have been conducted with culm, the waste from anthacite mines, and these have met with excellent results. Briquettes made from culm are now being tested by the Lehigh Valley railroad in its locomotives, and so far they have been successful. With the growing scarcity of anthracite coal, the vast amount of fuel that now lies unused at the anthracite mines, may in the future prove extremely valuable.

Personal Mention

Mr. R. L. Doolittle has been appointed assistant master mechanic of the Central of Georgia at Macon, Ga.

Mr. R. E. Fulmer has resigned as master mechanic of the Illinois Central at Paducah, Ky.

Mr. J. C. Wilkinson has resigned as general foreman of machine shop of the Chicago, Rock Island & Pacific at Shawnee, Okla.

Mr. A. S. Grant has been appointed master mechanic of the Texas Central, with headquarters at Walnut Springs, Tex., in place of Mr. N. L. Sullivan, resigned.

Mr. Thomas Yeager has been appointed master mechanic of the Illinois Southern, with office at Sparta, Ill., to succeed Mr. M. W. Fitzgerald, assigned to other duties.

Mr. S. H. Lewis, heretofore foreman of machinists of the Seaboard Air Line at Norfolk, Va., has been appointed master mechanic of the Virginia Railway.

Mr. W. F. Canavan has been appointed general foreman of locomotive shops of the Missouri, Kansas & Texas at Parsons, Kan.

Mr. E. I. Dodds, mechanical engineer of the Pullman Company, has been appointed assistant mechanical superintendent of the Erie, with headquarters at Meadville, Pa.

Mr. E. E. Chrysler, general foreman of shops of the Chicago, Rock Island & Pacific at Chickasha, I. T., has been appointed division master mechanic at that point.

Mr. L. T. Gibbs has been appointed electrical engineer of the Baltimore & Ohio, to succeed Mr. W. D. Young, who resigned a few weeks ago.

Mr. Henry Klapp has been appointed storekeeper of the Erie Railroad at the Buffalo car-shops, Buffalo, N. Y., vice Mr. W. A. Cotton transferred.

Mr. J. J. Hanline, master mechanic of the Birmingham division of the Seaboard Air Line, has been appointed master mechanic at Atlanta, Ga., succeeding Mr. A. J. Poole, promoted.

Mr. C. H. Heistand has been appointed storekeeper of the Louisiana & Arkansas, vice Mr. D. M. Hammett, resigned to engage in business on his own account.

Mr. B. F. Elliott has been appointed assistant master car builder of the Mexican Central, with headquarters at Aguascalientes, Mexico.

Mr. George J. Duffy has resigned as master mechanic of the Canada division of the Michigan Central at St. Thomas, Ont.

Mr. H. C. Ettinger has been appointed master mechanic of the Decatur and Springfield divisions of the Wabash, with office at Springfield, Ill., succeeding Mr. E. F. Needham, promoted; effective on September 15.

Mr. M. S. Monroe, heretofore general foreman of the Chicago, Lake Shore & Eastern, has been appointed master mechanic, with office at Joliet, Ill., and the former position has been abolished; effective on September 1.

Mr. A. H. Gairns, heretofore master mechanic of the Denver & Rio Grande, at Denver, Colo., has been appointed master mechanic at Salt Lake City, Utah, to succeed Mr. E. G. Haskins, transferred to another division; effective on September 1.

Mr. O. Stewart has tendered his resignation as superintendent of motive power and equipment of the Bangor and Aroostook, effective October 1st, having completed 60 years in railway service.

Mr. E. F. Needham, heretofore master mechanic of the Springfield and Decatur divisions of the Wabash, has been appointed superintendent of the locomotive and car department of that road, with headquarters at St. Louis, Mo., to succeed Mr. J. B. Barnes, retired.

Mr. R. A. Johnson has been appointed master mechanic of the Chihuahua division of the Mexican Central, with headquarters at Chihuahua, Mex., in place of Mr. J. M. Fulton, transferred to the Aguascalientes division, to succeed Mr. W. O. Martin, resigned.

Mr. E. S. Fitzsimmons, general foreman boilermaker of the Erie, has been appointed master mechanic at Galion, O., to succeed Mr. C. James, who has been transferred to Port Jervis, N. Y., as master mechanic, succeeding Mr. G. A. Moriarity, resigned.

Mr. W. O. Martin, master mechanic of the Aguascalientes division of the Mexican Central, has resigned, and will be succeeded by Mr. J. M. Fulton, master mechanic of the Chihuahua division at Chihuahua. Mr. R. A. Johnson succeeds Mr. Fulton at Chihuahua.

Mr. F. E. Fox, master mechanic of the Colorado and Nebraska divisions of the Chicago, Rock Island & Pacific, with headquarters at Goodland, Kan., has been appointed master mechanic of the first division of the Denver & Rio Grande, with headquarters at Burnham station, near Denver, Colo.

Mr. A. J. Poole, master mechanic of the Seaboard Air Line at Atlanta, Ga., has been appointed superintendent of motive power, with office at Portsmouth, Va., succeeding Mr. R. P. C. Sanderson, resigned.

Mr. Thomas E. Layden, assistant engineer of the Atchison, Topeka & Santa Fe at San Bernardino, Cal., has been appointed engineer of tests, with headquarters at Topeka, Kan., succeeding Mr. F. W. Thomas, who has been appointed supervisor of apprentices, with office at Topeka.

Mr. L. K. Smith, general foreman of shops of the

Wabash at Springfield, Ill., has been appointed assistant division master mechanic at Moberly, Mo. Mr. James F. Green, general foreman of shops at Landers, Ill., has been transferred to Springfield in place of Mr. Smith. Mr. Charles Branch, general foreman of shops at Moberly Mo., succeeds Mr. Green at Landers, Ill.

Mr. John Charlton, foreman of shops of the Chicago & Northwestern at Antigo, Wis., has been appointed acting division master mechanic at Chicago, to succeed Mr. L. M. Carlton, resigned. Mr. F. W. Peterson, division master mechanic at Fond du Lac, Wis., has been transferred to Green Bay, Wis., in a similar capacity. Mr. C. A. V. Axen, foreman of shops at Green Bay, has been transferred to Antigo in place of Mr. Charlton, and the former position has been abolished. Mr. C. O. Osborn, roundhouse foreman at Fond du Lac, has been appointed foreman of shops at that point.

Mr. W. L. Calvert, master mechanic of the Valley division of the Missouri Pacific and Iron Mountain system at McGehee, Ark., has been transferred to Cotter, Ark., as master mechanic of the Memphis and White River division. These divisions have been under the jurisdiction of the master mechanic at Van Buren, Ark. Mr. I. T. Jones, general foreman for the Toledo, St. Louis & Western at Frankfort, Ind. succeeds Mr. Calvert as master mechanic of the Valley division. Mr. W. A. Bedell, traveling engineer, has been promoted to master mechanic at Van Buren, Ark., succeeding Mr. B. Donohue, resigned.

Mr. T. H. Russum, heretofore supervisor of the car department of the Baltimore & Ohio, has been appointed superintendent of the passenger car department, and Mr. J. J. Tatum, heretofore general foreman of the car department has been appointed superintendent of the freight car department, both with headquarters at Baltimore, Md. Mr. H. A. Beaumont, general car inspector at Wheeling, W. Va., has been appointed general foreman of the car department at Baltimore, Md., in place of Mr. Tatum. Mr. E. B. Miller, general foreman of the car department at Keyser, W. Va., succeeds Mr. Beaumont as general car inspector at Wheeling, W. Va. Mr. J. F. Bowden, general foreman of the locomotive department at Washington, D. C., has been appointed master mechanic at Parkersburg, W. Va., succeeding Mr. J. P. Dorsey, resigned.

Automatic Pipe Bending Machine

A pipe bending machine is a necessity in every well equipped railroad shop. The large amount of pipe bending in locomotive repair work renders it important to have some economical method for handling it. Pipe bending by hand is slow and expensive.

An automatic pipe bending machine has been recently perfected by Jacob Neuert, of Chcago, Ill., which is of original design as shown by the accompanying illustrations. In using the machine it is not necessary to fill the pipe as the original section of the pipe is retained when bending. The number of bends that may be made in a given time depends upon the degree and radius of curvature. Three hundred bends of 2 in. pipe of 180 degrees were made in 9 hours. This illustrates the capacity of the machine and its superiority over hand work. The machine may be operated by belt or electric motor drive.

Figure 1 is a general view of the machine designed to bend pipe into various shapes, such as U and S bends, return coils, etc., without filling. It will bend 1 and 1¼-inch pipe any radius from 2½ to 12 inches; 1½-inch pipe from 3 to 12 inches radius; 2-inch pipe from 4 to 12 inches radius; 2½-nch pipe 6 to 12 inches radius.

The table is 61x32 inches, supported as shown on four legs, having braces between them which support the main driving and worm shafts. Between the braces is a bridge piece which sup-

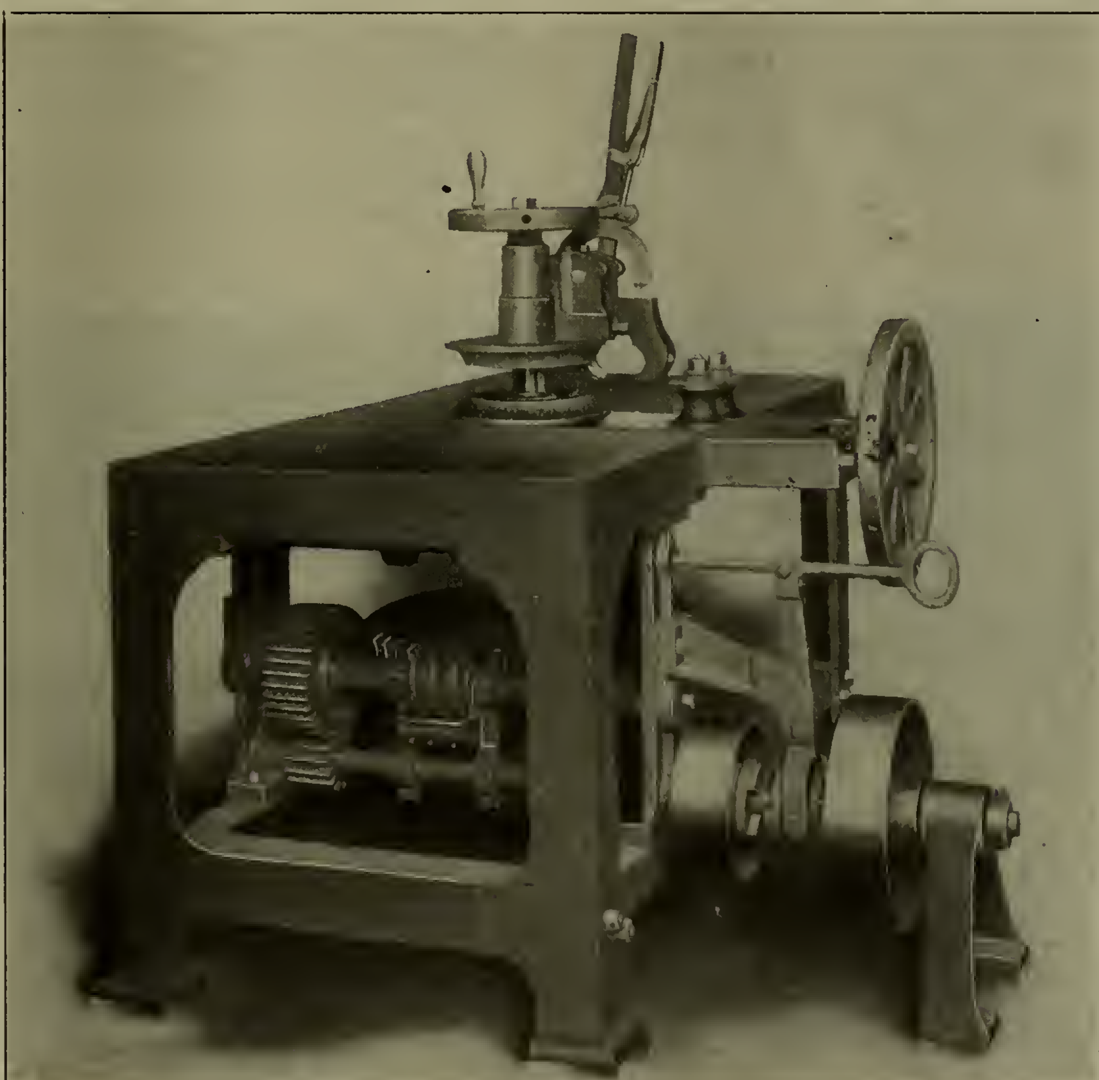


FIG. 1.—AUTOMATIC PIPE BENDING MACHINE.

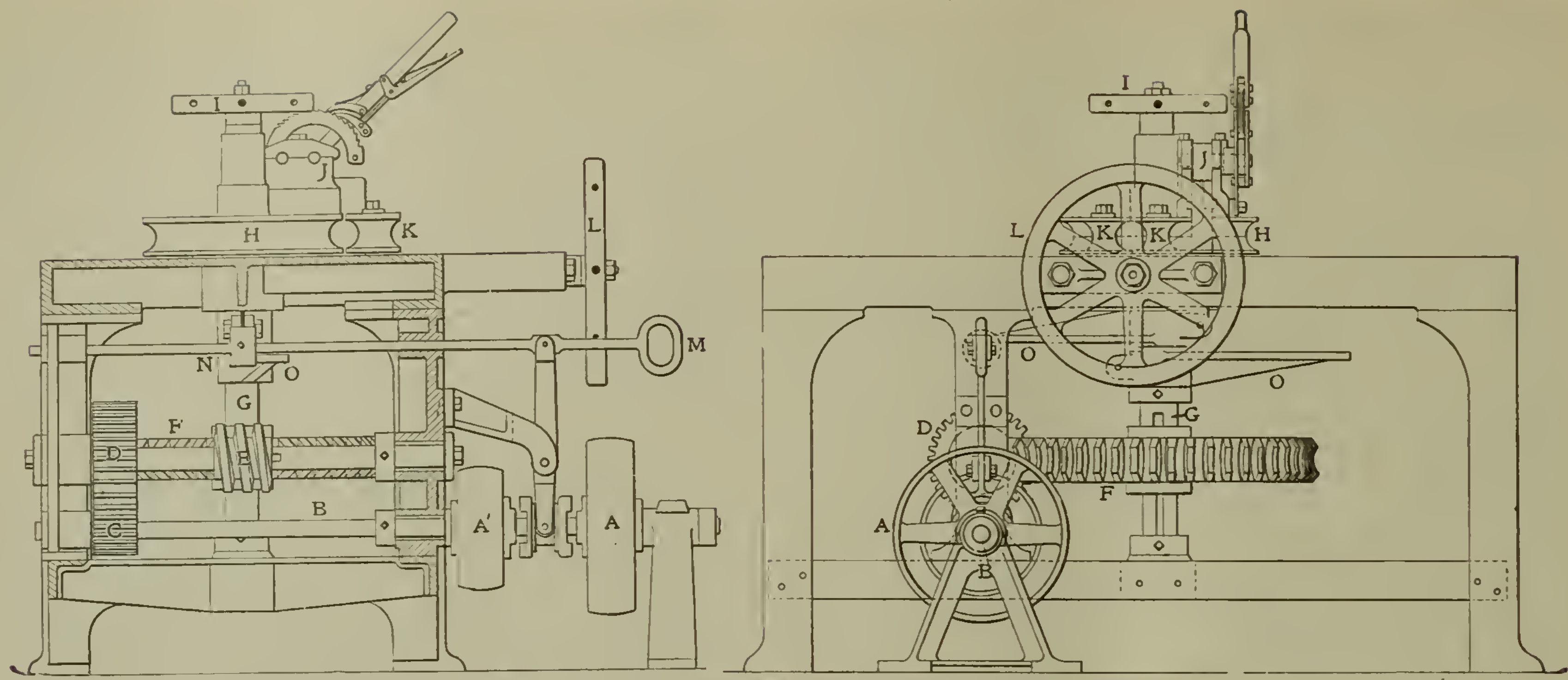


FIG. 2 AND 3—CROSS-SECTION AND SIDE ELEVATION OF PIPE BENDER.

ports the vertical shaft carrying the worm gear near its lower end. The vertical shaft projects through the table and carries at its upper end the forming roll and clamping device for holding the pipe while being bent. To the right in Fig. 1 are shown the two pressure rolls on top of the table. These are advanced or withdrawn by means of a screw operated by the hand wheel shown to the right.

Figs. 2 and 3 show the machine in section and side elevation. The driving pully *A* and the small quick-return pulley *A'* are mounted on the driving shaft *B* with a clutch between them. At the other end of *B* is the pinion *C*, which engages the spur gear *D* mounted on the worm shaft. The worm *E* on this shaft engages the worm wheel *F* mounted on the vertical shaft *G*. The forming roller *H* is in two parts. The upper part of *H* is splined to the shaft *G* and may be raised and lowered by means of a screw actuated by the hand wheel *I*. The clamp *J* is secured to the forming roll *H* and revolves with it. The clamp *J* is more fully shown in Fig. 4. The pressure rollers which bear against the pipe are shown at *K*. They are attached to a slide actuated by the hand wheel *L*. On the vertical shaft *G* are two levers *O*. These are adjustable and control the amount of bend given to the pipe, for when they come in contact with the collar *N* on the shifter rod *M* the clutch is thrown out of engagement with the pulley *A* or *A'*, whichever happens to be in engagement at the time. In this way the traverse of the forming roll may be set so as to produce uniform bends in any quantity.

Fig. 4 shows the details of the forming roll to the left and the clamping mechanism to the right. The line cut shows plainly how the upper half *A* of the forming roll is raised and lowered by the screw. The pipe clamps *F* and F^1 are opened and closed by the two racks operated by the two pinions as shown. The lever *D* and ratchet quadrant *E* provide an easy means of operating and a simple and secure lock for the clamp.

Referring to Figs. 2 and 3, the method of operating the machine is as follows: The pressure rollers *K* are drawn away from the forming roll *H*. The clamping lever is thrown up into a vertical position, which opens the pipe clamp *J*. The upper part of the forming roll *H* is raised about ½ inch. This permits the pipe to be readily entered in the machine. The pipe is entered and located at the proper position for the bend. The upper half of the forming roller *H* is then screwed down tight; the lever of the clamp *J* is pulled forward so that the clamp grasps the pipe; the pressure rollers *K* are forced against the pipe and the machine is started. The tripping arms *O* having been set at the desired points, the machine runs till the trip *N* operates, throws the clutch out and the machine stops.

This machine is built by the Stoever Foundry & Manufacturing Company, Myerstown, Lebanon county, Pa.

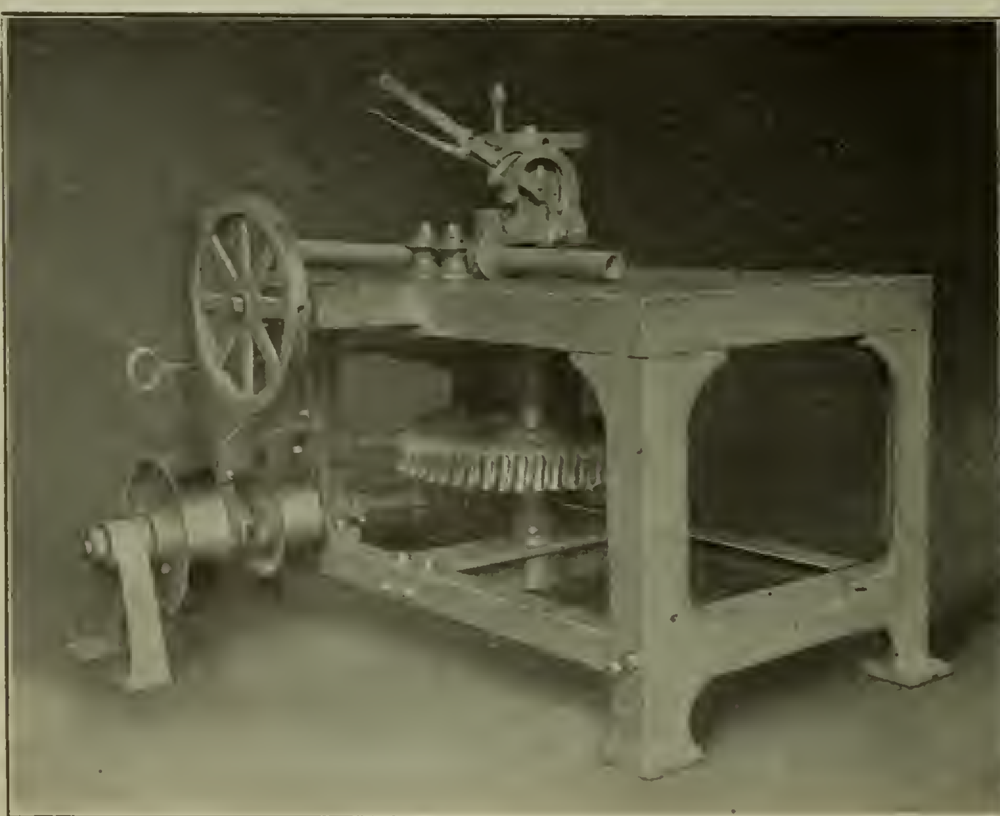


FIG. 5.—PIPE GRIPPED READY FOR BENDING.

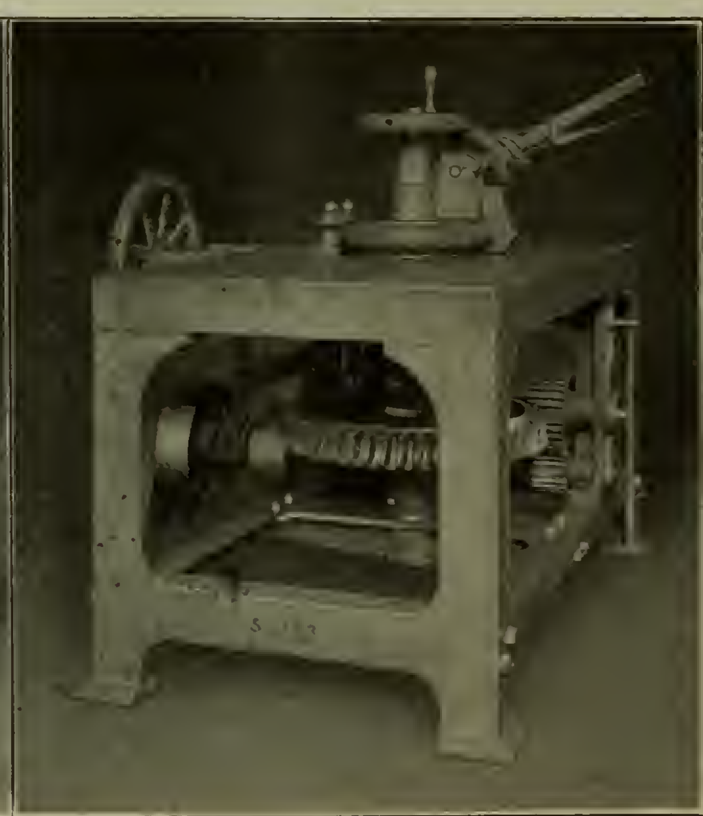


FIG. 6.—COMPLETION OF 180-DEGREE BEND.

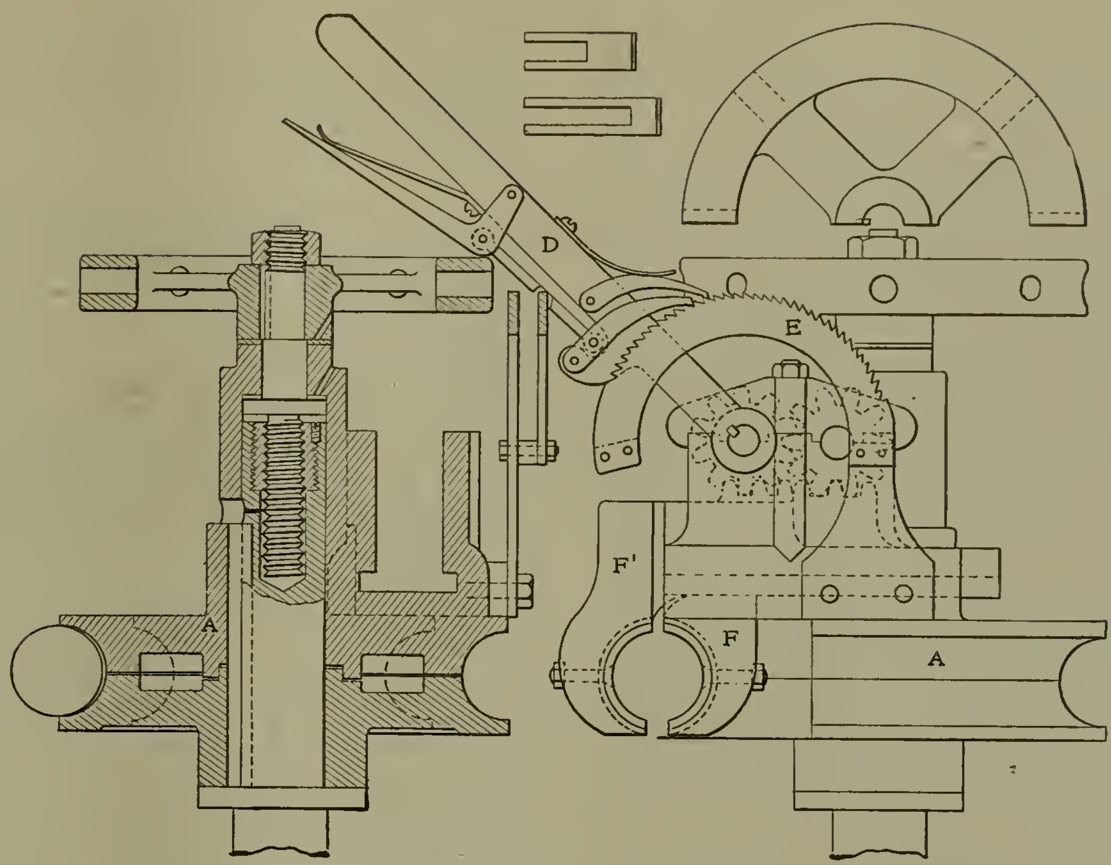


FIG. 4.—DETAILS OF FORMING HEAD.

About Graphite Lubrication

Although the excellence of graphite for all sorts of lubrication and its particular adaptability to certain difficult lubrication is a matter with which most of us are familiar, few, perhaps, are cognizant of the fact that there are two forms of graphite—flake, or foliated, and the amorphous, or nonstructural, graphite—and that though chemically the same the latter is capable of finer pulverization and with careful treatment may be reduced to an impalpably fine powder absolutely free from grit or any sort of harmful impurity. Flake graphite on the other hand, no matter how finely pulverized, always retains its original mica-like or crystalline structure and, comparing one with the other, there is a vast difference in nature, texture, action and effect.

In the first place amorphous graphite is adhesive in the highest degree. It stays put, and adhesiveness is one of the first requisites of an efficient lubricant in that to cool a hot bearing it is absolutley essential that the lubricating agent "stay put" where applied. To illustrate: Take a pinch of finely pulverized amorphous graphite and rub same in palm of the hand, on paper or on some other convenient surface and observe its action.

Note that the more one rubs the more effective the lubrication, for this form of graphite is not easily removed from surfaces in frictional contact but maintains constant and effective duty right at the point of contact and is at its best under heavy frictional pressure in that as above stated it is adhesive in the highest degree—"stays put"—and there is absolutely no waste as every particle is an active lubricating factor.

Then, too, as an impalpable powder it readily and quickly penetrates and distributes itself in a smooth, slippery, even coating between the tightest bearings, filling every pore, crevice and interstice, thereby evening irregular bearing surfaces and reducing friction to a minimum.

Let us also see how, mixed with lubricating oils, this amorphous graphite will minimize friction.

A microscopic examination of perfectly smooth bearings—cylinder surfaces for instance—will disclose many minute irregularities, which, in the nature of things must be productive of more or less friction. This friction of course means wasted energy—energy that instead of being utilized as power is absorbed as heat—a condition that more often than not means an overheated bearing with the consequent loss of time and temper. To effectively overcome this friction and utilize this otherwise wasted power, a lubricant possessing considerable "body" is required—that is a substantial lubricant of such a nature as to eliminate as far as possible these microscopical irregularities and provide a bearing offering minimum resistance to the surfaces in play.

The United States Graphite Co., Saginaw, Michigan, prepares a lubricating graphite of this description.

Notes of the Month

The Commonwealth Steel Company of St. Louis, Mo., has just moved into its new offices in the Pierce building, opposite the Planters' Hotel. The company has taken the entire southern wing on the sixteenth floor of the building.

The September issue of "Graphite," the illustrated monthly paper published by the Jos. Dixon Crucible Co., Jersey City, N. J., is an unusually interesting number. While graphite is necessarily the principal theme, the editorial work is such that the issue is good reading from cover to cover.

"Notwithstanding the fire on the 13th inst., which destroyed the greater portion of the building of the rolling mill of the Falls Hollow Staybolt Co., Cuyohaga Falls, O., the principal machinery was not damaged to any great extent, and we will be able to execute orders with the usual diligence within a few days."

Mr. F. D. Laughlin, formerly vice-president of the Atlantic Brass Co., has been appointed Eastern Sales Manager of the Pittsburg Pneumatic Co., of Canton, Ohio, manufacturers of Pneumatic Tools, with headquarters at 90 West St., New York City, succeeding Mr. Glenn B. Harris, recently in charge.

"In this union is strength" is the caption under which the Western Tube Co., Kewanee, Ill., have issued a small pamphlet descriptive of the Kewanee Flange Union. As indicated by the title, the strength of the Kewanee union in addition to its mechanical features and adaptability for use under difficult conditions, is the principal theme of the pamphlet.

More work, more efficiency, more comfort! The "Agrippa" Fittings Wrench gets into the tight, narrow places and bites on irregular forms when the broader Chain Wrench would fail. No more trouble handling short nipple and flange connections or jobs with a variety of outlets—a single, narrow, powerful jaw for both pipe and fittings. Thoroughly tried for several years before marketing. Twenty-five years of "good building" in the Vulcan (original) Chain Pipe Wrench is the maker's guarantee of sound principles in the Williams' "Agrippa."

At the Annual Meeting of the Stockholders of the Locomotive Appliance Company, which was held at their office, Old Colony

Building, Chicago, Ill., August 15th, last, the following directors were elected for the ensuing year: Mr. Frank W. Furry, Chicago, Ill.; Mr. Clarence H. Howard, St. Louis, Mo.; Mr. J. B. Allfree, Chicago, Ill.; Mr. C. A. Thompson, St. Louis, Mo.; Mr. Willis C. Squire, Chicago, Ill.: Mr. Ira B. Kegler, St. Louis, Mo.; Mr. J. J. McCarthy, Chicago, Ill.: Mr. F. B. Olney, Ludington, Mich.; Mr. E. H. Allfree, Chicago, Ill.; Mr. H. S. Gray, Benton Harbor, Mich.; Mr. Ira C. Hubbell, Chicago, Ill.

The American Locomotive Co. have received, among others, orders for the following locomotives: one 2-8-0 type, Morristown & Erie R. R.; four 4-6-0 type, California & Northwestern Ry.; two 4-4-0 type, California & Northwestern Ry.; one 0-4-0 type, Hangyang Iron Company of China; four 2-6-0 type, Chekiang Railway of China.

The Jones Positive Nut Lock Co., 2812 Wabash Ave., Chicago, is building a two-story addition to its present factory. The company doubled its capacity 18 months ago by building an addition, but owing to its large increase in business it has been forced to build the new addition, which will again double its output of Jones Positive Nut Locks. Mr. S. Barber, president of the company, is well pleased with the business outlook and the splendid growth of the businesss. The new addition to his factory will be completed within two months.

The Cleveland Twist Drill Co., Cleveland, Ohio, have devised a unique method for determining the feed and speed of drills for both carbon and high speed steel. A celluloid disc 3¼ in. in diameter is provided with rotating indicators which give quickly and accurately the proper speeds for both carbon and high speed drills from 1-16 to 3 inches in diameter. On the reverse side of the disc the decimal equivalents of fractions advancing by 1-64ths to 1 are arranged in a similar manner. These discs will appeal directly to everyone who uses drills. A set of the discs will be sent on request by the company named.

"Economical Machinery for the Coal Mine" is issued by Ingersoll-Rand Company, 11 Broadway, New York, is a neat and handy leaflet giving a variety of information concerning the various machines for the coal mine manufactured by this company. Ten entirely distinct lines of apparatus are treated of, all up to date and of the highest efficiency in their respective classes.

The Watson-Stillman Co., New York, have just issued Catalogue No. 70, which illustrates the products of the company. Over one-half of the matter in the catalogue has never been shown before by the firm. While the catalogue is not complete with respect to tools for machine shop purposes, it is one of the most extensive which has yet been printed, where only one feature of hydraulic machine shop tools are gathered under one cover.

The Bettendorf Axle Co., Davenport, Ia., have issued an artistic catalogue of 64 pages showing in detail the trucks, bolsters, tank cars, underframes and railway specialties manufactured by the company. The advantages of the cast steel truck are set forth clearly in the opening pages and by a set of excellent photographic reproductions the construction of the truck and manner of assembling the various parts are graphically shown. The sections of the catalogue devoted to truck and body bolsters, underframes, tank cars, etc., are arranged in an attractive way with numerous halftone illustrations. This catalogue creates a desire to buy the goods described.

Owing to the rapid increase of its business Armstrong Bros. Tool Co. of Chicago have been compelled to make further additions to the large modern plant which it erected about two years ago. These consist of two buildings of steel and brick construction, one 50 ft. x 105 ft., the other 40 ft. x 105 ft., with brick smokestack 60 in. diameter, 115 ft. high. In these buildings the company is installing the best and most improved machinery possible to buy.

The Emmert Mfg. Co., Waynesboro, Pa., have recently issued Catalogue No. 7, describing the Emmert Patent Universal and Standard Vises. The many styles of vises for machinists, toolmakers, wood workers, pattern makers, etc., are thoroughly illustrated and described. The catalogue is small but complete and handy for reference.

Technical Publications

Electric Railway Engineering, by H. F. Parshall, M. Inst. C. E., and H. M. Hobart, M. I. E. E. Published by D. Van Nostrand Co., New York. Cloth binding. 475 pages, 7x10½ ins., with 437 illustrations and a large number of folders. Price, $10.00.

This is one of the most complete works on electric railway engineering ever issued and the standing of the authors in the engineering field gives a character to the work which can be accepted without question. The book deals with the broad subject of the electrification of railroads and contains the results of the authors' observation and experience in that branch of engineering. The work is divided up into three parts as follows: first, The mechanics of Electric Traction; second, The Generation and Transmission of the Electrical Energy; third, The Rolling Stock. The subjects discussed in the first part are tractive resistance at constant speed, acceleration, the tractive force and the power and energy at the axles, etc. In part two, the electrical power generating plant is considered, also sub-stations, distributing system, etc. Part third deals with electric locomotives, cars and rolling stock. As a practical discussion on this important subject, the book will be an invaluable aid to those who are engaged in the electrification of railroads.

Substitution of the Electric Locomotive for the Steam Locomotive (with discussion), by L. B. Stillwell and H. St. Clair Putman. Published by the American Institute of Electrical Engineers, New York. Cloth binding, 132 pages, 6x9 in., with illustrations, diagrams and folders. Price, $1.00.

The paper on the substitution of the electric motor for the steam locomotive by Stillwell and Putman presented at the 213th meeting of the American Institute of Electrical Engineers and the subsequent discussion of the paper has been compiled and placed in book form. As the paper has been so widely discussed in the technical press it will not be necessary to call attention to its importance. With the discussion, it comprises one of the most important works on heavy electric traction that has yet been published.

"On the Art of Cutting Metals," by Frederick W. Taylor, M. E., Sc. D. Published by the American Society of Mechanical Engineers, New York. Cloth binding, 248 pages, 6 x 9 inches, and also 24 folders, containing 25 illustrations and 130 tables, diagrams and drawings. Price, $3.00.

This book is a reprint of the Presidential address at the last annual meeting of the American Society of Mechanical Engineers. This, or any other publication of the Society, may be had by addressing the secretary, 29 West 39th Street, New York. None of the publications of the Society are copyrighted.

The volume treats the following subjects: action of tool and its wear in cutting metals; wear of modern high-speed tools; making and recording experiments; lip and clearance angle of tools; forging and grinding tools; pressure of the clip upon the tool; cooling the tool with heavy stream of water; chatter of tools; time a tool should run before regrinding; effect of feed and depth of cut on cutting speed; tool steel and its treatment; theory of hardening steel; quality of metal being cut; line or curve of cutting edge; slide rules, and additional experiments and investigations.

The folders are of extreme value to the machinist because they contain tables, curves, diagrams and drawings for machine tools. These alone would justify the purchase of the volume. No shop should be without this book, because it may always be referred to for facts concerning machine tools.

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Devoted to the interests of railway motive power, car equipment, shops, machinery and supplies.

Communications on any topic suitable to our columns are solicited.

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Contents

Protection of Company Material

BRASS always has an intrinsic value whether in the form of scrap or otherwise. This fact is well known among the class of people given to pilfering from railway companies and the ends to which they will go to steal brass is evidenced by the frequency with which cars in yards and on sidings, are jacked up and the brasses removed. When brasses under cars are stolen it is very certain that loose brass is even more subject to theft, and therefore should be protected. Not only should scrap brass be stored safely wherever it is collected, but when loaded in cars for shipment over the line the cars should be sealed as carefully as other freight cars requiring sealed protection.

There is much company material besides brass which if properly protected would net a considerable saving. Carelessness in sealing cars containing company material should be no more permitted than carelessness in sealing cars used by shippers.

Car Inspection

ACCIDENTS sometimes occur as a result of car fixtures falling upon either the track over which a car is passing or upon an adjacent track, as well as from parts exceeding the clearance limit and engaging platforms and other obstructions along the side of the track. Accidents resulting in considerable damage to equipment have been occasioned by a brake shoe coming down and dropping on a frog. While it is practically impossible to provide absolutely against brake shoes falling, it is possible for inspectors to profit by past experiences and see that cars are not allowed to pass their stations unless brake shoes are of sufficient thickness and properly secured by brake shoe keys.

Cars are frequently allowed to run with loose doors and these doors are often held by one hanger. In view of the danger of accidents which might result from a door falling upon the track, loose doors should be carefully looked for by both train crews and inspectors. Such doors are dangerous while cars are in trains and in transit as well as on side tracks, as one hanger is liable to break and allow the door to drop on the main line or on a side track, where there is possibility of derailing trains.

Coal cars sometimes get in general bad order for lack of repairs before being loaded and side pockets are frequently seen that have been badly pulled through the side sills. The stakes are often cracked transversely at the top of the sill and as a result the stakes are forced out of position so far as to exceed clearance limits and are very apt to strike obstructions and cause damage to cars as well as to property along the line.

There are many other instances wherein accidents might be avoided by careful inspection and by repairing seemingly minor defects before they develop into defects of a serious nature.

A Private Office for Road Foremen

THE provision of an office for the traveling engineer and its suitable location are not always considered of primary importance. There are a number of reasons, however, why a road foreman of engines should have an appropriate office and its proper location would seem to be at the roundhouse. It is true that the greater portion of the road foreman's duties are on the road and he is not expected to develop into an office ornament; yet it is equally true that office facilities should be provided for his especial use.

The nature of his work places him in contact with road men and locomotives in service, so that when on duty, and not out on the line, his place of business should be near both the engines and the men. By being on the ground at the roundhouse it is a simple matter to meet an engineer or fireman when he comes in from his run. If not so situated it is necessary to require a man to make an extra visit to the office, using the time which he should be allowed for his personal affairs or for required rest.

Among the many duties of a traveling engineer, he is expected to instruct and encourage the men under his jurisdiction, especially the younger men—both young runners and inexperienced firemen—and be to a certain extent a friendly adviser. A private office in which he could keep his air brake and other charts and where he could talk to anyone without interruption would be of material assistance in his work.

Inspection of Broken Parts

IT frequently occurs that after breakage at some point on the line, the broken parts are sent to the general offices or to the company's principal shop for inspection. Very often the broken surfaces become so rusty and covered with dirt that it is impossible to inspect them to advantage and no conclusions can be drawn as to the cause of the fracture.

A broken cast wheel which was recently ordered to certain headquarters for inspection, was so poorly protected and was so roughly handled between the time that the break occurred and the time of arrival of the pieces at their destination, that the story which might have been told by the appearance of the surfaces at the break had been almost entirely destroyed.

By making a careful examination of a clean break it is often possible to come to some very definite conclusion as to its cause. It may be possible to determine whether a fracture originated from a flaw in the material which gradually developed into a crack or whether the weakness resulted from insufficient material to withstand a strain. There is much other evidence which may lead to various conclusions, all valuable because on such evidence changes and improvement in design may depend.

Instances of failure to protect fractured parts properly and the lack of evidence shown by the parts in consequence, suggests the advisability of directing attention to the necessity of carefully protecting all parts retained for inspection.

The Detail of Files

THE file is one of the universal hand tools of railway shops. Being a hand cutting tool, its efficiency as regards cutting rate and durability is of considerably more importance than its first cost. Therefore it would seem a matter of course that railways should have some criterion for judging the respective merits of the files offered by the different manufacturers. So far as we are aware, however, no railway has any such criterion, and the files are bought upon no specification whatever. In an English pamphlet dealing with the subject we note that by testing files by filing off the end of a bar of iron one inch square, most extraordinary differences in file efficiencies were found. Some files were worn out in filing away less than one cubic inch of iron and cutting at the rate of one cubic inch of iron per 10,000 strokes, while another file removed 12.5 cubic inches of iron before becoming worn out and cut at the rate of 5 cubic inches per 10,000 strokes. By studying such tests files were developed which removed 55 cubic inches of iron at the rate of 8 cubic inches per 10,000 strokes. This deals with only one side of the file. Other tests usually show a surprisingly large variation in efficiency between the opposite sides of the same file. Since the object of a file is to remove metal, and the relative efficiencies in this respect of files of the same size and kind, is seen to vary so many hundred per cent, there would seem to be a detail to which railway attention could be very profitably given. Then, with the file having a cutting efficiency of 5 cubic inches per 10,000 strokes, we will require 2,000 strokes per cubic inch, or 2,000÷50=40 minutes per cubic inch, or 400 minutes=6 hrs. 40 mins. =$1.83, and the file will be 10÷12.5÷2=.4 worn out. While with the file having a cutting efficiency of 8 cubic inches per 10,000 strokes we will only require 1,250 strokes per cubic inch, or 1,250÷50=25 minutes per cubic inch, or 250 minutes=4 hrs. 10 mins.=$1.46, and the file will only be 10÷55÷2=.09 worn out. For every 100 cubic inches of metal then, we would require in the first case $18.30 worth of labor and 4 new files, while requiring 25 hours more time for the accomplishment of the job than if we had used the file of the second case which would only involve $14.60 worth of labor and only two new files, the latter of which would yet be good for the removal of 10 cubic inches more of metal. Obviously then, a railway could very well afford to check up the file manufacturers and pay the requisite prices for high qualities of these goods.

A Modern Oil House

Great Northern Ry.

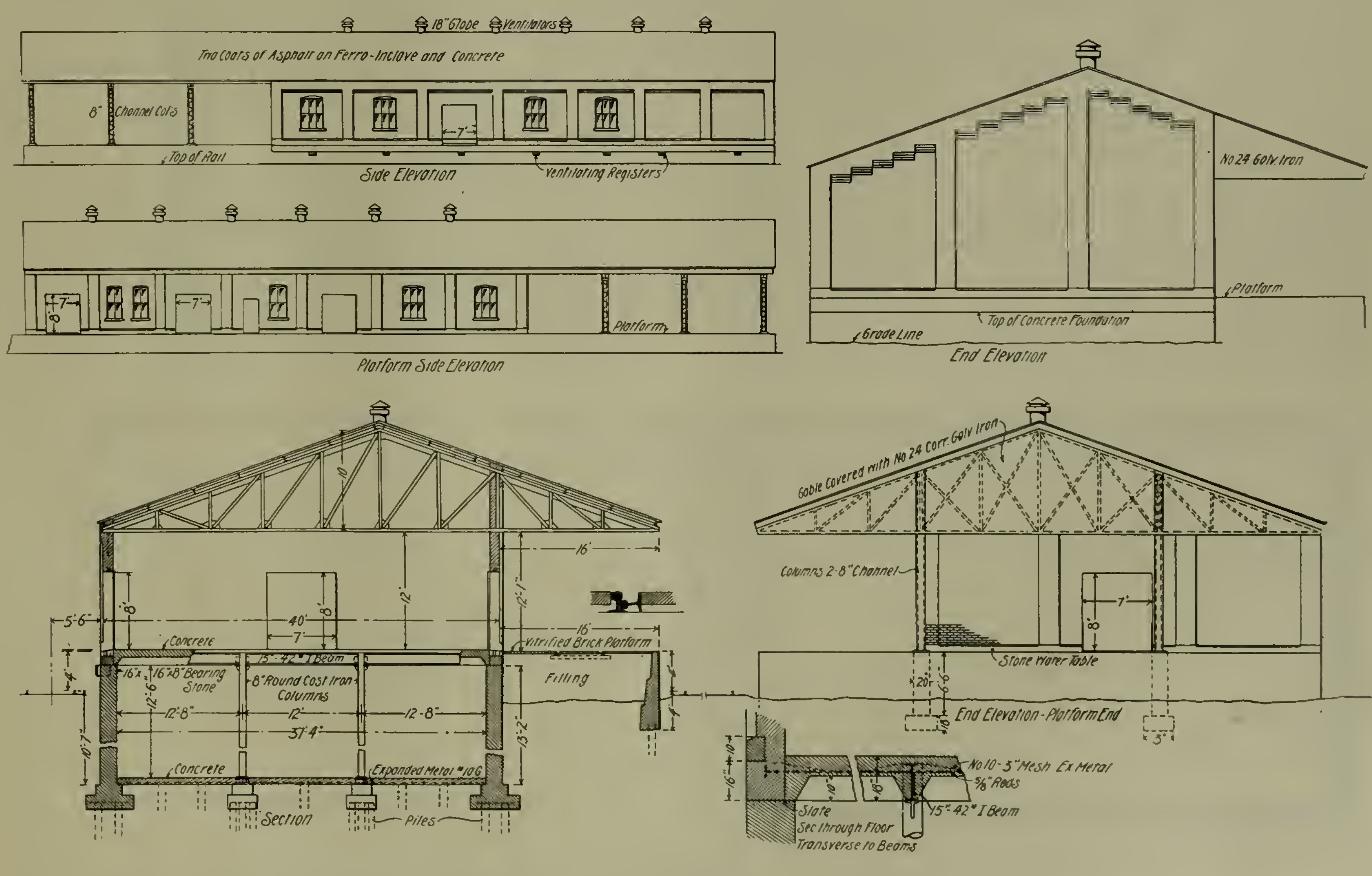
DURING the present season, there has been erected and put in operation at General Stores of the Great Northern Railway Line, in St. Paul, Minn., an oil-house for the storing and distribution of oils, paints, grease and waste, both for local and line requirements, where oil houses on line have not sufficient storage capacity to warrant shipping in tank cars direct. This building has been carefully designed and equipped with the most modern appliances obtainable for the barreling and handling of oils and other material compatible with economy and convenience. The actual process of handling oil through the house, involves the principle of unloading tank cars by gravity and discharging from storage tanks by pumps. All who are in any degree familiar with the proposition of supplying large territories with commodities of this kind, will readily appreciate the questions which require consideration in planning a building of this particular kind.

In addition to details given below, we have secured, through the courtesy of Mr. F. A. Bushnell, general storekeeper, a set of illustrations that set forth the main features of this plant.

With a view to accessibility as well as economy in switching, the building proper is placed in a parallel position between two storage or switching tracks, the track on the south side being used for placing the tank cars in which oils are received from dealers; while the other track admits of cars being placed conveniently for shipping oil and waste in barrel or bale lots to the line. In addition to the two tracks mentioned, a push-car track is provided on the platform between the building and the track on the north side, on a level with car doors, for the purpose of connecting the oil-house with the general storehouse platform, making it convenient to load small shipments in cars placed at the general storehouse, while being loaded with other material therefrom. The arrangement of these tracks is such that material can be delivered into and handled from the oil-house without any unnecessary expense whatever either for outlying points or local consumption at the company's shops, which are also located at Dale street, as the push-car track described connects the oil-house with all of the buildings of the entire plant.

BUILDING.

The building proper is ample in proportions, being 150 ft. in length by 44 ft. 6 inches in width; the main floor being subdivided into four compartments of the following sizes: No. 1, at the east end, 30x44 ft. 6 ins., is the coopering room. Directly adjoining, room No. 2 has a floor space of 60x44 ft. 6 ins., and this is the main room of the oil-house, having proper appliances for bar-



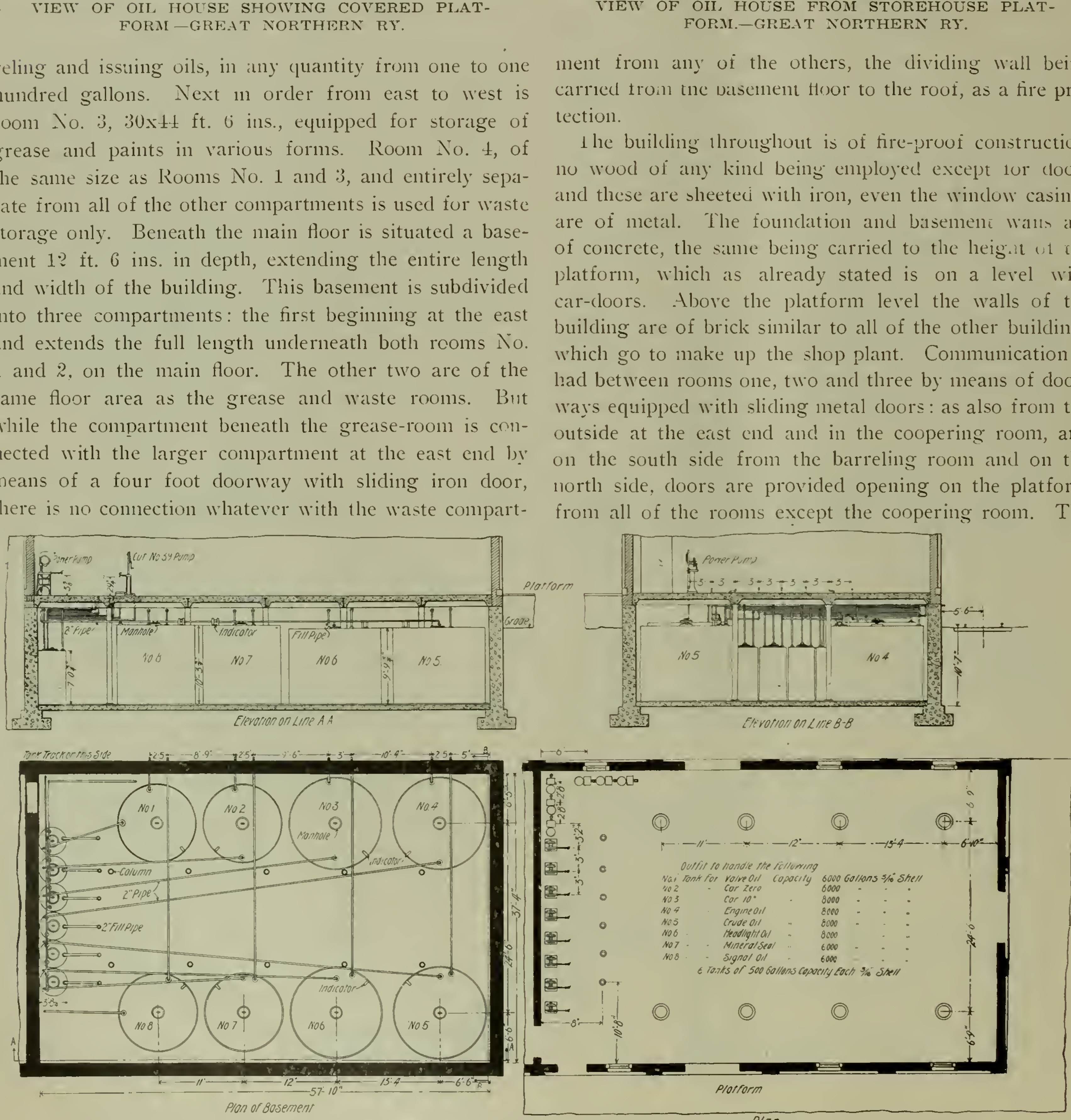
ELEVATIONS AND SECTION OF MODERN OIL HOUSE.—GREAT NORTHERN RY.

VIEW OF OIL HOUSE SHOWING COVERED PLATFORM.—GREAT NORTHERN RY.

VIEW OF OIL HOUSE FROM STOREHOUSE PLATFORM.—GREAT NORTHERN RY.

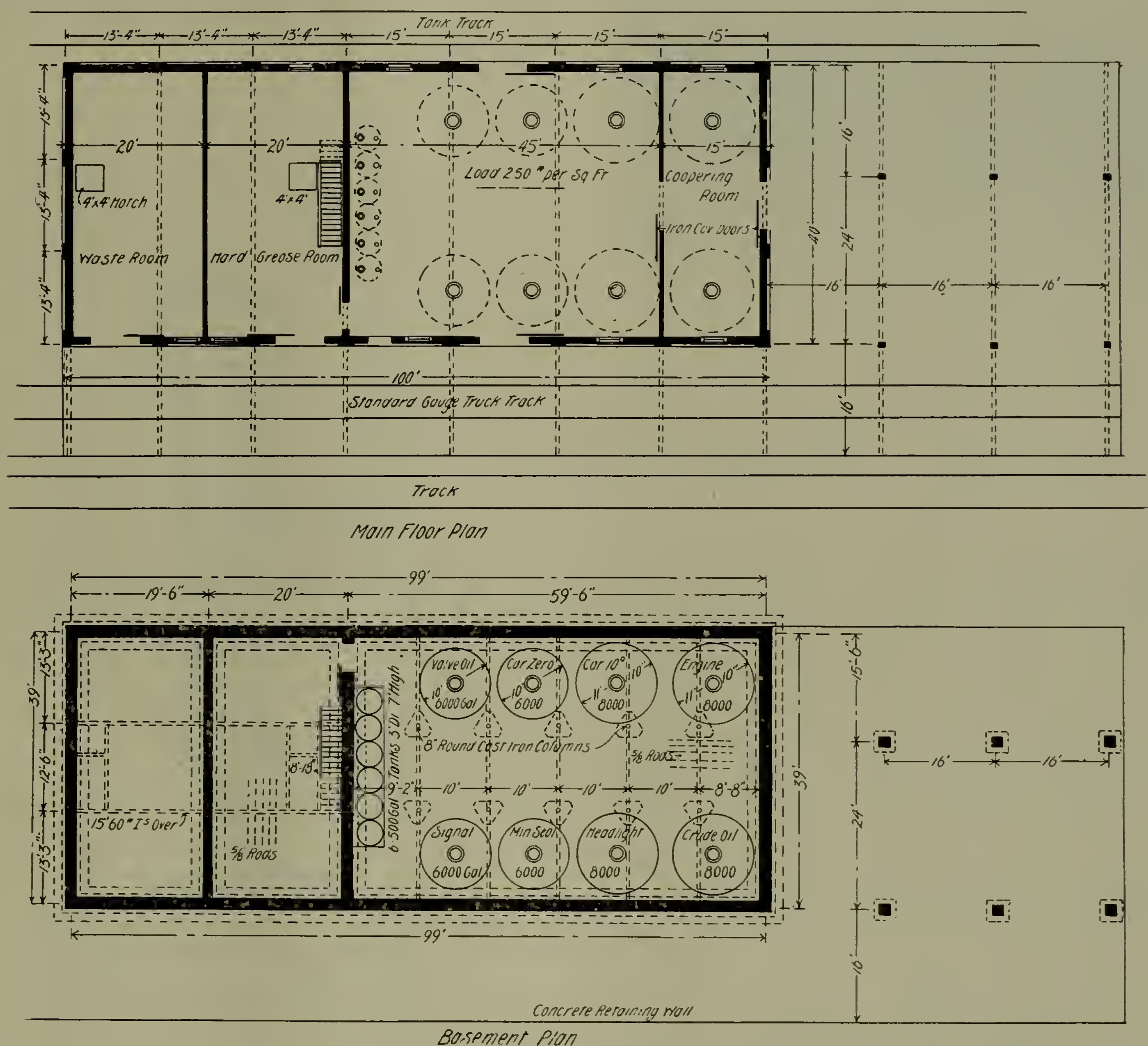
reling and issuing oils, in any quantity from one to one hundred gallons. Next in order from east to west is room No. 3, 30x44 ft. 6 ins., equipped for storage of grease and paints in various forms. Room No. 4, of the same size as Rooms No. 1 and 3, and entirely separate from all of the other compartments is used for waste storage only. Beneath the main floor is situated a basement 12 ft. 6 ins. in depth, extending the entire length and width of the building. This basement is subdivided into three compartments: the first beginning at the east and extends the full length underneath both rooms No. 1 and 2, on the main floor. The other two are of the same floor area as the grease and waste rooms. But while the compartment beneath the grease-room is connected with the larger compartment at the east end by means of a four foot doorway with sliding iron door, there is no connection whatever with the waste compartment from any of the others, the dividing wall being carried from the basement floor to the roof, as a fire protection.

The building throughout is of fire-proof construction, no wood of any kind being employed except for doors and these are sheeted with iron, even the window casings are of metal. The foundation and basement walls are of concrete, the same being carried to the height of the platform, which as already stated is on a level with car-doors. Above the platform level the walls of the building are of brick similar to all of the other buildings which go to make up the shop plant. Communication is had between rooms one, two and three by means of doorways equipped with sliding metal doors: as also from the outside at the east end and in the coopering room, and on the south side from the barreling room and on the north side, doors are provided opening on the platform from all of the rooms except the coopering room. The



SECTIONS AND PLANS OF MAIN ROOM AND BASEMENT OF MODERN OIL HOUSE.—GREAT NORTHERN RY.

floors in both the basement and main floor are of concrete, eight inches thick; but the main floor is carried on 15 in., 41 lb. I beams, supported by two rows of 8 in. circular cast columns, metal being 1 in. thick. The main floor, in addition, has a reinforcement of expanded metal embedded in the concrete two inches, from the bottom, the metal is No. 10 gauge, 3 inch meshes. The roof of the entire building is carried on steel trusses resting upon the outside walls without intermediate supports except for the division walls between the various compartments. The roof of the building is extended at east end and north side to cover the oil-house platform. The east portion foundation in the larger room in the basement at the east end. Each tank is equipped with a gauge on the outside which shows at all times the amount of oil then in the tank; also, 18 in. covered manholes are set in the center of each tank, directly underneath similar sized manholes in main floor of the barreling-room. The manholes in the upper floor are fitted with heavy cast iron rings and covers flush with the floor. Air-vents are also set in the top of each tank. These tanks are filled from tank-cars standing on a switching track on the south side of the building by gravity, care having been taken to set the tanks at a sufficiently lower level than the track.



PLANS OF MODERN OIL HOUSE.—GREAT NORTHERN RAILWAY.

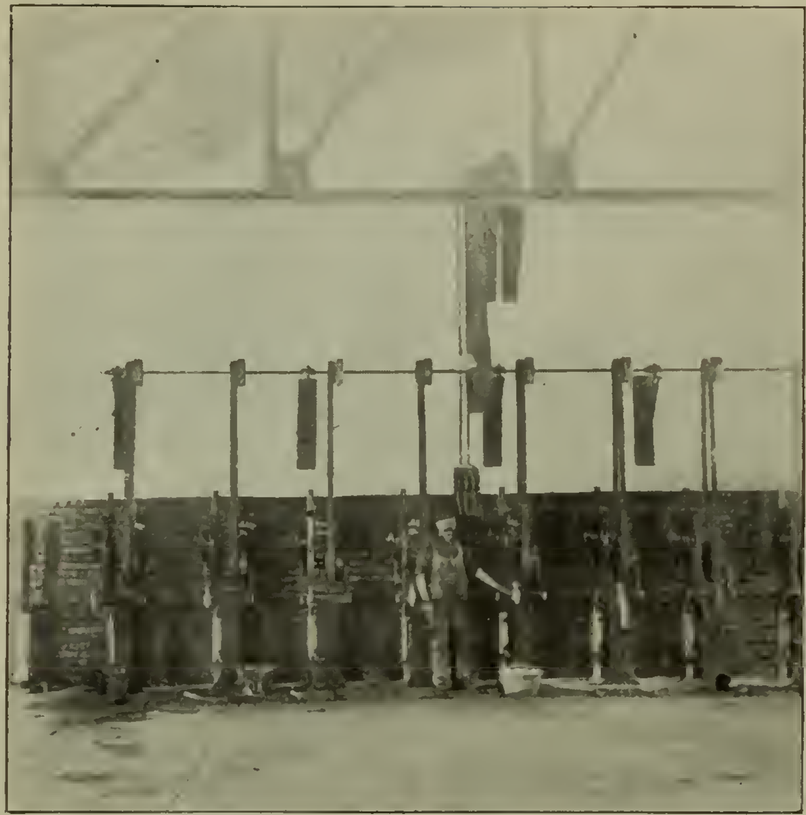
being supported by steel trusses similar to those in the interior of the building resting upon two rows of columns, each of which is constructed of two 8 in. channels latticed. As a protection to the trusses at this end the gable is sheeted with corrugated galvanized iron No. 24 gauge. The entire roof is composed of ferro-inclave and concrete, coated with asphalt. The several compartments are provided with ventilation through 6-19 in. globe ventilators at the apex of the roof.

STORAGE TANKS.

The tank or storage capacity is estimated at about 60,000 gal., being provided for by 8 steel tanks, four of 6,000 and four of 8,000 gal. capacity, placed on concrete

Filling-pipes pass out through the basement wall to a box on the outside of the wall beside the track. These boxes contain four valves of proper size so that connection can be made direct to the tank cars with hose of full size. Each valve is named to indicate which tank it serves, and the boxes can be locked to prevent tampering. The tanks described are used for storing car, engine, valve, signal, headlight, mineral seal and crude oils.

In addition to thes tanks, eight five-hundred gallon tanks are located in the same room also set on foundations of concrete; for storing locomotive black-varnish-elaterite paint, benzine, turpentine, boiled, lard and ideal

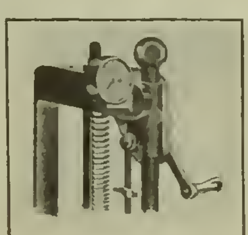


POWER PUMPS IN MAIN ROOM OF OIL HOUSE.—GREAT NORTHERN RY.

engine oil for local shop consumption and the smaller local shipments. These smaller tanks are also equipped with gauges on the outside so that it is apparent at all times just how many gallons each tank contains.

PUMPS.

In the distributing room, Bowser power oil pumps are located along the walls at the west end for drawing oils from the larger tanks in the basement. These pumps are self-measuring: or rather, automatic and can be set by gauge to any quantity from one-half to one hundred gallons; and are operated by an electric motor of 3 horsepower which operates all of these pumps from one shaft. The shaft is provided with cone pulleys for each pump, thus securing fast and slow speeds. These pumps are particularly adapted for barreling oil in either common wood or iron barrels. The gauge is set, the motor started and the valve opened; and in a few seconds the barrel or tank is filled to its capacity without being overflown, and stops automatically at number gallons at which gauge is set, and best of all without loss of oil. Proper trays or forms are set in front of each pump to hold a barrel while being filled and directly beneath them drain-pipes with strainers are located so that any surplus oil will be returned to the tank from which it was drawn by the pump. These drainage pipes have a further use, as same can be used for filling the storage tanks beneath in the event of oil being purchased in barrels.

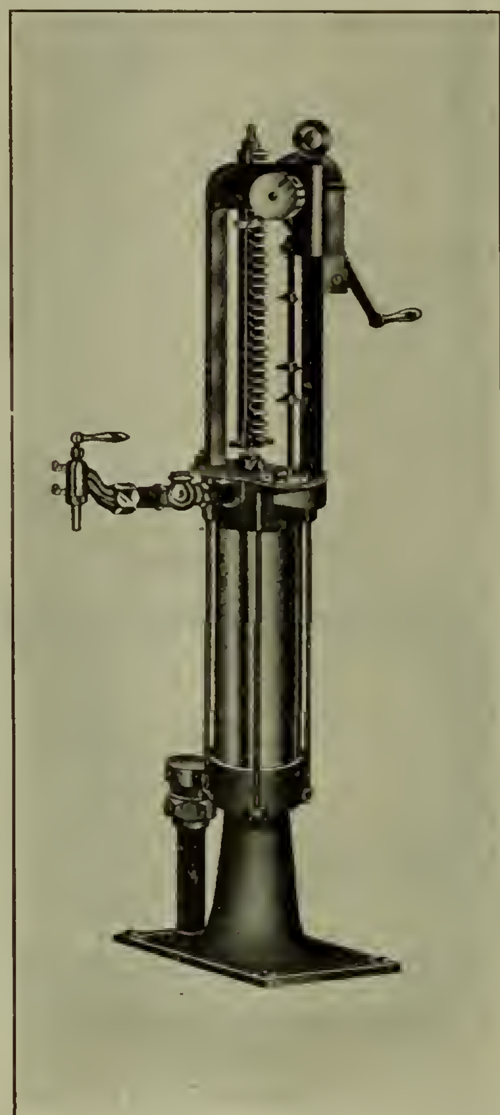


DISCHARGE REGISTER AND GALLON METER OF BOWSER SELF MEASURING OIL PUMP.

Bowser hand pumps are arranged along the south wall in the same room for discharging the benzine, gasoline, etc., tanks. These are, also, self-measuring pumps and can be set at any desired quantity, gallons, half-gallons, quarts or pints. On the walls behind all of the pumps, a stencil shows the kind of oil, which the pump serves. Before each of the hand pumps are located drainage pipes with strainers in a similar manner to those in front of the power-driven pumps, and through which the smaller tanks in the basement are filled. By referring to one of the photographic illustrations presented herewith, the power-driven pumps and motor are clearly shown, and to the left of the illustration will be seen one of the hand pumps.

GREASE AND WASTE.

The only other equipment located in the building is

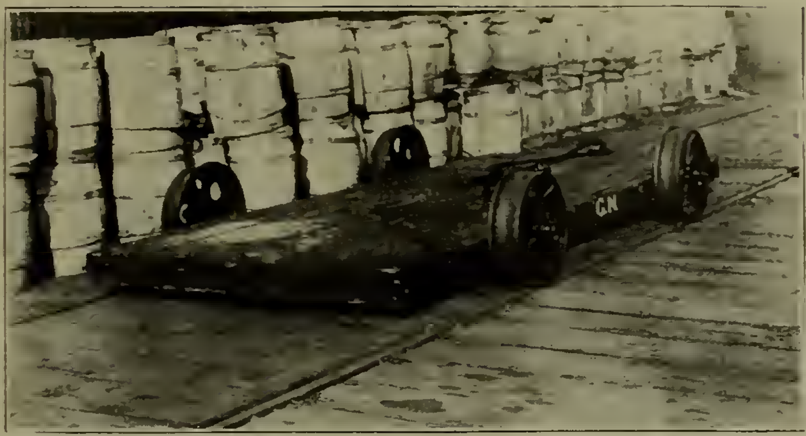


BOWSER LONG DISTANCE SELF-MEASURING PUMP.

an automatic grease press in the grease room which is used for preparing the lubricant for the hard grease cups on locomotives. In this room also is located an electrically operated hoist for conveniently raising and lowering grease and paint in barrels from the basement: though smaller quantities may be carried, as a steel stairway connects the basement with the upper floor in this room. In the waste room, a similar crane or hoist is arranged for handling waste to and from the lower compartment. It is estimated that these two compartments have a storage capacity of about 500 bales.

PLATFORM.

Another feature of interest is the platform previously



PUSH CAR FOR BARRELS, WASTE, ETC., AT OIL HOUSE.—GREAT NORTHERN RY.

mentioned, which surrounds the oil house on the east and north side. Track is set in the platform with the tops of directly adjoining, with which it is connected by means of a push-car track of standard gauge along the entire north side. Track is set in the platform with the tops of the rails flush. The platform at the east end is 50x60 ft., and is used for empty barrel storage. The platform on the north side is 200x19 ft. 6 ins. The flooring or deck is paved with vitrified brick set in sand, cement being used to keep the bricks in place and prevent oil percolating beneath. One of the illustrations herewith shows a push-car which has been designed for use in handling barrels, waste and analogous material. It will be noted that the height of this car is especially adapted for this class of work.

HEAT AND LIGHT.

The only other important features about this building are the arangements for heat and light; incandescent electric lights are distributed in all compartments of the building, both in the basement and on the main floor.

Steam pipes are located in all parts of the building, except the waste-room, for which no heating provision is made. Extra piping was installed in the tank room in the basement for use especially in cold weather. Provision was also made for a steam coil inside the valve oil tank, as it was found difficult to operate the pump for same even during the summer months. From the tank room in the basement, steam pipes were projected through the wall to the tank-car track, so that steam connections may be made direct with the tank cars, to facilitate discharging same when atmospheric conditions are low.

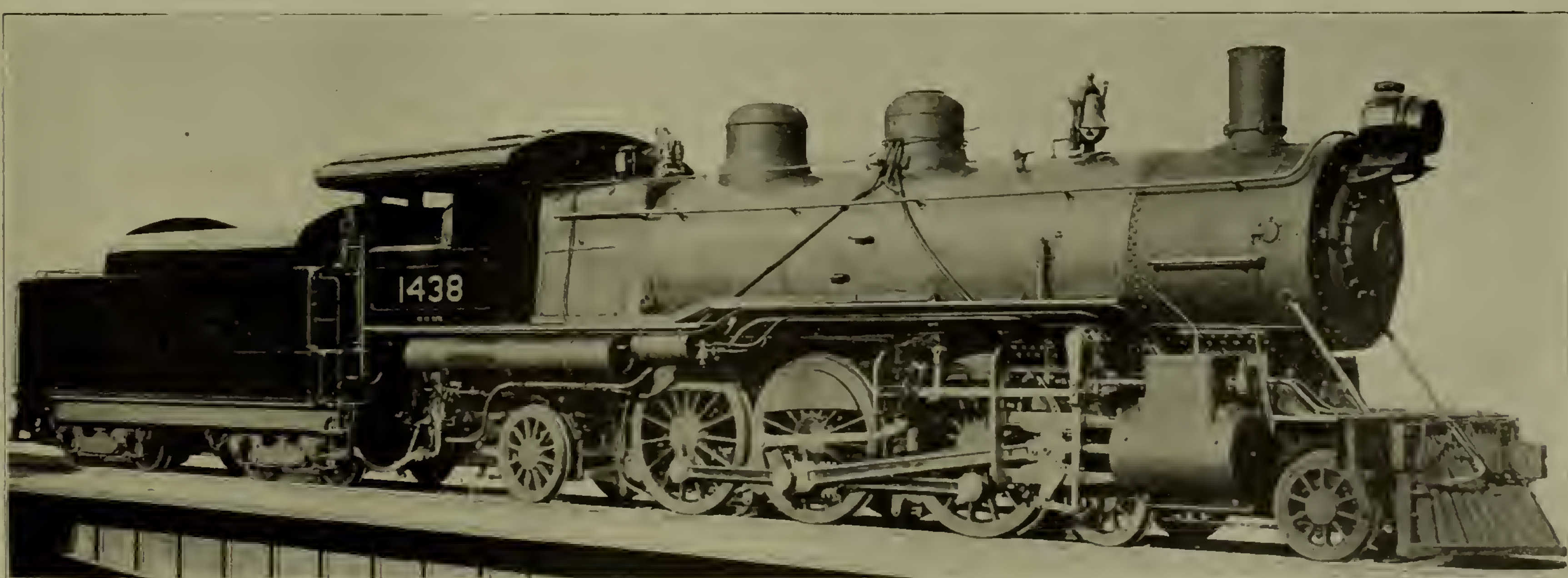
Pacific Type Locomotive

Great Northern Ry.

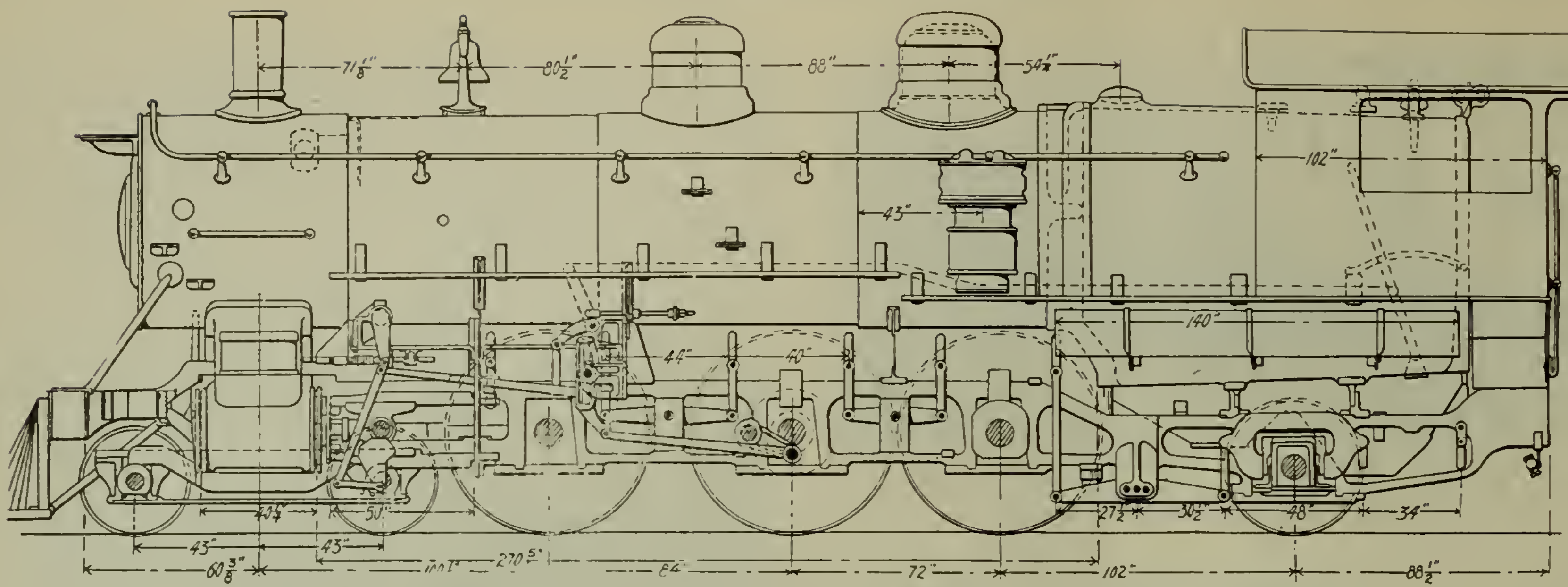
THE Baldwin Locomotive Works have recently built fifteen Pacific type locomotives for the Great Northern Railway. These are powerful engines for passenger service, as they can exert a tractive force of 37,550 pounds.

These locomotives are equipped with balanced slide valves which are driven by the Walschaert valve motion. The design of the gear represents the latest form as applied by the Baldwin Locomotive Works. A cross bearer, bolted to suitable knees, is located between the first and second pairs of driving-wheels, and serves as a support for the link bearings. These are of cast steel each being made in one piece, and provided with brass bushings. The link is built up of three pieces. The two slide plates, which are of cast steel, carry the trunions, while the center member to which the eccentric rod is attached, is of wrought iron. The links are finally assembled after the side plates have been placed in the bearings. The eccentric cranks are of cast steel, and are held in place by taper fits and through bolts.

The combining levers are placed outside the guides, and are coupled at their upper ends to rock shafts, which are supported on a suitable cross tie. This arrangement is necessary, as the steam chest center lines are placed three inches inside the cylinder center lines. Practically all the motion work, however, is located in one plane, and the symmetry of the link



PACIFIC TYPE LOCOMOTIVE.—GREAT NORTHERN RAILWAY.



GENERAL ELEVATION OF PACIFIC TYPE LOCOMOTIVE.—GREAT NORTHERN RY.

bearing is a noticeable feature of the gear. Only one reverse shaft is employed in this design.

The frames are of cast steel, 5 inches wide, with double wrought iron front rails and separate cast steel rear sections. The rear truck is of the Rushton type with inside journals. The general arrangement of the equalization system is shown on the accompanying side elevation.

In accordance with Great Northern practice, these locomotives are equipped with boilers of the Belpaire type. The boiler barrel is straight topped and is built up of three rings. The seams are located on the top center line, and are welded at the ends, with diamond welt strips inside. Water spaces of ample width are provided, the mud ring being 5 inches wide all around. Two rows of bolts, 1¼ inches in diameter between the threaded ends, brace the side sheets above the crown. The back head is stayed by 1½-inch rods, which are pinned to gusset plates. A detail of this arrangement is shown on the elevation of the boiler. The crown and roof sheets are both slightly arched, and the bolts pass through the sheets radially. The forward end of the crown is supported by two T-iron crown bars.

The tender frame is built of 12-inch steel channels, while the tank has a water bottom. The trucks are of the equalized type with cast steel bolsters.

The principal dimensions and specifications are as follows:

Type of engine	4-6-2
Service	Passenger
Fuel	Bituminous Coal
Tractive force	37550 lbs.
Gauge	4 ft. 8½ ins.
Cylinders	22 ins.x30 ins.
Valve Gear, type	Walschaert
Valves	Balanced Slide

RATIOS.

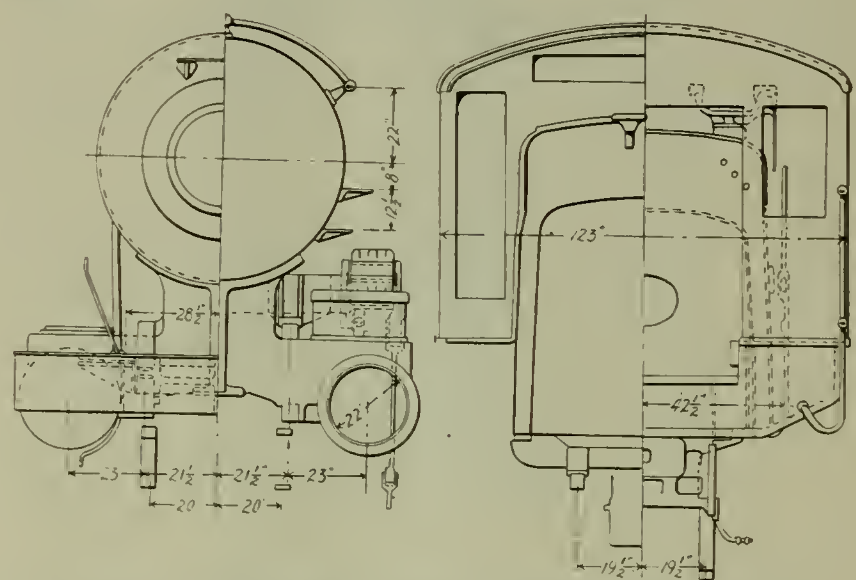
Weight on drivers ÷ tractive force	4.
Tractive force x diam. drivers ÷ heating surface	661.96
Total heating surface ÷ grate area	73.29
Tube heating surface ÷ firebox heating surface	18.
Weight on drivers ÷ total heating surface	38.57
Volume of cylinders cu. ft.	13.2
Total heating surface ÷ volume of cylinders	296.52
Grate area ÷ volume of cylinders	4.04

BOILER.

Type	Belpaire
Working pressure	210 lbs.
Diameter first ring	72 ins.
Material	Steel
Staying	Vertical

FIRE BOX.

Material	Steel		
Length	116½ ins.	Thickness of sheet.	
Width	66¼ ins.	sides	⅜ in.
Depth, front	72 ins.	Back	⅜ in.
Back	64 ins.	Crown	⅜ in.
Water space, front	5 ins.	Tube	½ in.
Sides	5 ins.		



END ELEVATIONS AND CROSS-SECTIONS OF PACIFIC TYPE LOCOMOTIVES.—GREAT NORTHERN RY.

TUBES.

Material	Iron
Wire gauge	No. 11
Number	301
Diameter	2¼ ins. Length 21 ft.

HEATING SURFACE.

Firebox	206 sq. ft.
Tubes	3,708 sq. ft.
Total	3,914 sq. ft.
Grate area	53.4 sq. ft.

DRIVING WHEELS.

Diameter, over tires	69 ins
Diameter, wheel centers	62 ins.
Journals, diameter and length	9½x12 ins.

ENGINE TRUCK WHEELS.

Diameter, engine truck	36 ins.

Journals, engine truck, diameter and length	6x12 ins.
Diameter, trailing truck	45 ins.
Journals, trailing truck, diameter and length	8x12 ins.

WHEEL BASE.

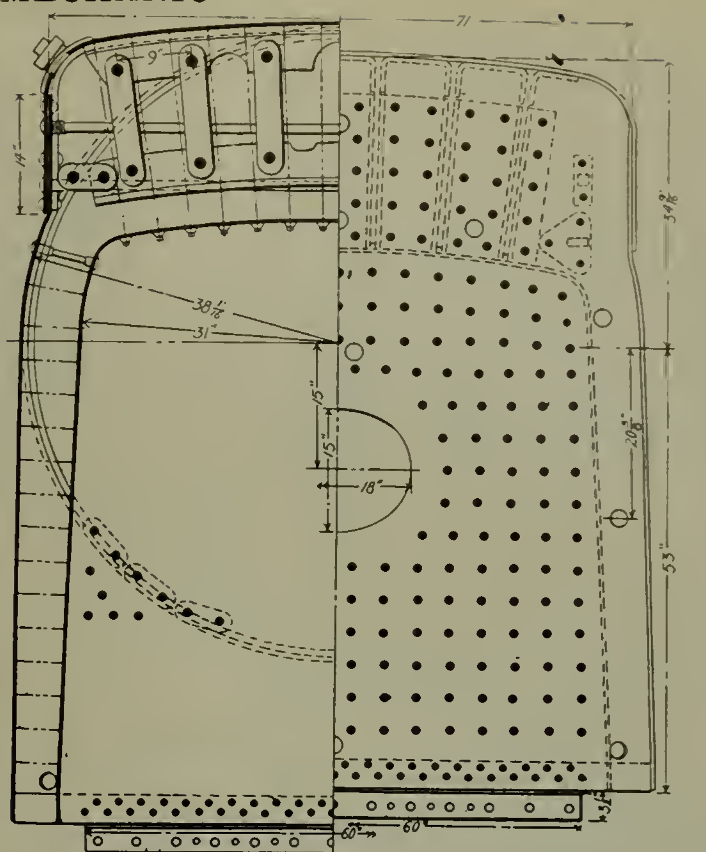
Driving	13 ft.
Total engine	33 ft. 5½ ins.
Total engine and tender	64 ft. 4 ins.

WEIGHT.

On driving wheels	151,000 lbs.
On engine truck	39,000 lbs.
On trailing truck	37,000 lbs.
Total engine	227,000 lbs.
Total engine and tender	375,000 lbs.

TENDER.

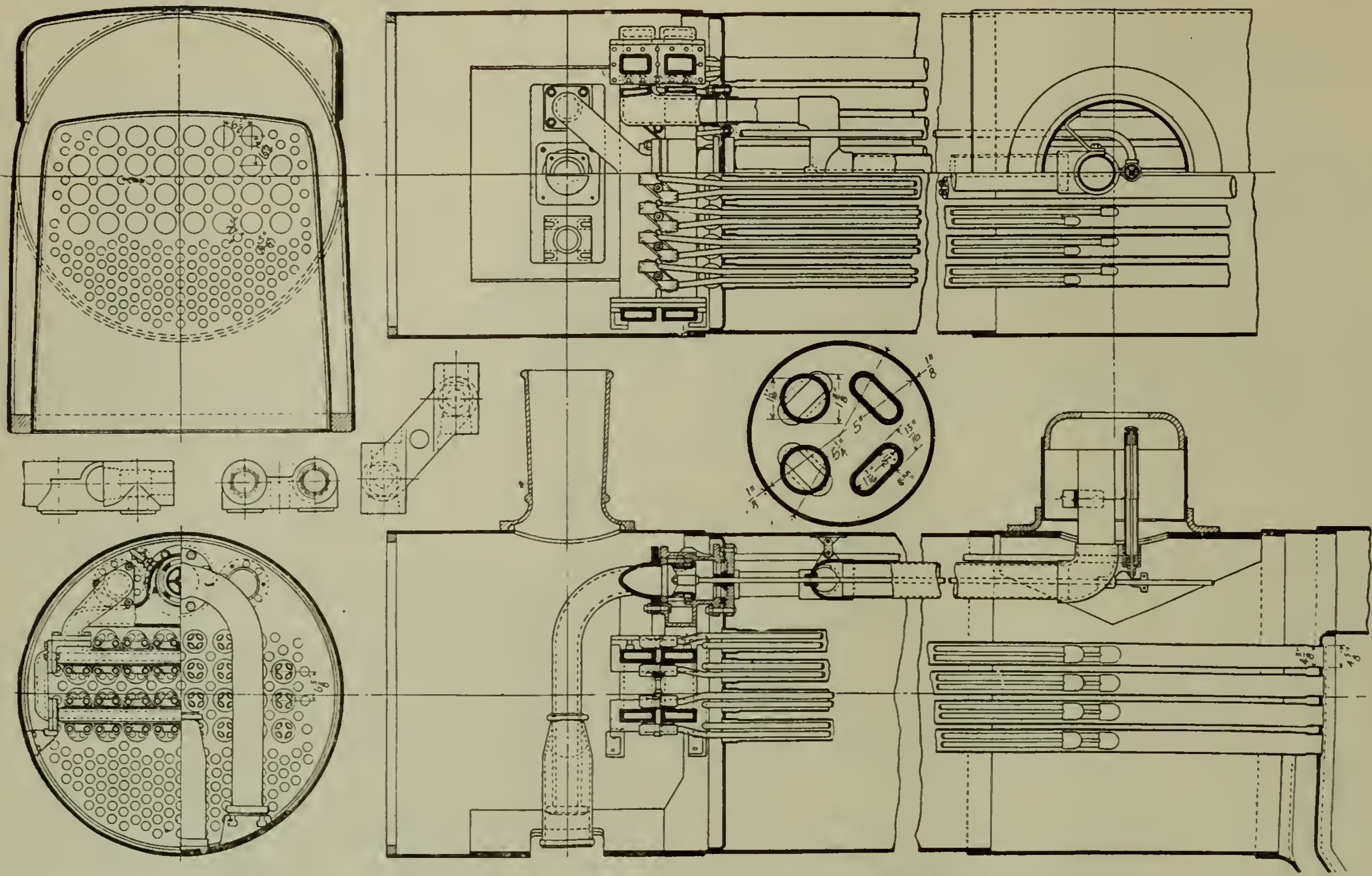
Style	Water bottom
Wheels, diameter	36 ins.
Journals, diameter and length	5½x10 ins.
Water, capacity	8,000 gals.
Coal, capacity	13 tons



CROSS SECTIONS OF FIREBOX, PACIFIC TYPE LOCOMOTIVE.--GREAT NORTHERN RY.

The Toltz Locomotive Superheater

THE Toltz locomotive superheater is of the smoke flue type. The large smoke flues have an inside diameter of 5 ins. and an outside diameter of 5¼ ins. The ends of the large flues in the smoke box end are enlarged to 5½ ins. outside diameter and are decreased in the flue sheet of the fire box to 4⅝ ins. outside diameter. The superheater elements consist of tubes of seamless cold drawn steel tubes, 1 1/16 ins. inside diameter and 1⅜ ins. outside diameter. The tubes are flattened to ½ in. by 1 7/16 inside diameter and 13/16 in. by 1¾ ins. outside diameter and are placed in the large smoke flue to form a square. The ends towards the fire box, where a cast steel return bend is used, are left round, also the ends in the smoke box where they are rolled into the drop forged cast steel flanges or clips, which connect the elements to the steam headers. There is only one element in each smoke flue, being double looped. The reason for flattening the pipe is to increase the velocity of the steam, whereby a greater amount of heat units will be transmitted; furthermore, flowing in a sheet, the steam will be more uniformly superheated than in a round pipe. Another important advantage is that due to the flattened pipes, the gas section in the smoke flue is considerably enlarged. As mentioned before, the flange or clip, into which the superheater elements are rolled like boiler flues, are connected with steam headers in pairs by one bolt. These flanges, which are either drop forged or cast steel, are manufactured solid and are drilled out for the connection of the superheater elements, the front end of which is enlarged and threaded to receive a plug. The steam headers which are located in a horizontal position midway between two rows of smoke flues, are of a flat section. The steam headers for the saturated steam are in front, the steam header for superheated steam being back, nearest to the front flue sheet. As there are four rows of smoke flues, in consequence there are two sets of horizontal headers which are connected on each side. The whole is supported by brackets connected to the shell of the smoke box. The saturated steam enters through the dry pipe on each end of the upper header. The dry pipe from the dome is split to give two connections near the front flue sheet. The steam entering the saturated steam headers will flow from there through the superheater elements into the superheated steam chamber, the outlet of which is also on each side of the upper header. The two superheated steam headers are also connected, same as the saturated steam headers. From there, the steam will flow to the throttle valve which in this case is located in front of the flue sheet in the smoke box. It consists of a double seated poppet valve actuated by a stem, which goes through the front flue sheet and through the center of the single dry pipe back through the cab. No packings necessary. By this construction, there is always steam in the superheater elements and for that reason, it will not be necessary to use dampers which for the purpose of protecting the elements from being overheated, are the cause of much attention. But to have another safety device for preventing any damages to the ends of the superheater elements nearest to the firebox, a circulation in the superheater elements is created by a connection which is made from the casing of the throttle valve, which always is surrounded by superheated steam, by a pipe which leads back into the dome, the top of which is higher than the dry pipe. This pipe on top is closed by a valve when the locomotive is working steam or when the thorottle valve is open. When the latter is closed, the valve on the circulation pipe will be open, because it is actuated by the stem of the throttle valve. Should, in this case the steam in the superheater elements, be heated to a very high degree, the steam will then, due to its smaller specific gravity, flow



PLAN, SECTIONS AND ELEVATIONS OF THE TOLTZ LOCOMOTIVE SUPERHEATER.

through the circulating pipe into the dome and new saturated steam will be drawn through the dry pipe into the superheater elements. At the same time, superheated steam is used for the air pump and if necessary for heating the train.

The advantages claimed for this design are:

First, to eliminate the dampers entirely. Second, on account of the flattened construction of the headers, inspection of the front flue sheet is not obstructed. Third, any of the superheater elements can be drawn out without difficulty. Fourth, there is only one bolt connection for two superheater elements. Fifth, a more uniform superheat due to the steam flowing in a sheet through the flattened superheater pipes.

The accompanying line drawing illustrates the design of the superheater and shows the boiler of a Prairie type locomotive arranged to accommodate the superheater. The weight of this locomotive on drivers is 151,000 lbs., and the outside diameter of drivers is 69 ins. Locomotives of the same class using saturated steam have cylinders 22 ins. in diameter by 30 ins. stroke, and operate under a boiler pressure of 200 lbs. With the application of the superheater the diameter of cylinders have been increased to 25¼ ins. and the boiler pressure reduced to 165 lbs. The boilers using saturated steam contain 301 tubes 2¼ ins. in diameter by 18 ft. 6 ins. long, providing a tube heating surface of 3,278 square feet. In the boiler arranged to accommodate the superheater 123 ordinary tubes were replaced by 30 tubes 5 ins. in diameter. These tubes provide a surface of 600 square feet, the remaining tubes have 1,935 square feet and the heating surface provided by the superheater elements equals 755 square feet, making a total tube heating surface of 3,490 square feet. The grate area in each case is 54 square feet, and the fire box area is 210 square feet. Then the locomotive using superheated steam has a boiler with a total heating surface of 3,700 square feet as against a total heating surface of 3,488 square feet with those using saturated steam.

The design of the Toltz superheater has been patented by Mr. Max Toltz and is handled by the Superheating and Engineering Company, 315 German-American Bank Building, St. Paul, Minn.

Car Foremen's Association of Chicago

THE Car Foremen's Association of Chicago celebrated the tenth anniversary of the organization on the evening of October 14th. During a short business meeting, the secretary reported a membership of 622 and a satisfactory cash balance on hand. The following officers were elected for the ensuing year:

President, T. H. Goodnow, master car builder, L. S. & M. S. Ry., Chicago.

First vice-president, P. H. Peck, master mechanic, C. & W. I. and Belt Ry. of Chicago.

Second vice-president, W. O. Davies, assistant general foreman, C. M. & St. P. Ry., Chicago.

Treasurer, W. E. Sharp, superintendent Armour Car Lines, Chicago.

Secretary, Aaron Kline, Chicago.

After the regular business session those in attendance adjourned to the regular banquet hall, where dinner was served to 208 members and guests of the association.

The address of the retiring president, Mr. O. M. Stimson, calling attention to the more important discussions before the club during the year, viz., "Unnecessary Movement of Cars at Terminals," "Strengthening Ends of Box Cars," "Friction vs. Spring Draft Gear" and "Terminal Passenger Car Cleaning," should carry conviction to the minds of all railroad men as to the good work the association is doing.

He was followed by Mr. T. R. Morris, past president, and by Mr. P. H. Peck, first vice-president, who gave very interesting accounts of the organization and early history of the association. Mr. F. C. Kroff gave some favorable reasons why car men should join the association. Next Mr. LeGrand Parish, superintendent of motive power, Lake Shore & Michigan Southern Railway, and several other past presidents addressed the members giving valuable suggestions and much encouragement to the association.

From the several speeches it was learned that the association was organized in October, 1898 (10 years ago), with nine charter members, for the purpose of promoting closer acquaintance among men engaged in handling cars at Chicago terminal, and growing to its present proportions of over 600 members, embracing almost every department of railroad work, represents hard work, self-sacrifice and a generous amount of the "I WILL" spirit on the part of the officers and members. That they have reaped full reward for their labors is evidenced by the adoption of a code of rules, governing the handling of cars at Chicago terminal, by the General Superintendents' Association as formulated by the Car Foremen's Association, also by the generous contributions to the support of the club by the railroad and private car companies.

Mr. W. E. Sharp served as toastmaster at the banquet introducing each speaker. To him is largely due the success of this the tenth anniversary of the Car Foremen's Association of Chicago.

The association meets regularly on the second Monday evening of each month. The minutes formerly published in the RAILWAY MASTER MECHANIC are now published in pamphlet form and distributed from the Ohio River to the Pacific Coast, giving the car men at the out-of-the-way junction point an opportunity to keep posted on up-to-date methods of car interchange and repair work. The greatest good has been accomplished through education by bringing together the car inspectors and repair men for the common purpose of facilitating the movement of railroad cars.

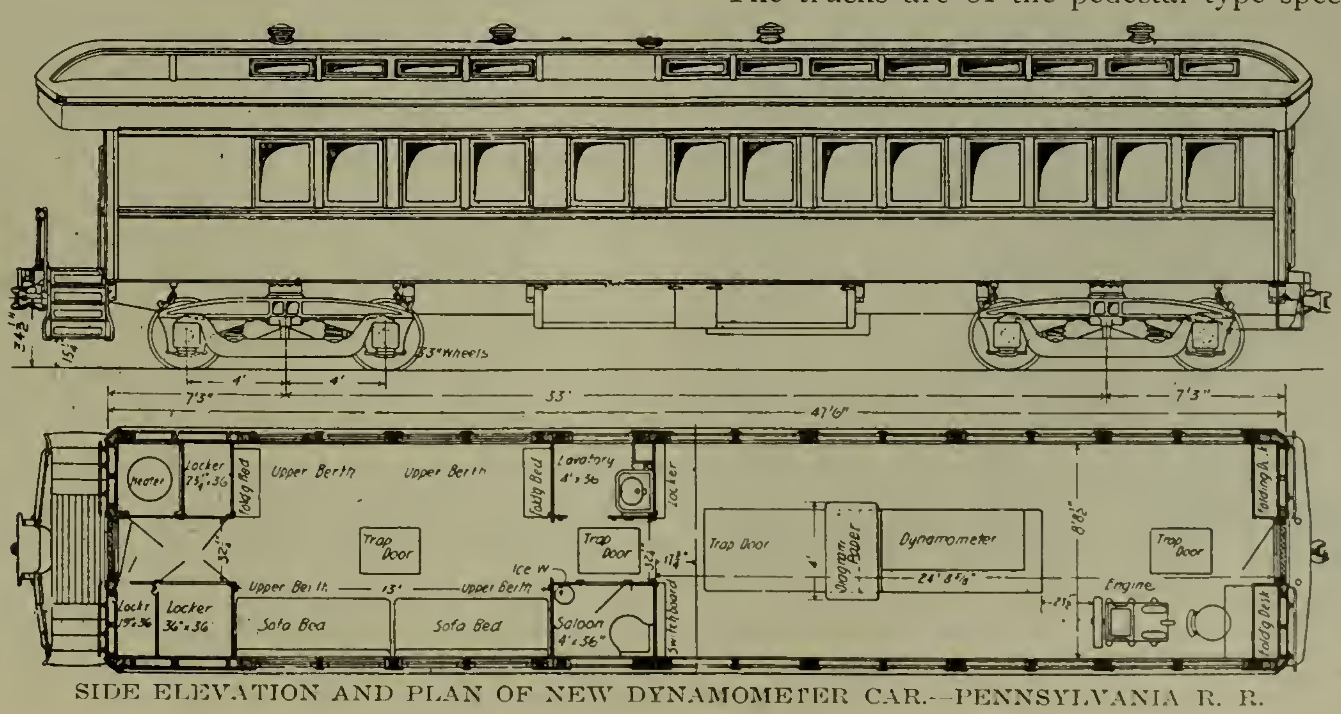
New Dynamometer Car

Pennsylvania Railroad

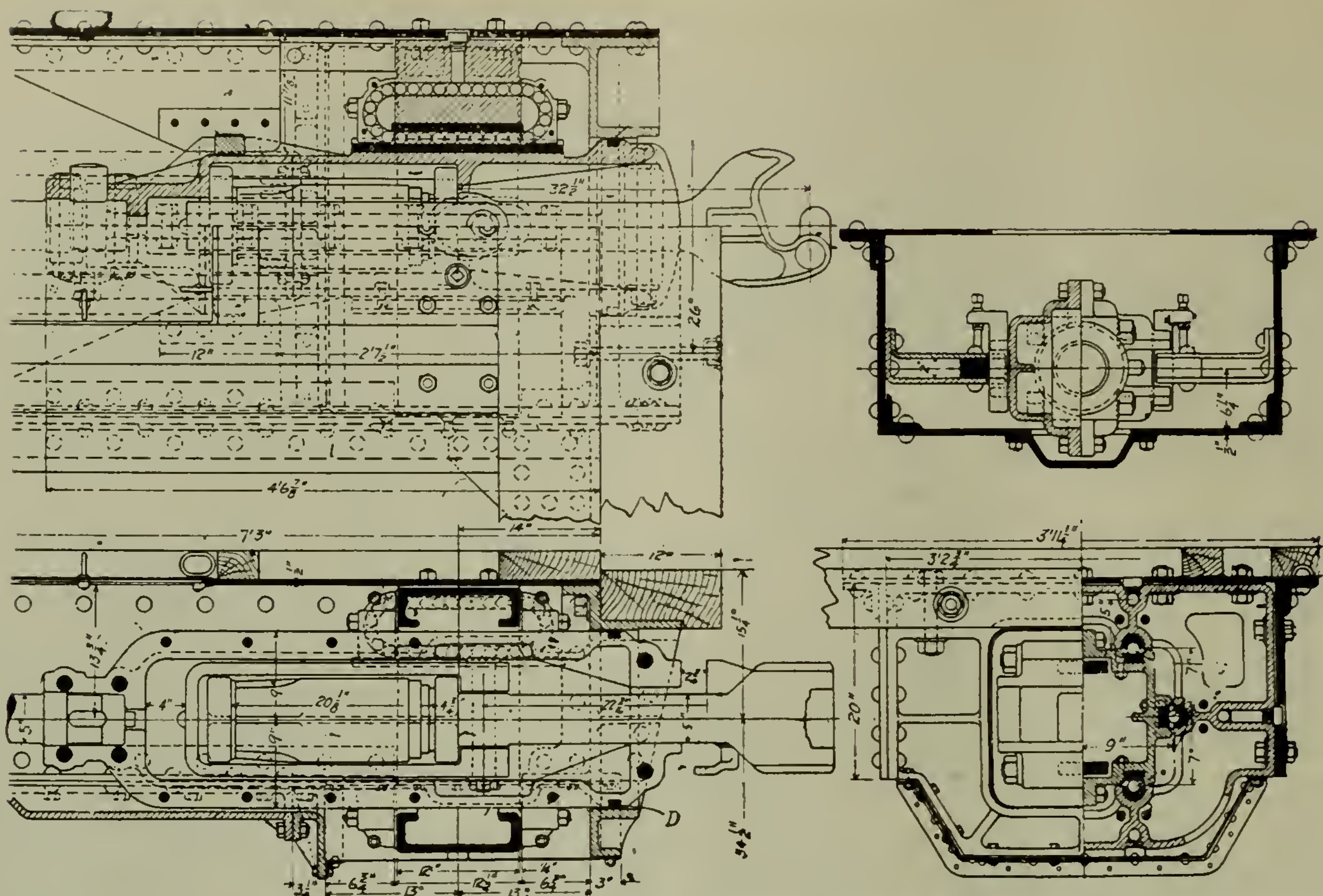
THE Pennsylvania Railroad has just completed a dynamometer car which in its construction and working embodies the result of many years of test and experiment. The new car, regarded as one of the best now in service on American railroads, has a capacity of 100,000 pounds, three and one-half times that of its predecessor; a significant indication of the enormous increase in locomotive capacity during the past 22 years. Except for the fact that it is a trifle shorter, has but one platform, and that its trucks are of rather unusual design, this car closely resembles the standard passenger coach.

The under frame consists of a center sill of box section 38 inches wide by 21 inches deep, extending the entire length of the car, its form being modified when necessary, to accommodate such portion of the mechanism as are placed within it. The car body is supported by body bolsters and a series of lateral struts made of structural material, and firmly riveted to the side walls of the main girder. The ends of the struts and body bolsters are secured to 5-inch Z bar side sills running the entire length of the car body on either side, and supporting the timber framing of the car.

The trucks are of the pedestal type specially designed



SIDE ELEVATION AND PLAN OF NEW DYNAMOMETER CAR.—PENNSYLVANIA R. R.

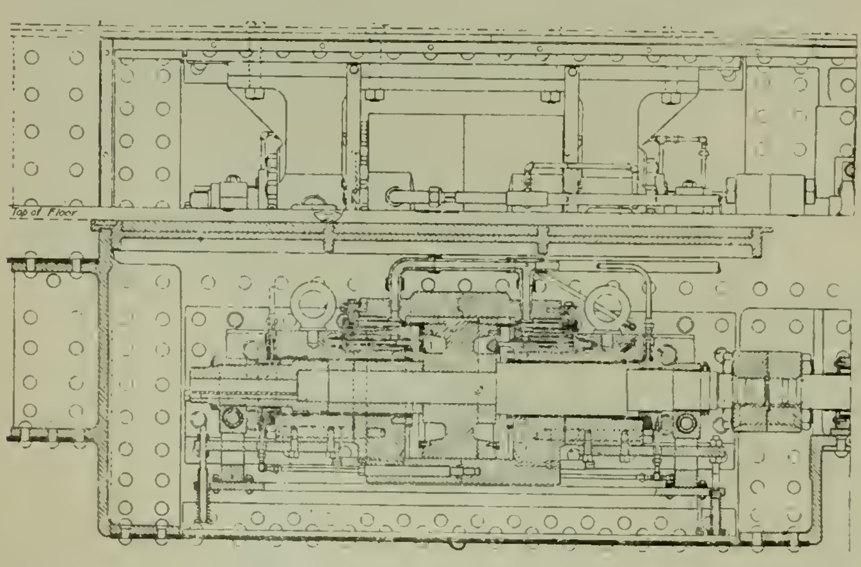


PLAN AND SECTIONS OF DRAFT GEAR AND HOUSING.—NEW DYNAMOMETER CAR.—PENNSYLVANIA R. R.

to accommodate the deep center sill. Journal boxes, pedestal jaws and side frames are of cast steel, the latter being rigidly secured to the p-essed steel truck bolsters. An eight-foot whel base is secured, and 33-inch steel tired wheels with 5½x10-inch journals are provided.

Air brakes of the usual form supplemented by hand brakes are applied to all wheels except for forward pair on the rear truck, from which pair the paper mechanism is driven. The draft mechanism at the rear or platform end of the car consists of a standard tender coupler in connection with a Westinghouse friction draft gear.

The interior of the car is divided into two main compartments; the dynamometer compartment at the forward end, and the computing compartment at the rear. The former contains in addition to the weighing and recording apparatus, a generating set car switchboard, tool cabinets, and two folding desks. A lookout window, permitting the observeh to see the track ahead, can be adjusted to any one of four windows, depending on the direction of motion of the car and the side from which it is preferred to make the observations.



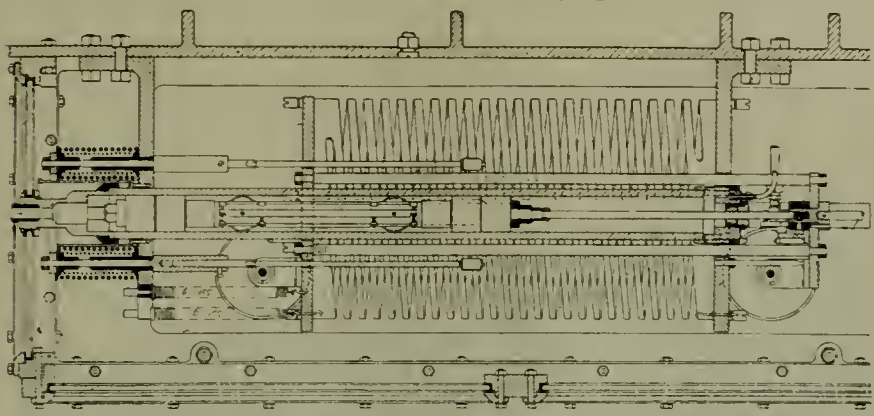
ELEVATION AND SECTIONS OF MAIN HYDRAULIC CYLINDER.—NEW DYNAMOMETER CAR.—PENNSYLVANIA R. R.

The rear or computing compartment is equipped with a table and chairs; also four upper berths, two folding beds and two convertible sofas, which furnish sleeping accommodations for the crew of 8 persons when a hotel is not available. Furniture is of substantial and practical design, in keeping with the purely business purposes of the car. An oil bath for storing the weighing springs when not in use, lavatory, saloon, heater compartment and lockers for fuel, oil and tools complete the equipment. The weight of the car is about 62 tons.

The coupler and friction draft gear are connected by the usual yoke and both secured within the heavy cast steel housing to which the main drawbar is attached. The housing is guided in the frame of the car by a set of 6 ball bearings parallel to the line of draft, each containing 32 hardened steel bails 1¼ inch diameter. To relieve the dynamometer mechanism from all load when not in use provision is made for securely locking the housing to the frame of the car, by inserting a pair of tapered keys into notches in the housing.

About 6 feet back of the housing the drawbar passes through a cast steel partition and is connected to the buffer composed of a nest of 36 helical springs, compressed and held at an initial load of 100,000 pounds. The function of the buffer is to protect the dynamometer apparatus from injury in case of loads or shocks of any kind in excess of 100,000 pounds, the normal capacity of the car.

At a point 20 inches back of the buffer, the drawbar connects with the piston rod of the main hydraulic cylinder by means of a coupling. The piston rod on either side of the pistcn is fitted to the glands with the utmost possible accuracy to allow of its working without packing and at the same time without friction. The piston, 16¾ inches in diameter by 8 inches long, is accurately fitted to the cylinder and grooved upon its periphery to secure lubrication and avoid the use of packing. The main hydraulic cylinder is made of gun iron in two parts, and its interior surfaces are carefully ground to size to



DETAILS OF RECORDING CYLINDER.—NEW DYNAMOMETER CAR.—PENNSYLVANIA R. R.

receive both the piston and the bronze glands for the piston rod.

The draft mechanism from the inside face of the coupler to the center line of the piston is 21 ft. 10 ins. long. A series of ball, roller and rocker bearings keep it in proper alignment, and by supporting its entire weight, lessen the possibility of friction in the main hydraulic cylinder, piston rod glands, and in various other bushings through which the drawbar passes.

In each end of the cylinder are two automatic valves arranged to transmit the pressure within the cylinder to the weighing mechanism irrespective of the direction of motion of the piston, thus making it possible to record either push or pull on same side of the datum line of the diagram. Valves communicating with the weighing apparatus are termed the "high-pressure" valves, while the "low-pressure" valves communicate with the supply tank. With the main piston in mid-position, all valves are slightly open and a state of equilibrium exists in the two ends of the cylinder, under which condition the line made by the drawbar pull pen coincides with the datum or no-load line on the diagram.

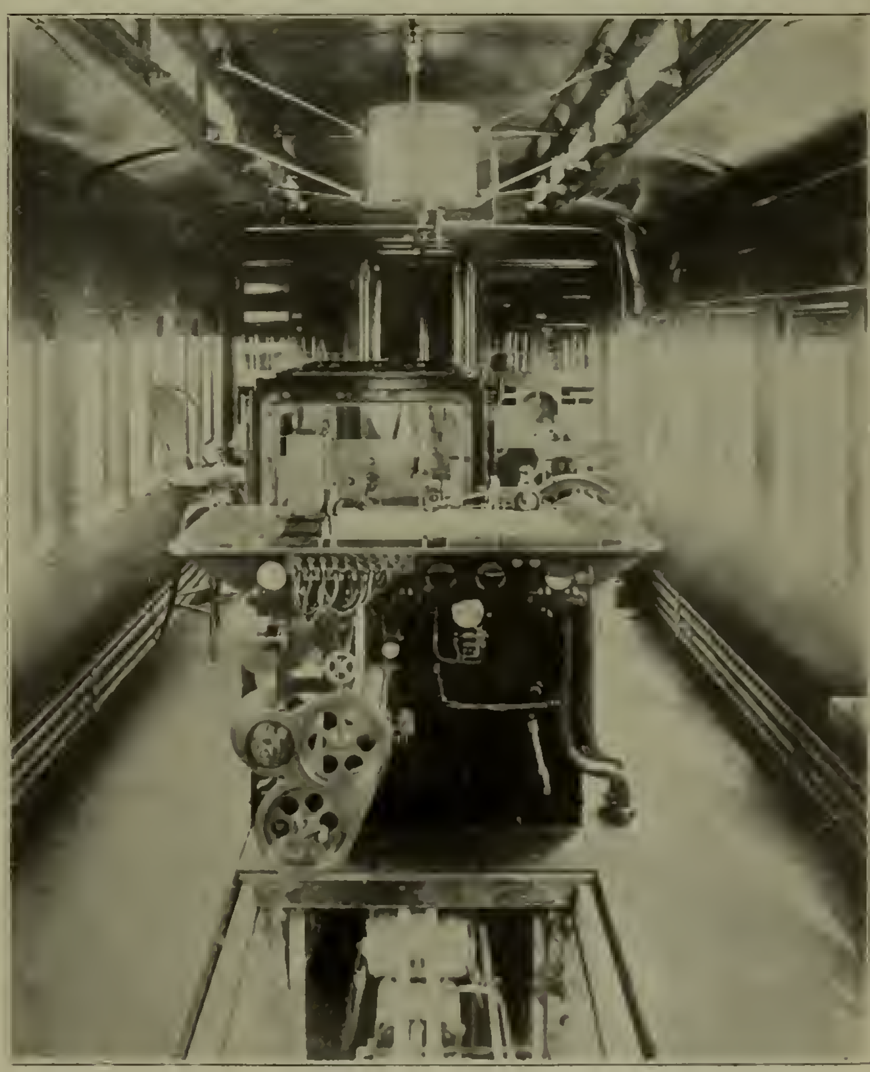
The recording cylinder, connected at the end of the main hydraulic cylinder, is 40 inches long by 2 17-32 inches inside diameter, and has a piston area equal to 1-36 that of the main cylinder. It is provided with two pair of pistons held at either end of a two-wheeled spring-supported carriage. They are carefully fitted to the cylinder and instead of being packed have quadruple spiral grooves cut on their outer surfaces, insuring even lubrication and reducing friction to a negligible amount. The normal movement of the piston within the recording cylinder is 10 inches, but a system of stops and buffer springs allows an additional movement of .8 of an inch in case the weighing mechanism is accidently overloaded.

The scale of value of the pen movement in pounds per inch of ordinate is dependent on the capacity of the springs used, and can be varied to suit conditions by combinations of different springs, giving ordinates from 1,000 pounds per inch to 10,000 pounds per inch, excepting the 9,000 pound ordinate. To secure these various combinations, a total of 8 springs has been provided, they are always used in pairs, there being one pair of 1,000 pounds capacity, one pair of 2,000 pounds capacity, and two pairs of 4,000 pounds capacity. In order to secure springs of great uniformity throughout their entire range of movement, they were cut from solid cylinders of nickel steel after hardening, instead of being wound from bar stock and then hardened. They were carefully calibrated and corrected by hand scraping, until their errors were within allowable limits. The force actually resisted by the springs is 1-36 of the load on the drawbar as the piston areas of the recording and main hydraulic cylinders bear this ratio.

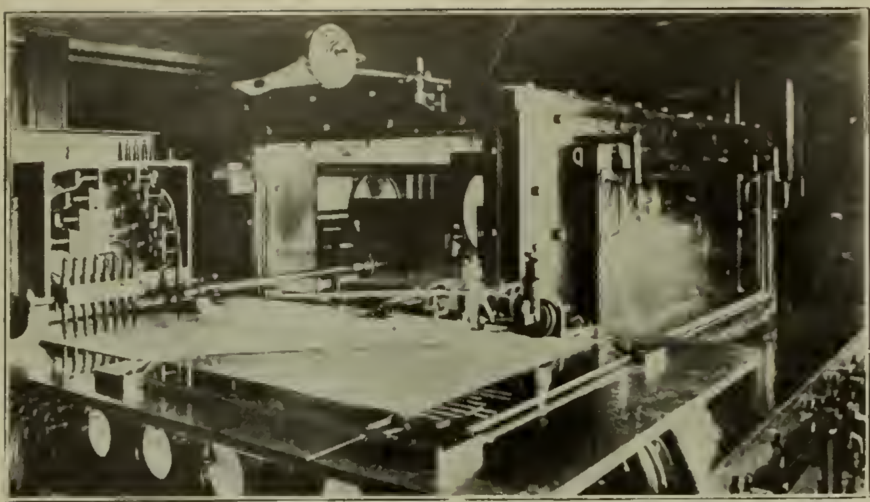
For supplying oil to the cylinders and taking care of the leakage past the piston a complete system of tanks, piping, and pumps is provided.

The paper, or recording mechanism, is driven from the forward axle of the rear truck. The wheels on this axle are 33 inches in diameter, straight faced and have no brakes. Motion is taken from the axle by means of a pair of spiral gears, the driver being cut directly on the axle and the follower keyed to the transmission shaft, whereby the motion is carried forward a distance of 21 feet and up through the floor to the feed mechanism. By means of gears and a clutch, the movement of the paper is controlled and kept in the proper direction, irrespective of the direction of movement of the car.

The various guide, feed, supply, and receiving rolls are supported in the framework underneath the record



INTERIOR OF NEW DYNAMOMETER CAR.—PENNSYLVANIA R. R.



RECORDING TABLE AND RECORDING PENS.—NEW DYNAMOMETER CAR.—PENNSYLVANIA R. R.

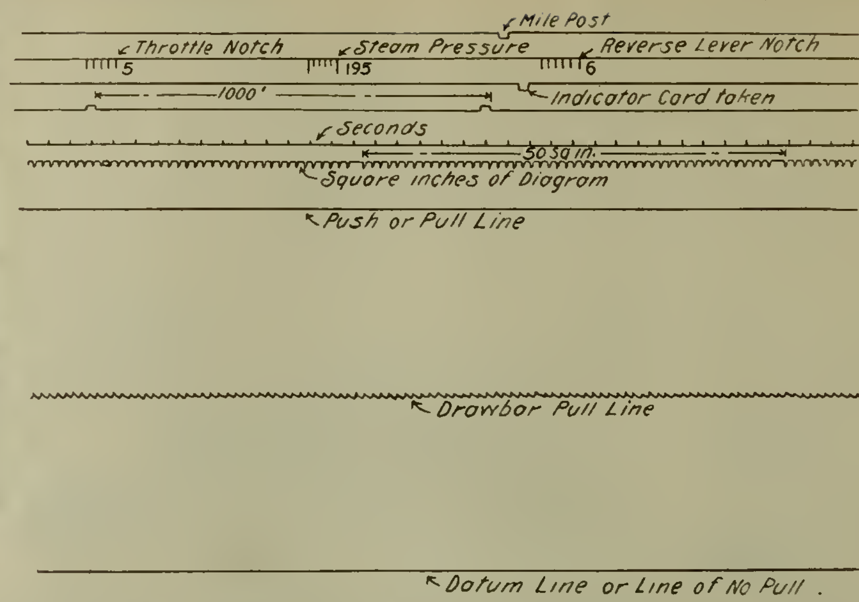


DIAGRAM OF RECORD MADE BY NEW DYNAMOMETER CAR.—PENNSYLVANIA R. R.

table. The feed mechanism consists of a corrugated roll against which the paper is firmly held by a rubber roll. The corrugated roll is of such size and revolves at such a rate as to draw the paper off the supply drum and across the record table at the rate of 1 inch of paper to 100 feet of travel of the car. The receiving drum is driven by a friction disc, by means of which it revolves just fast enough to take up the paper as it comes through the feed mechanism. Tension in the paper can be regulated by adjusting the compression of a spring bearing against the friction disc.

The zero or datum line is made by means of a small wheel, the circumference of which is in contact with an inking pad, and which revolves as the paper passes under it. Provision is made for 8 additional lines, each made by an electrically operated stylographic pen. The various pens record the following data: whether the load is a push or pull; area of diagram in square inches; distance passed in 5 second intervals; every 1,000 feet traveled; time of taking indicator cards; steam pressure, throttle and reverse lever positions; location of mile posts, stations, etc. One extra pen is provided.

Loss of Heat Due to Scale

There is a direct loss in heat transmission in a locomotive boiler, due to scale on the tubes and sheets. This varies, but in cases where the scale is ⅛ of an inch thick, the loss sometimes amounts to 10 or 12 per cent. The mechanical structure of the scale affects the percentage of loss, while the chemical nature of the scale does not bear a direct influence on the heat transmitting qualities except as affecting the structure of the scale.

Pacific Type Locomotive

New York Central Lines

SINCE 1901 when the first Prairie type engine was put in service on the Lake Shore & Michigan Southern Railroad, this type has been the favorite type of heavy passenger engine on that road. Recently, however, in adding to their motive power equipment, they placed an order with the American Locomotive Company for twenty-five Pacific type engines, one of which is illustrated herewith. Besides being interesting as representing the introduction of a new type on this road, they are with the exception of the Pacific type recently built for the Pennsylvania Railroad, the heaviest passenger engines ever built by the American Locomotive Company. Another interesting feature is the application of a combustion chamber to the last three engines of the order.

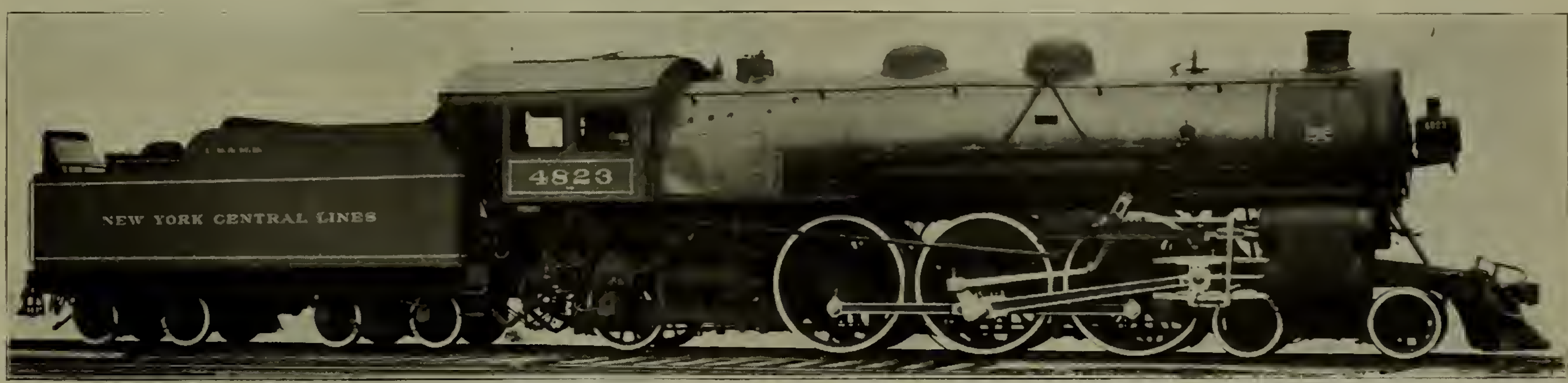
As compared with the heaviest class of Prairie type engines now in service on the road, the engines illustrated have about the same weight on driving-wheels, the same diameter of drivers and the same boiler pressure, but with cylinders one-half inch larger in diameter they have a greater tractive power.

The following table gives the principal dimensions and ratios of the two types:

Type	2-6-2	4-6-2 with combustion	4-6-2 without
Total Weight	244,700	261,500	261,500
Weight on Drivers	170,000	170,000	167,000
Tractive Effort	27,850	29,200	29,200
Size of Cylinders	21½x28	22x28	22x28
Diameter of Drivers	79	79	79
Total Heating Surface	3,905	4,195	3,409
Grate Area	55	56.3	56.3
Tractive Effort ÷ Total Heating Surface	7.13	6.96	6.56
Weight on Drivers ÷ Tractive Effort	6.1	5.83	5.72
Total Weight ÷ Tractive Effort	8.8	9.03	9.03
Tractive Effort x Dia. Drivers ÷ Heating Surface	563	550	675
Total Heating Surface ÷ Grate Area	71	75.5	60.5
Total Heating Surface ÷ Vol. of both Cylinders	332	340	276
Firebox Heating Surface ÷ Tube Heating Surface, per cent	6.17	4.92	8.62
Weight on Drivers ÷ Total Heating Surface	43.6	40.6	48.9
Total Weight ÷ Total Heating Heating Surface	1,061	1,091	1,002.3

It will be noticed from the above tables that in the Pacific type engine 310 square feet of heating surface for every cubic foot of cylinder volume has been provided; also that the figure representing the B. D. factor or factor of steam consumption is well within the usual limits for this type of engine, which would indicate that these engines have a large boiler capacity for high speed sustained for long periods.

A careful comparison of the ratios of the two types will also show that especial attention has been given in the design to the Pacific type engine to provide the same satisfactory proportion between boiler and cylinder capacity as were obtained in the Prairie type engine. The boiler of the engines illustrated are of the radial stayed type with conical connection, the outside diameter of the first or smallest course being 72 inches. Those without combustion chambers contain 379 tubes 2 inches in diameter and 20 feet long. In the boiler with combustion chambers shown in the accompanying illustration, the only changes made are the introduction of the 4 foot combustion chamber and a reduction in the number and length of the tubes; otherwise they are the same as the boiler of the other engines of the order. The tube sheet has been moved ahead so that the tubes are 18 feet long or only 2 feet shorter than in the engines without combustion chamber, although the combustion chamber is 4 feet long. The number of tubes has been reduced to 332 as against 379 in the other engines. These changes reduce the tube heating surface 848 square feet or 21.4 per cent, while the firebox heating surface is increased 62 square feet or 33.4 per cent. Results from the use of the combustion chamber on the Northern Pacific Railroad have shown that the increase in firebox heating surface fully offsets the decrease in tube heating surface and the evaporative efficiency of the boiler is in no way decreased by the introduction of this feature. The relative steaming qualities of the two boilers here described is best shown by a comparison of the figures in the above tables for equated heating surface. These figures are obtained from Mr. H. H Vaughan's formula which equates the total firebox heating surface to the tube heating surface divided by the square root of the length of the tubes in feet. By such a comparison it will be seen that although the total actual heating surface has been reduced 786 square feet or 18.7 per cent, the total equated heating surface has been reduced only 89 square feet or 8.1 per cent, which would indicate that the engine with combustion chamber will steam fully as well as those not so equipped.

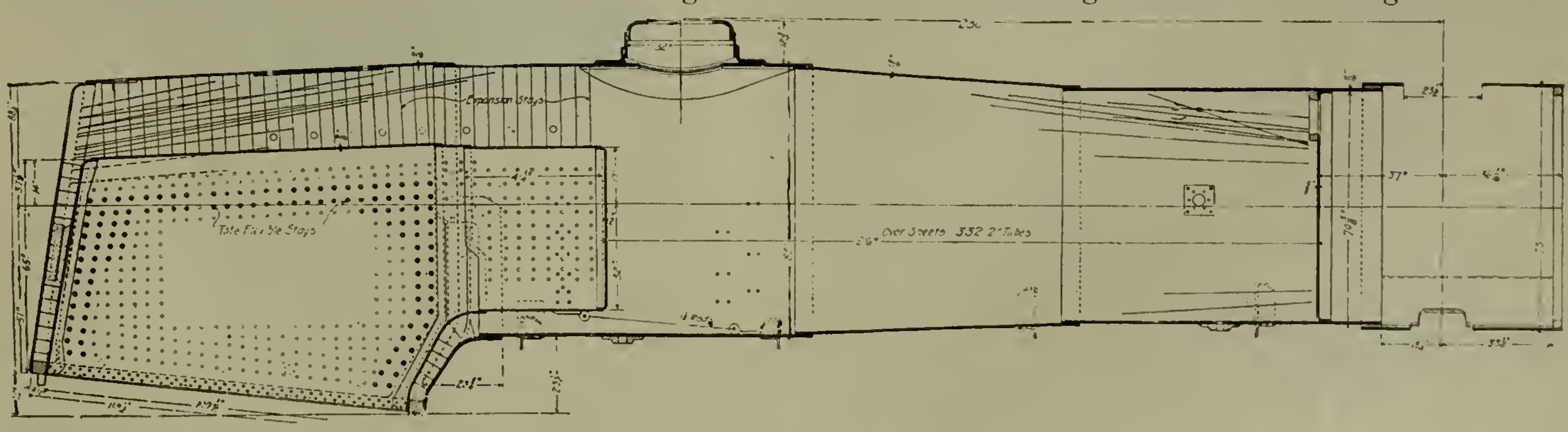


PACIFIC TYPE LOCOMOTIVE.—LAKE SHORE & MICHIGAN SOUTHERN RY.

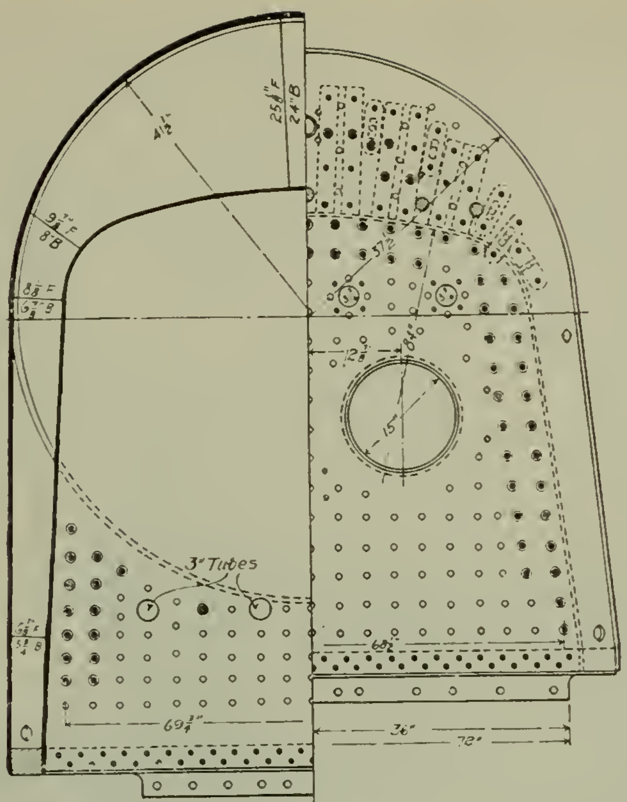
As will be seen from the illustration the combustion chamber is stayed to the shell of the boiler by radial stays on the bottom and sides and expansion stays on the upper section. A number of 1⅛ inch rod braces between the chamber and the shell of the boiler serve to further stiffen it. The water space between the chamber and the shell of the boiler is about 8¼ inches at the bottom and 7 inches at the closest point on the sides, which gives ample space for good circulation.

The application of the combustion chamber to these engines, as to also two of another duplicate order of 20 for the same road, and to the 6 decapod engines recently completed for the Buffalo, Rochester & Pittsburg Railroad (see elsewhere in this issue), shows the increasing popularity of this feature as a means of reducing boiler trouble.

Another interesting feature of the design is the ar-



LONGITUDINAL SECTION OF BOILER SHOWING COMBUSTION CHAMBER.—PACIFIC TYPE LOCOMOTIVE.—LAKE SHORE & MICHIGAN SOUTHERN RY.


END ELEVATION AND SECTION OF FIREBOX.—PACIFIC TYPE LOCOMOTIVE.—LAKE SHORE & MICHIGAN SOUTHERN RY.

rangement of the Walschaert valve gear which is similar to that employed on the Pacific type locomotive built for the Pennsylvania Railroad by the American Locomotive Company. The link is located just back of the center of the forward driving-wheels and is supported on a steel casting outside of the driving-wheels, which extends between the guide yoke and the frame cross-tie located between the first and second pair of driving-wheels. The reverse shaft is supported on the back end of this same casting and the reverse shaft arm is directly connected to the radius bar by means of a slip joint.

Improved Electric Headlight

THE Galveston, Harrisburg and San Antonia Railway has been conducting a long series of tests with electric headlights, with a view of simplifying the usual lamp construction and rendering its operation more certain. The experimental work has been under the supervision of Mr. B. B. Lacy, of Houston, Texas, and service trials with new apparatus have given very gratifying results.

Secured to the base of the headlight, an ingenious bracket supports the lamp frame and permits adjustment laterally as well as forward and back, to bring the arc at the focal point of the reflector so that the rays will be thrown ahead in a well concentrated beam. Lateral adjustment is secured by rocking the lamp frame about a horizontal trunion, and movement forward and backward by an adjustable slide within the bracket.

The lamp frame is shaped similar to the letter "C". Its lower arm carries an adjustable bracket which clamps the lower electrode of ½ inch copper while the upper arm carries a vertical guide for the upper electrode of ⅝ inch carbon. At its lower end, about two inches above the arc, this guide is provided with a horizontal lug through a hole in which the carbon passes. The guide is also provided with a clamp which slides vertically upon it and grips the upper end of the carbon.

On the back of the lamp frame is a solenoid, connected in series with the lamp and generator. The armature of the solenoid is connected at its upper end to a small cross-head which slides vertically in guides. An adjustable helical tension spring is attached to the top of the cross-head to carry the weight of the moving parts and furnish resistance to oppose the action of the solenoid. An oil dash pot attached to the cross-head prevents sudden or jerky action of the operating parts.

A horizontal lever rocks about a stud supported by the upper arm of the lamp frame. One end of this lever is connected to the cross-head operated by the solenoid and the other end is attached to the clutch which grips the carbon near its lower end.

The clutch is simple in operation and consists of a


IMPROVED ELECTRIC HEADLIGHT.—GALVESTON, HARRISBURG & SAN ANTONIO R. R.

flat plate having in one end a hole enough longer than the carbon, to allow the carbon to slip through freely when the clutch plate is at right angles to the carbon. The link connecting the clutch plate to the horizontal lever is attached to the plate near its middle. At the end of the plate opposite the carbon, a rod is connected which at its upper end slides upon the link and is forced upward by a light helical compression spring wound about the link and secured to it at the lower end.

ELECTRIC GENERATOR FOR IMPROVED ELECTRIC HEADLIGHT.—GALVESTON, HARRISBURG & SAN ANTONIO R. R.

The object of this spring attachment to the clutch plate, is to render its operation more certain and free from the possibility of slipping, brought about by jar while the locomotive is running.

When no current is passing through the lamp, the armature of the solenoid and its cross-head are held in their upper position by the spring, the carbon clutch is released by being brought in contact with the lug at the bottom of the carbon guide, and the carbon electrode rests upon the lower copper electrode.

If current is sent through the lamp, it energises the solenoid, which in turn attracts its armature, rocks the horizontal lever, raises the carbon clutch which grips the carbon electrode and raises it from the copper electrode creating an arc between the two. Separation of the electrodes is limited by the fact, that as their distance apart increases the resistance of the arc to passage of current also increases, and the flow is cut down which in turn lessens the power of the solenoid to pull against its opposing spring. It is the balance between the spring and the pulling power of the solenoid, which regulates the arc and by adjusting the tension of the spring any desired condition may be realized.

Wearing away of the upper carbon due to action of the arc, cuts down the current, which in turn weakens the pull of the solenoid and allows the spring to lower the carbon enough to make up for the portion worn away by the arc. When the carbon has been lowered enough to bring the clutch into contact with the guide lug the clutch releases, allowing the carbon to slide down. The latter action increases the current and the clutch takes its hold again, further up, on the carbon and lifts the carbon to form an arc. The lower electrode being of copper does not waste away appreciably and the arc is therefor always maintained at the same vertical point in focus with the reflector.

Direct current of 12 to 17 amperes at a potential of 35 volts is furnished by an enclosed generator directly connected to a two-horsepower rotary engine controlled by a governor which throttles the steam supply and maintains the speed of 800 revolutions per minute.

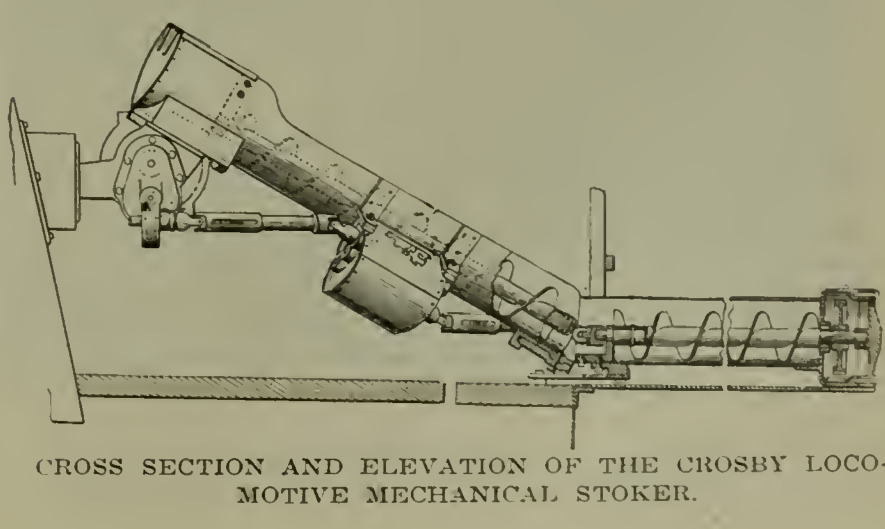
The Crosby Locomotive Mechanical Stoker

WHILE it is not generally agreed that the mechanical stoker is necessary on all locomotives, there is no doubt that some classes of locomotives have about reached the limit of human physical endurance to fire and a mechanical device is needed to reduce the heavy work of the fireman. The endurance of the average skilled fireman is the real limit governing the size and capacity of the locomotive. By providing a mechanical device that will transfer coal from the tender to the door of the firebox and impart to the coal sufficient force to deliver it properly upon the grate, the arduous portion of the fireman's duties will be minimized. The locomotive of today requires two skilled men of intelligence in the cab, and the mechanical stoker provides a means of accomplishing work of high efficiency by the use of intelligent management rather than by mere, main strength.

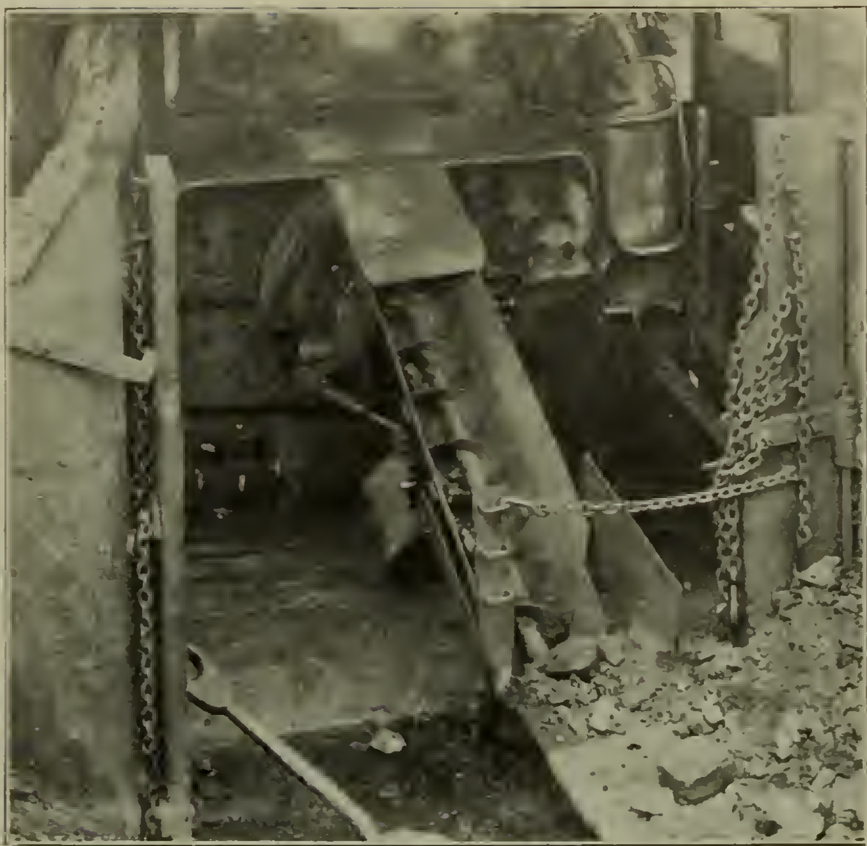
The mechanical stoker has long been in service in stationary power plants where it has accomplished very satisfactory results. Conditions have been favorable to its development in stationary service, while conditions peculiar to locomotive service have presented a number of obstacles difficult to surmount. During the past few years efforts have been made to develop mechanical stokers to meet the requirements of locomotive work, but the committee charged by the Master Mechanics' Association to investigate and report upon the progress made, has not considered that advance has been sufficient to recommend a favorable report.

For some time experiments have been made quietly to work out a stoker suitable for locomotive requirements and these have resulted in a device of original design and construction which with every day hard service has demonstrated to be capable of meeting requirements. The stoker has been contrived and developed by Mr. Clarence W. Crosby and is called the Crosby mechanical stoker.

In developing this stoker three principal factors



CROSS SECTION AND ELEVATION OF THE CROSBY LOCOMOTIVE MECHANICAL STOKER.



THE CROSBY LOCOMOTIVE MECHANICAL STOKER APPLIED TO LOCOMOTIVE WITH WIDE FIREBOX.—VIEW SHOWS CONVEYOR IN POSITION AND INDICATES THE SPACE OCCUPIED BY THE STOKER.

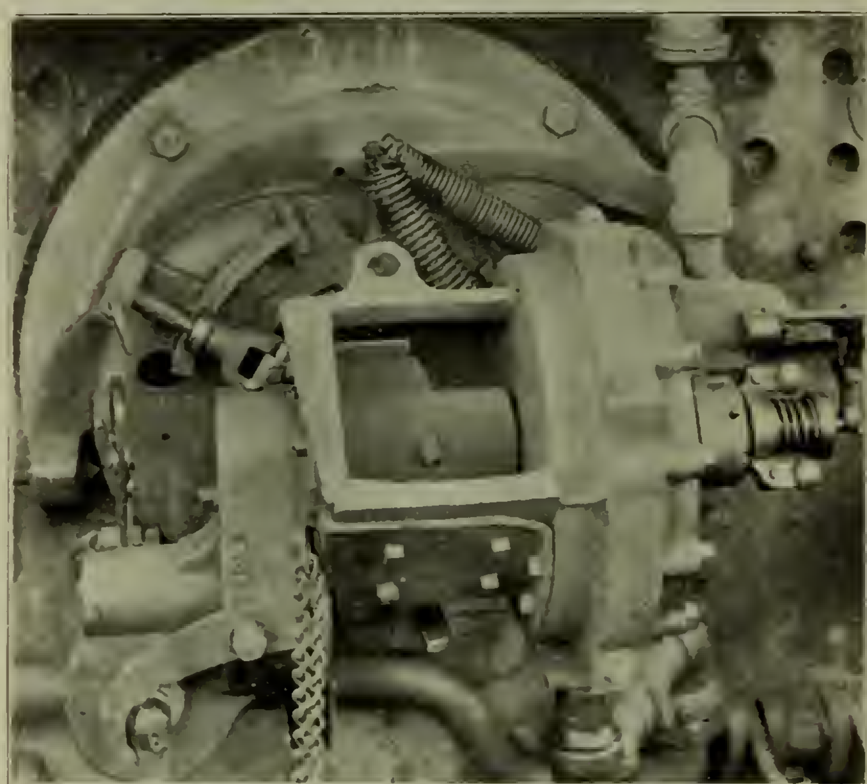
have been observed and adhered to carefully. The work of the mechanical device is; first, to elevate coal from the deck of the tender to the firebox door; second, to impart sufficient force to deliver coal to the grate, and third, to guide the coal to the required position on the grate.

At the same time that these three principal requirements have been accomplished, the mechanical details of the device have been so designed that the stoker is not an encumbrance to the cab and it may be disconnected quickly and readily in case of an accident which would require hand firing. The stoker occupies comparatively little space; movement about the cab and deck is practically unobstructed; while the parts are of ample strength, the mechanism is light and arranged in compact form; the stoker is adapted to the locomotive, and no change whatever is required in the design or construction of the locomotive except for a special fire door which fits the standard door frame; the device is free from complications and is simple in operation; renewals or repairs may be made quickly and at low cost, and the rapidity with which fuel is delivered may be varied according to requirements of grade, tonnage and efficiency of fuel.

While the Crosby stoker is beyond the experimental stage, it is natural to look for future improvements suggested by necessities likely to arise. At the same time, the stoker has been subjected to the tests of ordinary service on regular freight trains of several divisions of one prominent western road and meet the requirements generally in a satisfactory manner. It was not until its practicability had been thoroughly investigated, that information has been given out concerning this stoker, and since its efficiency has been evidenced, representatives of several roads have investigated its service carefully.

The illustrations accompanying this text show the general features in the construction and operation of the stoker. Coal is delivered from the tender to a small hopper attached to the fire door by a screw conveyor. A portion of the conveyor extends back of the coal gate along the deck of the tender. Forward of the coal gate the conveyor is inclined from the deck to the door; when the tender is filled with coal, that portion of the conveyor extending along the deck is covered by removable plates, and as the coal pile is exhausted, the plates are removed in order that coal may fall by gravity into the conveyor and within reach of the worm. The conveyor is so constructed at the joint and so attached to the hopper at the fire door, as to allow for all motion between the engine and tender. The worm receives its motion from a jointed shaft operated in connection with a cone gear which provides four variations of speed.

From the conveyor, coal falls by gravity directly into a hopper attached to the fire door, and drops immediately within reach of a rotary discharger. This rotary discharger carries two blades on opposite sides of the shaft and so offset that each blade discharges one-

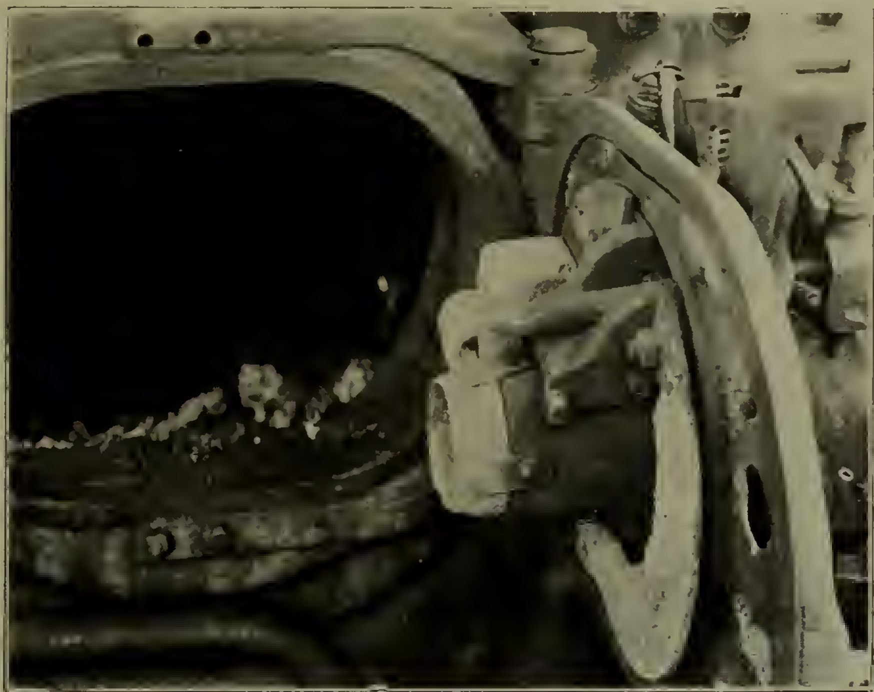


INTERIOR OF ROTARY DISCHARGER AND GENERAL VIEW OF STEAM TURBINE, ETC.—THE CONVEYOR IS REMOVED.—THE CROSBY LOCOMOTIVE MECHANICAL STOKER.

half of the hopper. This discharger will receive coal that will pass a 4-in. mesh and in passing into the hopper is ejected by the discharger with sufficient force to throw it to any position of the grate. Motion is given to the discharger by a steam turbine carried on the fire door.

Coal passes from the discharger through a nozzle extending through the door; from this nozzle the direction of the coal is governed by a spout hinged above the nozzle; this deflecting spout spreads coal evenly over the grate.

The mechanism operating the deflecting spout receives its motion from the steam turbine operating the rotary discharger and conveying worm. The spout is scoop shaped and is made to revolve in a semi-circle so as to direct coal throughout the width of the grate. In addition to this the end of the spout is given a vertical motion. The motions are intermittent and are so planned that six consecutive movements cover the entire grate. In the



FIRE DOOR OPEN, SHOWING THE DELIVERY NOZZLE WITH DEFLECTING SPOUT REMOVED.—THE CROSBY LOCOMOTIVE MECHANICAL STOKER.

first position the spout directs coal to the forward left corner of the grate. A downward movement of the outer end of the spout directs a flow of coal in a gradual sweep extending from the front to the back end of the grate and covering one-third the entire area of same. When this area has been covered, the spout turns automatically through a partial revolution, and the end is elevated quickly so as to again direct the flow toward the forward end of the grate and the center section of the grate is covered as in the case of the left section. In a similar manner the right section is covered and after the entire grate has been so fed the spout again turns toward the left front corner and the movement proceeds indefinitely.

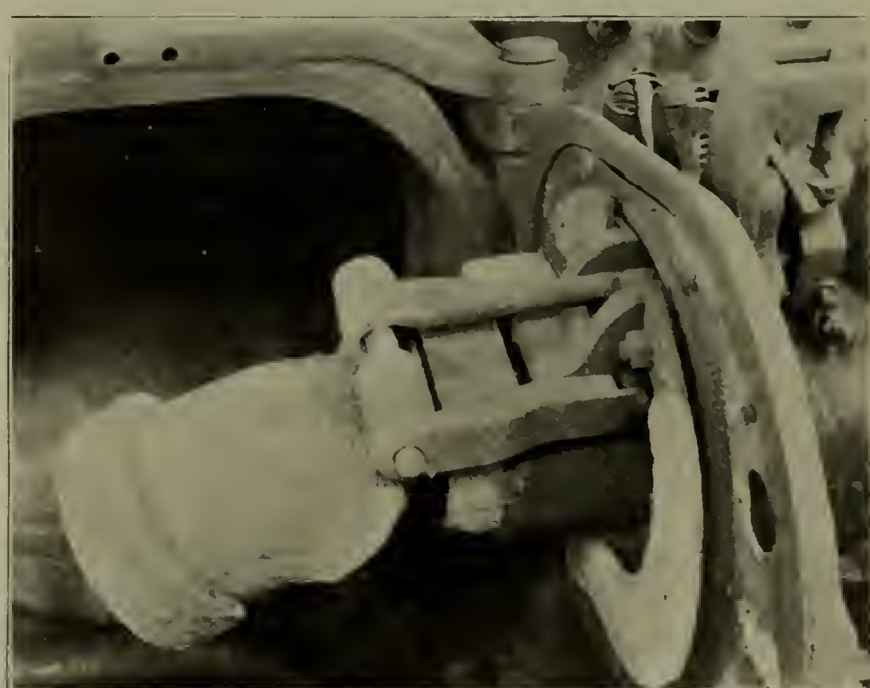
The conveyor passes through the coal gate at the right of the center so that in the event of its being necessary to fire by hand, the conveyor will not interfere with scooping up coal. The upper end of the conveyor is held in position by a single pin attached to the conveyor, engaging a hole in the hopper casting. A sleeve, which forms a section of the shaft operating the conveying worm, is held in position on the driving shaft by a latch which engages a groove in the sleeve. To disconnect the stoker, the turbine is shut off, the latch engaging the sleeve is raised and the inclined portion of the conveyor is tilted back against the coal gate. The stoker can be disconnected in about thirty seconds.

In order that the deflecting spout may offer no obstruction to the door opening when firing by hand or when knocking fires, it is secured in a manner to permit its being readily disconnected. To remove the spout the hook at the end of the rod which gives the spout its vertical motion is disengaged from its pin and the spout is entirely released.

To operate the stoker to best advantage naturally requires skillful manipulation. However, a fireman requires but a short time in which to become thoroughly familiar with it and it is believed that when operated by a fireman skilled in the operation of this stoker it will be possible to go from the roundhouse at one end of the division to the cinder pit at the other terminal without opening the fire door, under favorable conditions. Where a large amount of switching is necessary at local points over the division it is sometimes necessary to fire by hand during the switching work, but where the period spent in switching does not exceed thirty or forty minutes, the stoker is capable of handling the work and will maintain a good fire with which to go out on the road again.

In operating the stoker the fireman is required to see that coal falls by gravity into the conveyor as long as there is sufficient coal above the conveyor; to shovel coal in reach of the conveyor as the pile above the conveyor becomes exhausted; to break large lumps to a size that will pass through the conveying worm and hopper, and to regulate the delivery through the conveyor. By properly manipulating the gear the amount of coal delivered may be regulated as required and it is possible to fire light or heavy as conditions of the road demand, making the variations as frequently as necessary and with no more effort than required to turn a light lever.

The most satisfactory results have been obtained with this stoker when used in connection with a firebrick arch. On two engines on which the stoker has been used successfully the arch has been so constructed as to extend down entirely to the grate, and by closing that portion of the grate between the arch and the flue sheet a combustion chamber has been formed above and in front of the arch. By this arrangement the effective grate area has



FIRE DOOR OPEN SHOWING DELIVERY NOZZLE AND DEFLECTING SPOUT IN POSITION.—THE CROSBY LOCOMOTIVE MECHANICAL STOKER.

been reduced about 22 per cent below the area of the grate as used in hand firing. When used in connection with a stoker the life of the arch has been found to exceed that ordinarily obtained with hand firing.

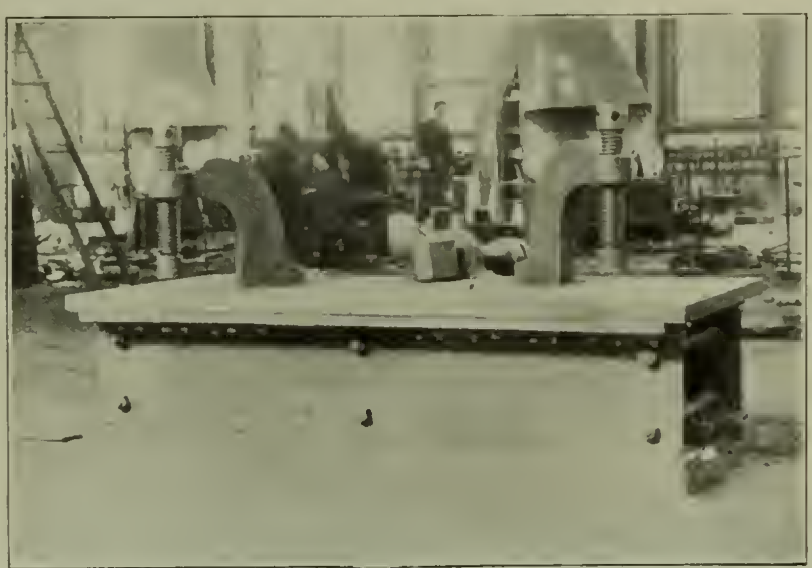
While no figures are available to show the actual economy effected by the stoker, the coal record as obtained from the several coal chutes, shows the engine equipped with the stoker to have used a smaller amount of coal than other engines of the same class in similar service. The expense for flue repair work has been considerably reduced. The operating parts that are exposed to the fire will last from 4,000 to 10,000 miles, and the deflecting spout, which is the part most exposed to intense heat, may be replaced for about twenty-five cents.

The condition of the fire at terminals, the ease with which steam pressure is maintained and the almost entire absence of smoke issuing from the stack indicate that good combustion of fuel is obtained.

The Crosby stoker is controlled by the International Stoker Company with offices at 181 La Salle street, Chicago.

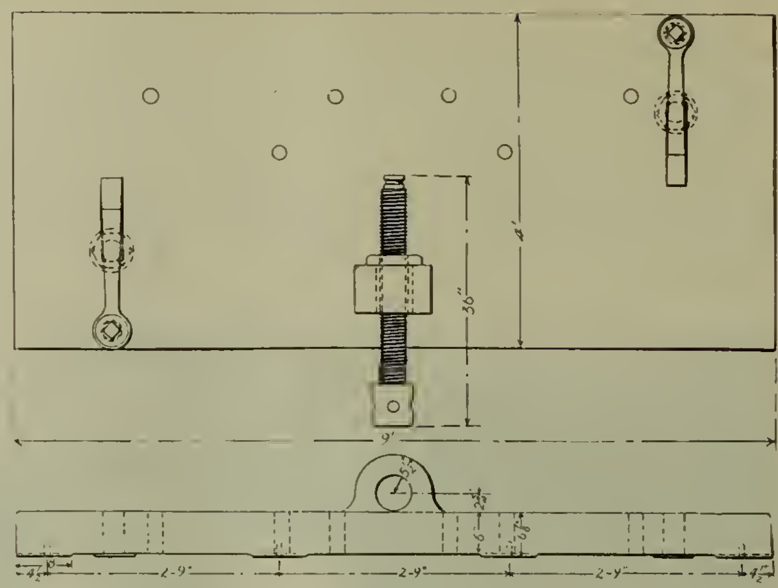
Bending and Straightening Face Plate

A SIMPLE and ingenious face plate has been devised by Mr. A. W. McCaslin, foreman blacksmith of the Pittsburg & Lake Erie Railroad at McKees Rocks,



McCASLIN'S IMPROVED BLACKSMITH'S FACE PLATE IN BLACKSMITH SHOP AT McKEES ROCKS.—PITTSBURG & LAKE ERIE R. R.

Pa., and has been placed in service in the shop under his jurisdiction. It consists of a cast iron plate or slab 9 feet long, 4 feet wide by 6 inches thick, resting on a rigid



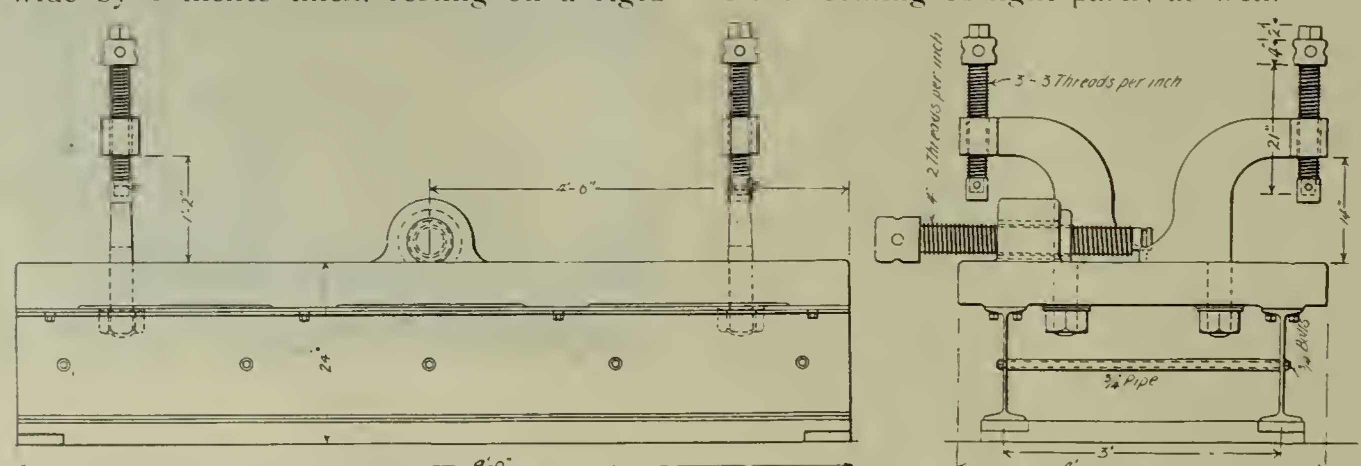
PLAN AND DETAILS OF McCASLIN'S IMPROVED BLACKSMITH'S FACE PLATE.

support, at a height of 24 inches above the floor. The slab is securely bolted to two 15-inch I beams arranged on 3-foot centers and braced by six ¾-inch rods passing through pipe sleeves. The plate is secured by twelve 1-inch bolts with countersunk heads. The I-beams rest on two wooden beams 8 inches by 8 inches by 9 feet, to which they are firmly bolted. The timbers are let into the floor with their upper faces flush with the floor line.

The table is equipped with three screws, two of which operate vertically and one horizontally. Each of the former is 3 inches in diameter, having three threads per inch, and the latter is 4 inches in diameter, having two threads per inch. The details of construction and the general appearance of the forging table are clearly shown by the accompanying illustrations.

Since this table has been in service it has proved very convenient and serviceable in handling heavy parts and has been found capable of facilitating a large variety of operations, such as straightening frames, guides, main and side rods; straightening and bending bumper rails, I-beams, channel irons, coach truck equalizers, boiler front end rings; squaring rocker arms, tumbling shafts, etc. In fact, it is found to be one of the best, if not the best tool in the shop.

It is situated near the large forges and cranes, thus accommodating the heavy work, and is in constant use in the forming of light parts, as well.



SIDE AND END ELEVATIONS OF McCASLIN'S IMPROVED BLACKSMITH'S FACE PLATE.

Decapod Locomotive With Combination Chamber

Buffalo, Rochester and Pittsburgh Ry.

SIX decapod locomotives have been recently completed at the Brooks works of the American Locomotive Company for the Buffalo, Rochester and Pittsburg Railway, which are the heaviest simple locomotives ever built by the company. The locomotives were designed for pushing service on the heavy grade between Clarion Junction and Freeman, Pa., which is the ruling grade for north bound trains. The distance is 17 miles, and the ruling grade 58 feet to the mile with numerous curves, the sharpest being 8 degrees. At the present time 3,350 Ms. are handle up this grade with two consolidation locomotives, each having 38,000 pounds tractive force. The rating of this class of locomotives is 3,500 Ms. on other portions of the road. This shows the hauling capacity of the locomotives, and indicates the reduction in tonnage necessary on the ruling grade. With the new locomotives as helpers, the consolidation locomotives are expected to handle trains of 4,000 Ms. over the ruling grade, which illustrates clearly the capacity of the helper locomotives.

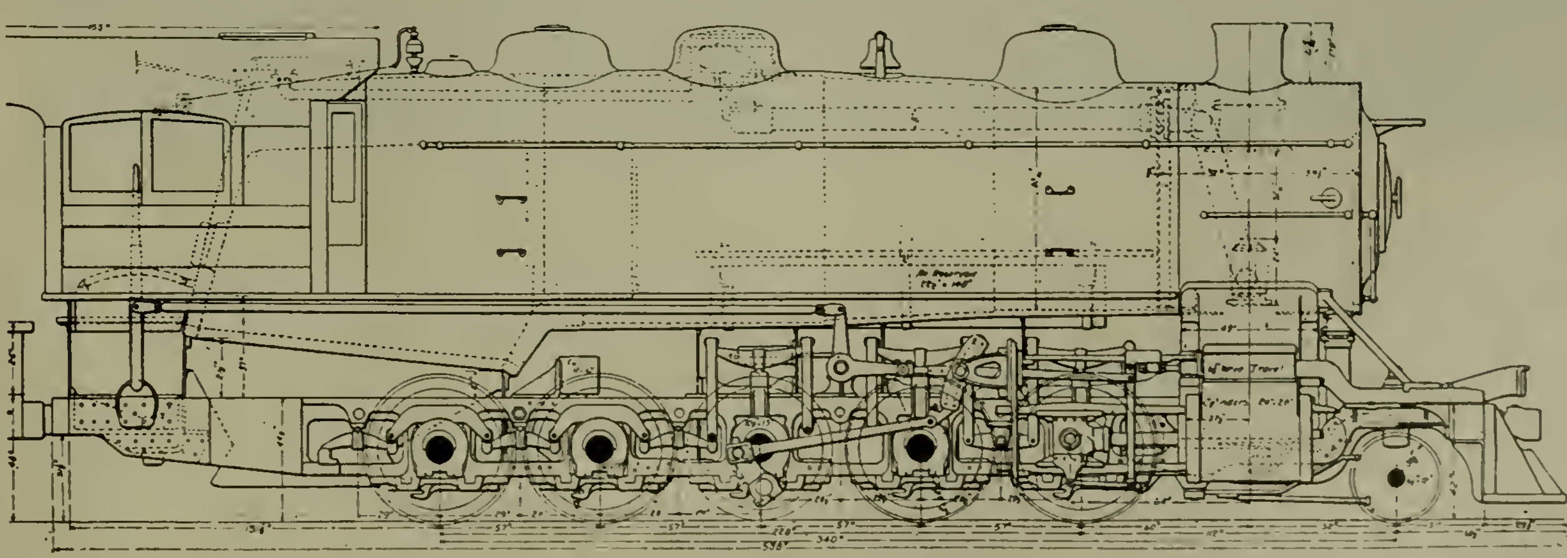
The weight of the locomotives, in working order, is 268,000 pounds, with 243,000 pounds on the drivers. Cylinders, 24 by 28 inches, drivers 52 inches over tires, steam pressure 210 pounds. The maximum tractive force is 55,360 pounds and factor of adhesion 4.4.

One of the interesting features of this design is the use of a combustion chamber in the boiler. The advantages claimed for the combustion chamber are: that it removes the tubes from the hottest part of the fire, thereby decreasing flue leakage; adds to the heating surface of the firebox; gives a largely increased firebox volume which tends towards better combustion. In these engines the combustion chamber is three feet long and is stayed to the shell of the boiler by radial and sling stays on the upper section and by radial stays on the sides and bottom, bracing rods being also attached to the bottom and extending forward to the waist to add stiffness. Ample clearance between the combustion chamber and the shell of the boiler is provided to furnish good water circulation.

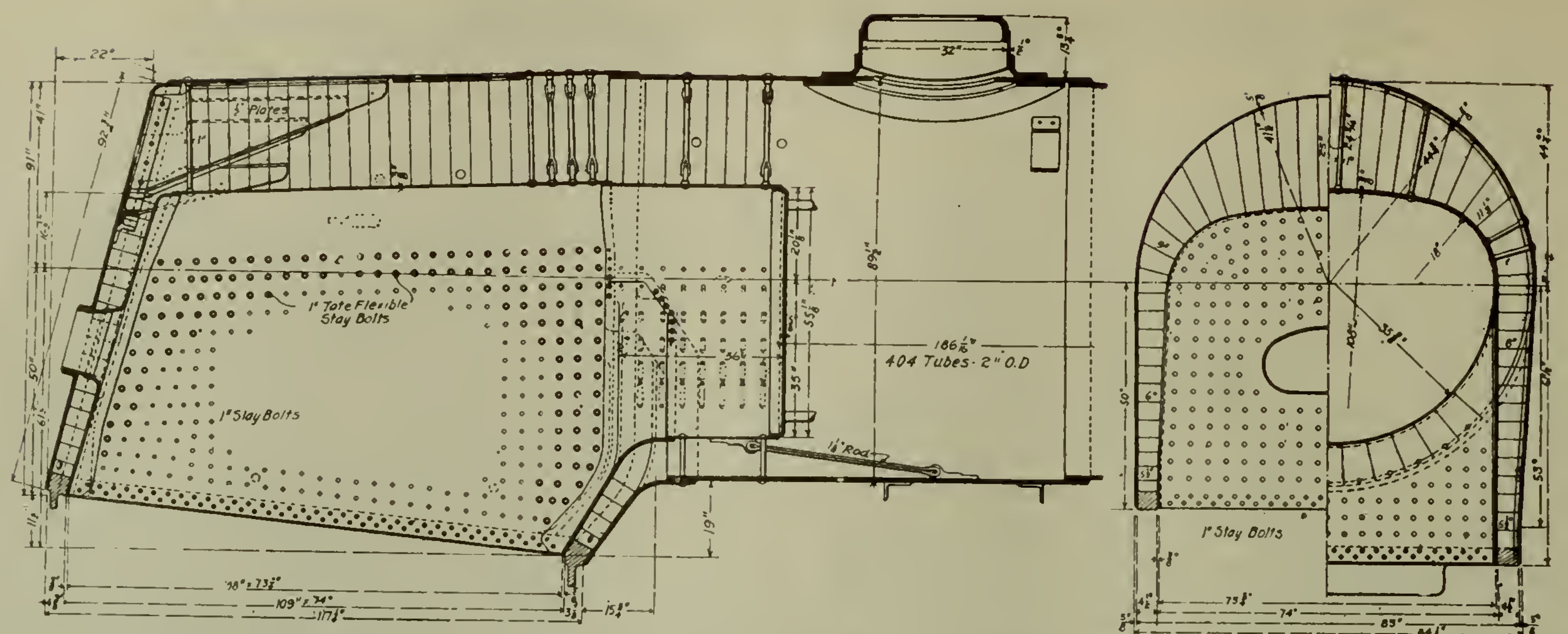
The boiler is of the wagon top type, 80 inches in diameter at the front end, and has a total heating surface of 2,535.5 square feet, of which the tubes contribute 3,280 square feet and the firebox 255 square feet. The tubes are 2 inches in diameter and 15 feet 6 1-16 inches long, there being 404 in the barrel of the boiler. The introduction of the combustion chamber, of course, reduced the amount of tube heating surface, and the engines with combustion chamber and less actual heating surface, steam fully as well as those without combustion chamber and more heating surface.

The firebox is 108 inches long and 73¼ inches wide, which gives a grate area of 55.5 square feet. The frames are of cast steel with double front rail and are 6 inches wide.

DECAPOD LOCOMOTIVE WITH COMBUSTION CHAMBER,—BUFFALO, ROCHESTER & PITTSBURG RY.



ELEVATION OF DECAPOD LOCOMOTIVE WITH COMBUSTION CHAMBER.—BUFFALO, ROCHESTER & PITTSBURG RY.



SECTIONS OF FIREBOX, SHOWING CONSTRUCTION AND DESIGN OF COMBUSTION CHAMBER.—DECAPOD LOCOMOTIVE.—BUFFALO, ROCHESTER & PITTSBURG RY.

Another distinguishing feature of these engines is the unusually large capacity of the tender. The tank is of the water bottom type and has a capacity of 9,000 gallons, which to the best of our knowledge is the largest water capacity ever provided in a locomotive tender.

The principal dimensions of the locomotive are as follows:

Type of engine	Decapod
Service	Helper
Fuel	Bit. Coal
Tractive force	55,360 lbs.
Gauge	4 ft. 8½ ins.
Cylinders	24 ins. x 28 ins.
Valve gear, type	Walschaert
Valves, kind	Richardson, slide
Valves, steam lap	1 in.
Valves travel, in full gear	6¼ in.

RATIOS.

Weight on drivers, ÷ tractive force	4.4
Tractive force, × diam. drivers ÷ heating surface	814.0
Total heating surface, ÷ grate area	63.6
Fireox heating surface, ÷ tube heating surface	.077
Weight on drivers ÷ total heating surface	70.3
Volume of cylinders, cu. ft.	14.62
Total heating surface, ÷ volume of cylinders	241.5
Grate area, ÷ volume of cylinders	3.8

BOILER.

Type	R. S. C. C.
Working pressure	210 lbs.
Diameter, first ring	80 ins.
Staying	Radial

FIRE BOX.

Length 108 ins., Width	73¼ ins.
Thickness of sheet, sides ⅜ in., Back	⅜ in.
Thickness of sheets, crown ⅜ in., Tube	⅝ in.
Water space, front 4½ ins., Sides 4½ ins., Back	4½ ins.

TUBES.

Material	Charcoal Iron
Wire gauge	No. 11
Number	404
Diameter 2 ins., Length	15 ft. 6 1-16 ins.

HEATING SURFACE.

Firebox	255.5 sq. ft.
Tubes	3,280 sq. ft.
Total	3,535.5 sq. ft.
Grate area	55.5 sq. ft.

DRIVING WHEELS.

Diameter, over tires	52 ins.
Diameter, wheel centers	44 ins.
Journals, main, diameter and length	10½x13 ins.
Journals, others, diameter and length	10x13 ins.

ENGINE TRUCK WHEELS.

Diameter, engine truck	30 ins.
Journals, engine truck, diameter and length	6½x12 ins.

WHEEL BASE.

Driving	19 ft.
Total engine	28 ft. 4 ins.
Total engine and tender	65 ft. 3¼ ins.

WEIGHT.

On driving wheels	243,000 lbs.
On engine truck	25,000 lbs.
Total engine	268,000 lbs.
Total engine and tender	432,000 lbs.

TENDER.

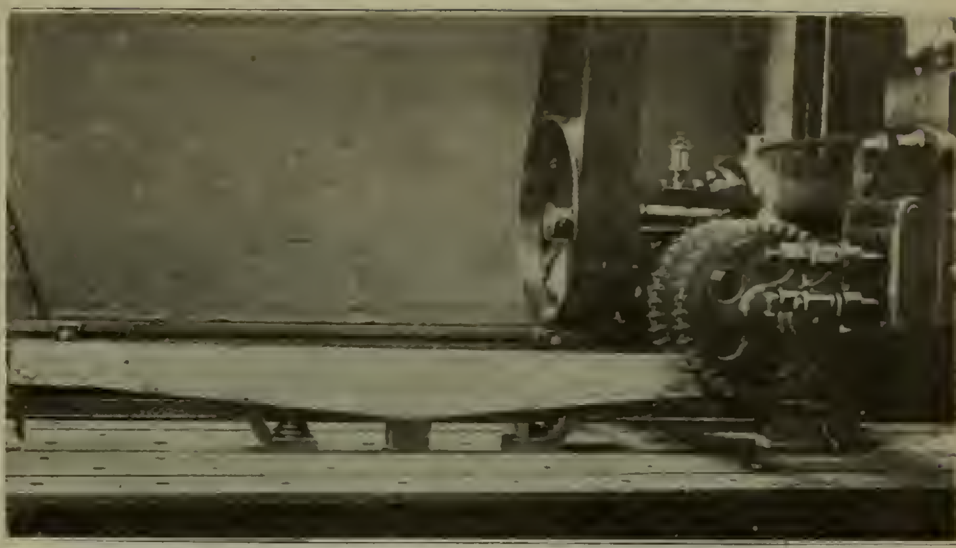
Style	Water bottom
Wheels, diameter	33 ins.
Journals, diameter and length	5½x10 ins.
Water, capacity	9,000 gals.
Coal, capacity	14 tons

Milling Attachment for Planers

THE use of milling machines has been gaining rapid headway in railway shops during recent years and many classes of work previously machined on planers are now performed more economically and in much less time on milling machines. In consequence some classes of work have been transferred from planers to milling machines and in some instances railway mechanical officials are co-operating with machine tool manufacturers in the perfection of milling machines especially adapted for railway shop service.

An instance of a clever arrangement by which an old planer has been converted into a milling machine on which practical results are being obtained, is illustrated by the accompanying reproduction of a photograph taken in the machine department of the Port Huron shops of the Grand Trunk Railway. This conversion was made under the jurisdiction of Mr. M. H. Westbrook by applying a Farwell milling attachment to an out-of-date planer.

Truck pedestal jaws, shoes and wedges, cross head gibs and shoes, and much other work of a similar nature is now performed by milling with this machine in much less time than was possible with the previous arrangement of the machine as a planer. The illustration shows the three sides of a cast iron guide bar finished in one operation.



MILLING ATTACHMENT FOR PLANERS.

Electric Locomotives

Pennsylvania R. R.

WITH a view of determining the type best adapted to pulling its heavy passenger trains through the New York tunnels, the Pennsylvania Railroad has in a progress a series of experiments upon electric locomotives.

Through the experiments which are being conducted on its West Jersey and Seashore Division and the Long Island Railroads, the company intends to determine some of the genral characteristics of the electric locomotive and to secure operating data based on actual service.

Of the two direct current locomotives now undergoing tests, one is equipped with four 350 horsepower geared motors, and the other with four gearless motors in order that the relative merits of the two types may be determined.

The locomotive with gearless motors has one of its trucks equipped with two 320 horsepower motors supported by springs from the main journals and wholly independent of the truck frame, while the other truck has two 300 horsepower motors rigidly fastened to the truck frame. This arrangement will demonstrate the advantages of the two methods of motor suspension under the same conditions of service.

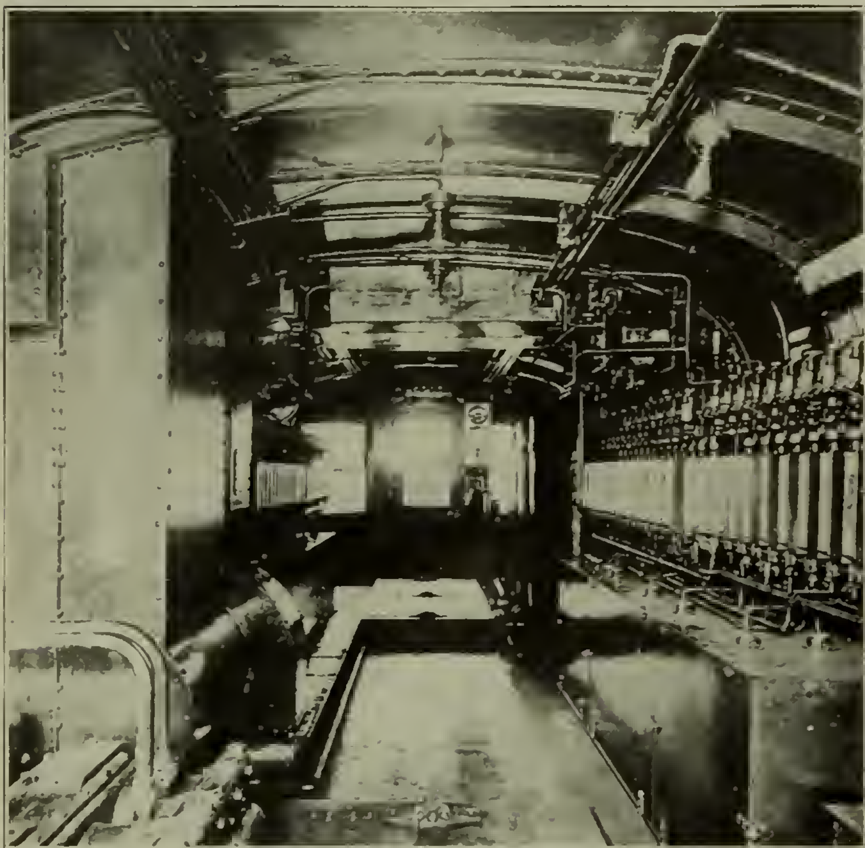
In exterior appearance the two locomotives are almost identical. They resemble somewhat a short truck passenger car with few windows and large wheels.

The trucks are of the four wheel type, having frames placed outside the wheels, with pedestal boxes and adjustable wedges similar to those used in locomotive practice.

On account of their short wheel base the trucks have a tendency to tilt in operation, and thereby shift a portion of the effective load from one pair of wheels to the other. By an ingenious automatic switching mechanism on the lightly loaded axle diminished, in proportion to the difference in axle loads. By this expedient the pulling power of the locomotive is increased 25 per cent.

EXPERIMENTAL ELECTRIC LOCOMOTIVE.—PENNSYLVANIA RAILROAD.

The outer-end casting of each truck carries the coupler, draft spring and buffer arrangement, so that strains caused by pushing, pulling and buffing are taken directly by the truck frames and do not come upon the underframe of the cab, except as they are transmitted between bolsters through the center sill. In order to allow sufficient lateral play when the locomotive is coupled to a long passenger car with considerable overhang, the coupler head has a free movement of 15 inches on either side of the center line of the truck. To facilitate coupling



INTERIOR OF EXPERIMENTAL ELECTRIC LOCOMOTIVE.—PENNSYLVANIA RAILROAD.

and uncoupling on curves, the coupler can be swung sideways and its uncoupling pin raised by means of levers at the end of the cab, which can be operated from the platform.

Driving wheels are 56 inches in diameter, with removable tires secured by retaining rings. They are carried by axles 8 ins. in diameter at the center, provided with 6 in. x 11 in. journals.

The spring rigging if of the locomotive type, with semi-elliptical springs over the journal boxes, and equalizers between the springs. To prevent teetering, the equalizer beam is not provided with a fixed fulcrum, but instead supports two nests of helical springs, which in turn help to support the truck frame.

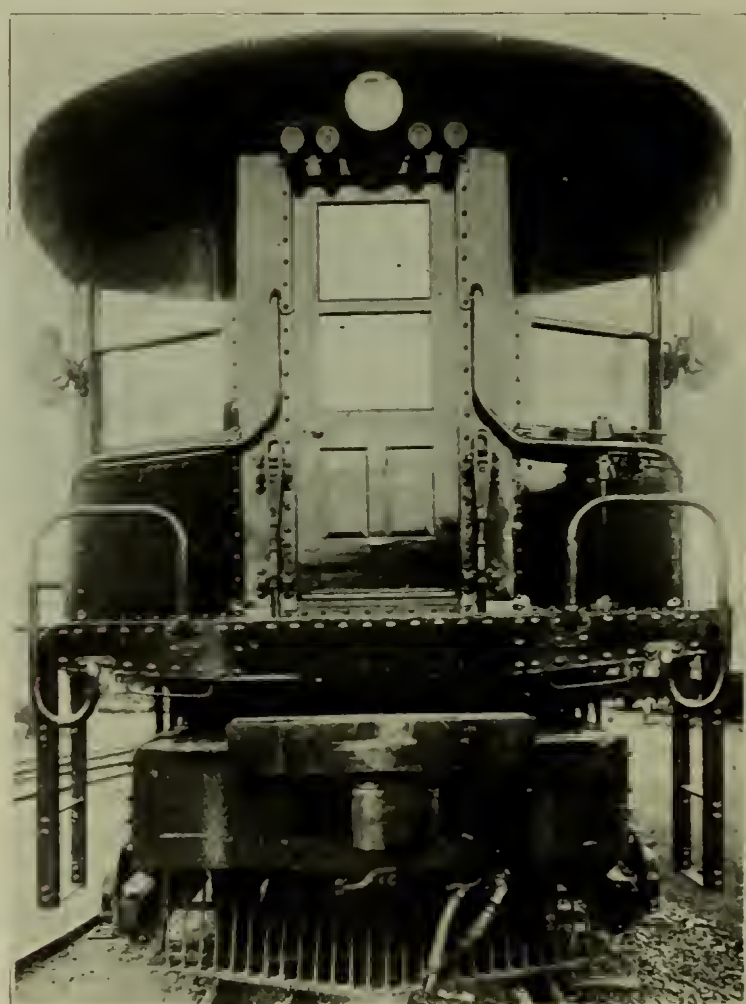
The collector shoes are attached to the four end journal boxes, and are made of two castings forming a spring hinge, with one wing lying in a horizontal plane, and sliding on top of the third rail. The current passes from the third-rail through the collector shoes and the heavy cables connected thereto, to the fuse-boxes located near the shoes.

The cab is entirely of metal, its underframe composed of a center sill, built of two 10-inch channels, side sills of 7 in. x 3½ in. angles, plate bolsters and end sills. Within the cab the apparatus is distributed along the sides, leaving a passageway through the middle. The equipment on one side of the cab consists of three main reservoirs, a sand-box, with electro-pneumatic valves underneath, a switch group, two line switches, a case of diverters, and two sets of storage batteries. That on the other side consists of an air compressor, a compressed air cooler, a fan and motor, a reservoir for control apparatus, a sand-box, two line switches, a whistle reservoir, a motor cut out, a switch group, and a case of diverters.

The locomotive control mechanism is in duplicate, and placed in diagonally opposite corners of the cab, so that the motorman can operate a locomotive, of group of locomotives, from either end of the cab, in either direction. By means of a special grouping of switches it is possible to obtain a constant flow of current without a break, when changing from series to series parallel, and from series parallel to full-multiple. The preliminary tests made with the locomotive proved that by means of this system of grouping switches, the acceleration of the locomotive could be made practically uniform. Both ends of the cab are provided with sockets, so that when two or more locomotives are coupled together connections can be made by means of these sockets, and the group of locomotives can be simultaneously operated and controlled by one motorman from one locomotive.

Hung from the ceiling in the center of the cab are two plug switches, and an ammeter shunt. The conductors from the third rail shoes are connected to one switch, and the trolley cable is connected to the other. .

The switches in the switch group are operated by air pressure. The air valve is actuated by a control magnet on a fourteen-volt circuit. When current flows through the magnet the armature opens the air valve, admitting air behind the piston, which closes the switch through which the main current flows. By breaking the control circuit the armature of the magnet is released, which



END VIEW OF EXPERIMENTAL ELECTRIC LOCOMOTIVE.—PENNSYLVANIA R. R.

closes the air passage from the reservoir and prevents the egress of air from the cylinder. A spring under the piston pushes it up, and thus opens the main circuit. The line switches re actuated in a similar manner, and also open when an excess of current flows through them.

The cab can be lighted by three lamps, which are in series with the lamps with the headlights; but normally these lamps are to be concealed. Five more lamps, which are in series, are distributed over the ceiling, to assist in lighting the cab when repairs are under way, but are not used when the locomotive is in service.

The storage batteries are in two sets, so that they can be charged alternately by being placed in series with the motor of the air compressor, one set being charged while the other set is in service, the alternation being made each day.

Locomotives are equipped with hand, straight air, automatic, and high speed brakes.

Number of pairs of driving wheels	4 ins.
Diameter of driving wheels	56 ins.
Axles, 8 ins. diameter, 6 ins.x11 ins. journals	
Length, inside couplers	37 ft. 10½ ins.
Length over platforms	35 ft. 8 ins.
Wheel base of trucks	8 ft. 6 ins.
Total wheel base of locomotives	26 ft. 1 ins.
Width, cab	10 ft. 1¾ ins.
Width, body	9 ft. 11¾ ins.
Height, rail to top platform	5 ft. 5 ins.
Height, rail to top roof	13 ft. 4 ins.
Height, rail to top bell (extreme)	14 ft. 5⅜ ins.
Weight—	
Locomotive No. 1001 (with geared motors)	175,100
Locomotive No. 1002 (with gearless motors)	195,200

Personal Mention

Mr. F. W. Dickinson has been appointed master car builder of the Bessemer & Lake Erie, with office at Greenville, Pa., to succeed Mr. W. J. Buchanan, resigned.

Mr. W. F. Thornton has resigned as foreman of the car department of the Orange & Northwestern to engage in other business at Orange, Tex.

Mr. A. J. Poole, previously master mechanic of the Seaboard Air Line at Atlanta, Ga., is now general master mechanic, a new poosition, with office at Portsmouth, Va.

Mr. P. G. Leonard, heretofore road foreman of engines of the Springfield division of the Wabash, has been appointed air brake inspector, succeeding Mr. H. C. Ettinger, promoted. Mr. James B. Long succeeds Mr. Leonard as road foreman of engines at Springfield, Ill.

Mr. Alfred Lovell has tendered his resignation as superintendent of motive power of the Atchison, Topeka & Santa Fe to engage in private business. He has been in the service of the Santa Fe since September, 1902, when he became assistant superintendent of motive power, and in February, 1905, he was promoted to the office of superintendent of motive power.

Mr. Edward F. Fay, general foreman of shops of the Union Pacific at Omaha, Neb., has been appointed master mechanic at Denver, Colo. Mr. George Brown succeeds Mr. Fay as general foreman. Mr. J. H. Rush has been appointed district foreman at Cheyenne, Wyo.

Mr. T. Rumney, heretofore mechanical superintendent of the Erie, has been appointed general mechanical superintendent of that road and its allied and controlled lines, with office at 11 Broadway, New York, N. Y. Mr. William Schlafge, assistant mechanical superintendent, has been appointed mechanical superintendent of the Erie grand division and the New York, Susquehanna & Western Railroad, with headquarters at Jersey City, N. J. Mr. A. G. Trumbull, heretofore assistant mechanical superintendent, has been appointed mechanical superintendent of the Ohio division and the Chicago & Erie Railroad, with office at Cleveland, O. Effective on October 1.

Mr. B. H. Gray, master mechanic of the New Orleans Terminal Company, has been appointed superintendent of motive power of the Mobile, Jackson & Kansas City, with office at Mobile, Ala.

Mr. Joseph W. Walker, heretofore motive power inspector of the Pennsylvania Railroad at Altoona, Pa., has been appointed chief air and motive power inspector of the Western Pennsylvania division, with office at Pittsburg, Pa.

Mr. J. H. Nash, division master mechanic of the Illinois Central at East St. Louis, Ill., has been transferred to Paducah, Ky., as division master mechanic, succeeding Mr. R. E. Fulmer, resigned.

Mr. R. D. Smith, mechanical expert of the Lake Shore & Michigan Southern, has been appointed assistant superintendent of motive power of the Boston & Albany, with headquarters at Albany, N. Y.

Mr. R. C. Evans has been appointed superintendent of motive power and car departments of the Western Maryland, with headquarters at Union Bridge, Md., in place of Mr. William Miller, resigned, account of ill health.

Mr. R. Tawse, master mechanic of the Ann Arbor, has been appointed superintendent of motive power of that road and the Detroit, Toledo & Iron Mountain, with office at Jackson, O., succeeding Mr. W. G. Wallace, resigned.

Mr. J. A. Lewis has been appointed master mechanic of the Mexican Central at Monterey, Mex., to succeed Mr. R. D. Gibbons, who has been transferred to Aguascalientes, Mex., as master mechanic, succeeding Mr. J. M. Fulton, resigned.

Mr. W. A. Mitchell has resigned as assistant general foreman of machine shops at Topeka, Kan., and has been appointed fuel inspector for the Southern division of the Atchison, Topeka & Santa Fe, with headquarters at Temple, Texas. This is a new department.

Mr. E. J. Harris, general foreman of shops of the Chicago, Rock Island & Pacific at Valley Junction, Ia., has been appointed master mechanic at that point, succeeding Mr. D. W. Cunningham, resigned to accept a similar position with the Missouri Pacific.

Mr. H. E. Whittenberger, division superintendent of the Kansas City Southern at Pittsburg, Kan., has resigned to take a like position with the Grand Trunk at Montrael, succeeding Mr. M. S. Blaiklock, promoted.

Mr. H. R. Kight has been appointed master mechanic of the West Virginia division of the Western Maryland, with headquarters at Elkins, W. Va., in place of Mr. R. C. Evans, promoted.

Mr. I. N. Wilber, division master mechanic of the Chicago, Burlington & Quincy, at Hannibal, Mo., will retire on January 1 next, when he will have completed 50 years' service with the Burlington system.

Mr. A. Buchanan, Jr., has resigned as superintendent of motive power of the Central Vermont to become chief of the bureau of inspection of the New York public service commission, second district, with headquarters at Albany, N. Y.

Mr. A. L. Moler has been appointed master mechanic of the Orange & Northwestern, the Colorado Southern, New Orleans & Pacific and the Beaumont Sour Lake & Western, with headquarters at Beaumont, Tex., succeeding Mr. J. A. Baker, resigned; effective on October 21.

Mr. E. H. Smith, heretofore traveling engineer for the Boston & Albany, has been appointed division master mechanic at Allston, Mass., succeeding Mr. A. J. Fries, who is transferred to Springfield, Mass., as master mechanic, succeeding Mr. P. T. Lonergan, resigned. Mr. H. S. Walton has been appointed air brake and steam heat inspector at Springfield, Mass., in place of Mr. E. G. Desoe, resigned.

Heavy Slab Milling Machine

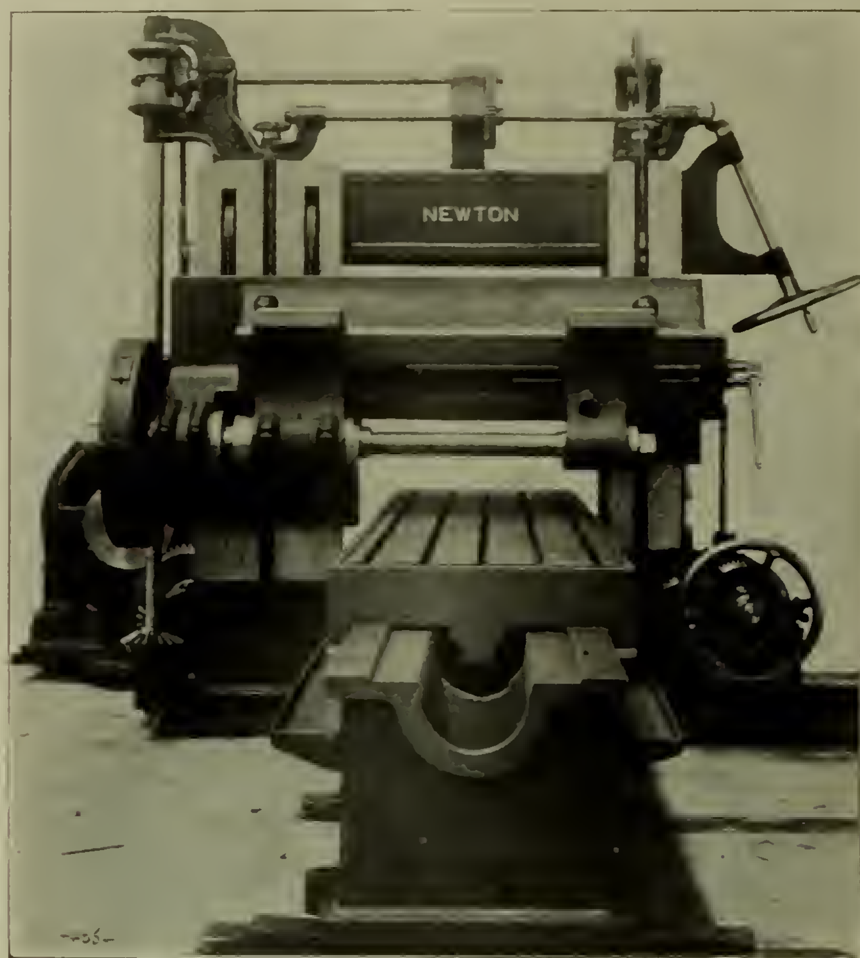
On account of the excessive duty required of milling machines in railroad machine shops, a new design of extra heavy slab milling machine has been put on the market by the Newton Machine Tool Works. The illustrations show one of these machines which is especially adapted for any heavy grade of slab milling.

The spindle of this machine is 6½ inches in diameter, having a main bearing 15 inches long. It is driven by means of a phosphor bronze worm wheel and case hardened steel worm of steep lead, having roller thrust bearings and geared with a 35-hp. variable speed motor. The driving worm and worm wheel have a ratio of 20 to 1. All other gears on this machine with the exception of the worm and worm wheels are made of steel.

The spindle is reduced to 6 inches in diameter in the bearing through the driving worm wheel. The spindle has an 8-inch side adjustment for convenience in setting cutters, after the work has been placed on the machine. The arbor is arranged to drive by a "face key" which is a slot across the face of the spindle. The bushing for the outboard bearing of the arbor is tapered on the outside and split, so as to compensate for wear, being adjusted to support the arbor close up to the work and arranged to fit over the arbor bushings.

The cross-rail is of the inclined-face design which, in addition to carrying the spindle close to the uprights, overcomes to a very great extent the tendency of the cutter to "pull in," when milling on a piece with hard and wide surfaces. This angular rail bears the same relation to the straight tool in the planer, as it prevents gouging and reduces chatter on light work to a minimum.

The bearing of the cross-rail on the main or wide upright is 25 inches face, 8 inches in length and on the outboard or narrow upright 12 inches face, 21 inches in length. The cross-rail is 16 inches wide on its face. The center of spindle is carried 4 inches below the point of rail, so as to allow one to work around forged oil cups on locomotive connecting rods and also to be able to sink in the mill keyways on shafts of large diameter. The cross-rail is counter-weighted and has hand adjustment with quick power movement in both directions. The quick power movement is so designed as to be available for sinking the cutter to a required depth by power. The cross-rail screws are arranged to pull the cross-

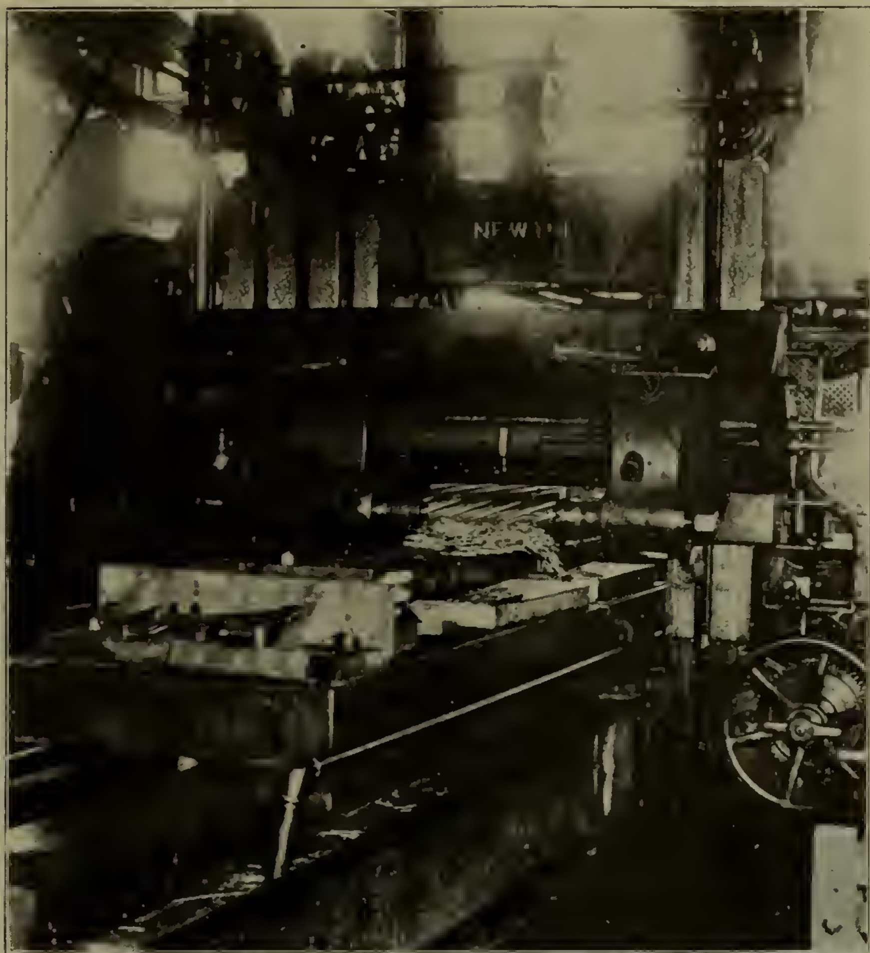


HEAVY SLAB MILLING MACHINE.

rail down into the work instead of pushing it. This arrangement overcomes the tendency of the cross-rail to rise, previously experienced in fluting locomotive connecting-rods, where it is necessary to sink a cutter 1½ to 1¾ inches in the rod. Provision is also made to prevent the table from pulling forward, when sinking in, or working back, due to pulling of the cutter. This latter improvement prevents the breaking of cutters, arbors and consequent damage, resulting from the cross-rail pushing upwards.

The carriage is 36 inches wide and 7 inches deep to mill 14 feet in length, having a bearing on the bed which is 29½ inches wide over all. The carriage is operated by means of a steel rack, 4 inches wide, and a bronze spiral pinion. It is fitted with a compact gear box of special design.

The feed to the carriage is from 1 to 10 inches per minute, being furnished with quick power motion in both directions. This construction makes not only the drive but also the feed motion of the machine absolutely positive between the cutter and the motor. The levers for raising the cross-rail are made

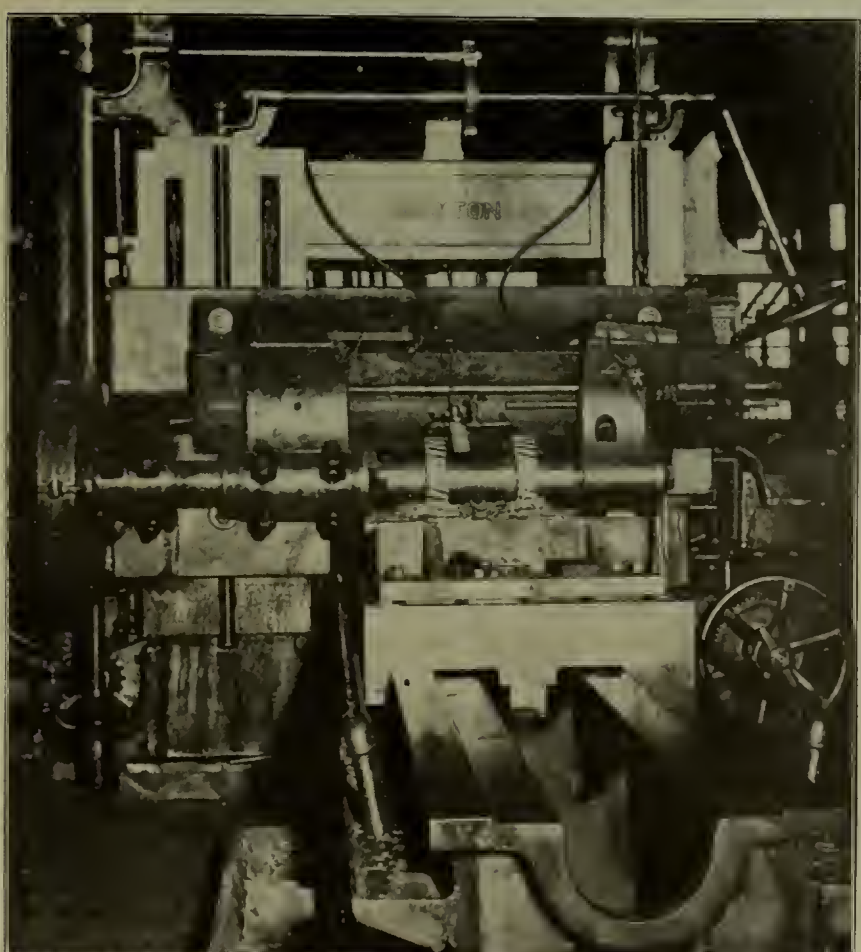


TAKING A 9½ IN. CUT. 9-16 IN. DEEP AT THE RATE OF 8 IN. PER MIN.—HEAVY SLAB MILLING MACHINE.

so that, when the lever is raised, the cross-rail goes up and, when it is depressed, the cross-rail is lowered for the carriage. By moving the lever forward the quick forward motion is obtained.

The machine is shown in operation on a slab milling cut. The following results have been obtained during a period of over six months: The width of cut was 9½ inches, the depth 9-16 inch, and the lineal feed of table 8 inches per minute. Under these conditions, 43 cubic inches of metal or chips were removed per minute, which equals about 1¼ cubic inches per rated horse-power of motor per minute. These results indicate that it is good practice to use the worm and worm wheel drive for milling machines.

In channeling two locomotive connection rods, the cut was 3 inches wide and 1½ inches deep and the feed 3¼ inches per minute. Thus, 9 square inches were removed at a feed of 3¼ inches per minute. The success of this operation may be credited somewhat to the design of cutter, which is the Peck inserted spiral tooth, the teeth being of air-hardened steel inserted on a true spiral.



CHANNELING TWO LOCOMOTIVE SIDE RODS SIMULTANEOUSLY.—CUTS TAKEN 3 IN. WIDE, 1½ IN. DEEP, FEED 3¼ IN. PER MIN.—HEAVY SLAB MILLING MACHINE.

Malleable Back Journal Bearing

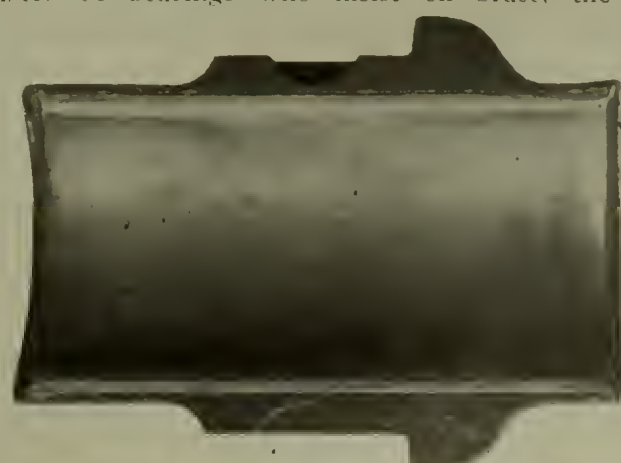
An exhibit which attracted considerable attention during the last conventions of the American Railway Master Mechanics' and Master Car Builders' Associations at Atlantic City was that of the malleable back bearing shown by the Standard Metal Manufacturing Company of Chicago. The bearing consists of a very thin malleable iron shell, of great strength, filled to the required thickness with S. T. B. bearing metal, a high-grade alloy which is the result of many years' experience under all conditions.

BACK VIEW OF MALLEABLE BACK BEARING WHICH HAS BEEN IN CONTINUOUS USE 1 YR. 3 MO. ON A 60,000 LB. CAPY. CAR.

The bearings exhibited had been subjected to severe tests which showed very satisfactory results. They had made a mileage of over 61,000 under severe conditions, having been in service under a tank car of 60,000 lbs. capacity during a period covering one year and eleven months. At the end of this period the bearings showed very little wear. The accompanying illustration shows a bearing of this type removed from a car after it had withstood hard service.

The Standard Metal Manufacturing Company claims an unusual saving of expense for its malleable back bearing, not only in first cost, but in the economy resulting from the greater mileage, as well as reduced "hot box" trouble attending its use. This company is prepared to make good its claims by letters from owners of thousands of cars on which bearings of this type are giving great satisfaction.

For users of bearings who insist on brass, the Standard



FRONT VIEW OF MALLEABLE BACK BEARING WHICH HAS BEEN IN CONTINUOUS USE 1 YR. 3 MO. ON A 60,000 LB. CAPY. CAR.

Metal Manufacturing Company offers its high-grade brass back S. T. B. filled bearing or solid bronze bearing, which will meet every requirement of fast passenger or heavy freight service on steam and electric roads.

The Miller System of Washing and Filling Locomotive Boilers with Hot Water

Where locomotive boilers are washed with cold water, the time necessary to hold engines in the house for boiler washing is one of the principal causes of terminal detention. Applying cold water to the hot metal of the boiler is very injurious to firebox, sheets, staybolts and flues due to the strains set up in the metal by sudden contraction. On this account it is necessary to allow a boiler to cool down to that temperature at which cold water will have no injurious effect, if satisfactory results are to be had with cold water. That this is so has been proved on many occasions where roundhouse foremen have attempted to reduce terminal delay by failing to allow sufficient time for boilers to cool before washing with cold water, and failures have been traceable directly to this cause.

The time requisite for a boiler to cool slowly to that temperature at which cold water will not be injurious when applied to the metal, represents a reduction in the earning capacity of the locomotive, for it is while moving over the road that a locomotive earns interest on itself as an investment. The time necessary to raise the temperature of the water with which the boiler is filled represents an additional delay in preparing an engine for service.

Under ordinary conditions the time which a locomotive is held for washing with cold water is usually about six or eight hours. As a result of a determined effort to reduce this time and to do away with many objectionable features formerly attending the process of boiler washing, the Miller system of washing out and refilling locomotive boilers with hot water has been devised and put into successful operation.

The principle involved in this system provides for raising the temperature of clean, fresh water by the heat contained in the steam and water blown out of locomotive boilers and supplemented by exhaust steam from various sources. Further, the piping arrangement is so disposed as to carry steam and water from a boiler being blown off, away from the interior of the house, thus eliminating steam and fog which gathers under ordinary conditions.

The equipment required by this system is simple in its arrangement. It consists of two heaters connected by suitable piping with a blow-off main, the washout line, the hot-water refilling line, cold water supply main and with the sewer system. The heaters are of the same length and one heater of smaller diameter is placed immediately above the larger. Within each heater are two inner heads, situated a short distance from the outer heads. The space between the inner heads contains a number of flues, well worked into the heads, and providing for circulation between the two compartments at each end of the heater.

Clean, fresh water is delivered to the bottom portion of the lower heater, and from this point it circulates around the outside of the tubes, passing through a pipe connection to the upper heater, and thence through the hot-water main to the various connections in the roundhouse. Hot water and steam from the blow-off main enter one end of the lower heater and circulate through the interior of the tubes. An overflow pipe leading to the sewer system regulates the height of this water in the lower heater The steam brought in with the water passes through a connection to the upper heater and circulates through the interior of the tubes. A back pressure pipe leading through the roof provides for the escape of steam.

The arrangement of the heaters, then, is such that while the

INTERIOR OF 49TH ST. ROUNDHOUSE OF THE CHICAGO & WESTERN INDIANA R. R., SHOWING ARRANGEMENT OF CONNECTIONS OF THE MILLER SYSTEM.

hot water blown from locomotive boilers is used to heat the water used in washing and refilling, the waters are not mixed and clean, fresh, hot water is delivered to the roundhouse connections.

The system may be so arranged as to use the hot water blown off for washing out boilers and to use only clean, fresh, hot water for refilling. When the blown off water is so used it first gives up a portion of its heat and is settled and mixed with clean water, before delivery.

The various mains encircle the wash out section of the roundhouse, with suitable connections to serve each pit. Each washout valve is connected with both the hot water and cold water mains in order that the water used in washing out may be tempered as desired. The accompanying half-tone engraving, illustrating the interior of the new roundhouse of the Chicago & Western Railway at Chicago, shows the arrangement of connections of the Miller system.

The hot water for washing and refilling is heated without extra cost for fuel or labor for the reason that the heat so used would be otherwise wasted. Practically no expense is entailed for operation and maintenance over and above cold water methods. The operation of the apparatus is practically automatic and it is so constructed that there is very little liability of its giving out or causing trouble and the work of repairs, if necessary, is simplified by reason of all piping, connections, valves, etc., being of standard material carried at all terminals.

The apparatus is so designed that sludge blown into it causes no trouble. The sludge collects in two places without interfering with the operation of the system and may be discharged to the sewer from time to time through sludge valves.

At some terminals conditions are such that the blown off water and steam together with the waste exhaust steam produce more heated water than can be used for washing and filling locomotive boilers. In such cases, in the event of the stationary power plant being near the roundhouse, the surplus heat may be utilized to raise the temperature of the plant.

Having considered the principle of this system it is interesting to turn to the benefits derived from washing and filling locomotive boilers with hot water.

As hot water is always available at the maximum temperature at which it may be handled by boiler washers, it is possible to begin the process of washing out as soon as the boiler has been blown off. Immediately after boiler washing work has been completed, the boiler may be filled with clean, fresh water at a temperature of nearly 212° F. As the boiler metal has not become cold at any time during the process of washing and as the changes of temperature have been slight and gradual, little or no strain has been set up in the metal and the ill effects of sudden changes of temperature have been eliminated. It has been necessary to hold the engine only for that length of time absolutely required to blow off the boiler, wash it, refill it and raise sufficient steam to move the engine. As the boiler is refilled with hot water, much less time is required to raise steam than when it is refilled with cold water. By so washing and refilling boilers actual experience at a number of roundhouses on various railroads has demonstrated that terminal detentions due to boiler washing has been reduced one-half, and where an engine was held for six or eight hours it may be ready in three hours and sometimes less.

This system is handled by Julian L. Yale & Company, Railway Exchange, Chicago.

Lang's T-Bolt Head

Operators of planers, shapers, drill presses, boring mills, milling machines, etc., usually have a varied collection of bolts assembled at their machines for clamping the work securely in place during the operation of machining. These bolts are often temporary makeshifts and the heads are not always of standard form to fit properly the slots in the

LANG'S PATENT T BOLT HEAD.

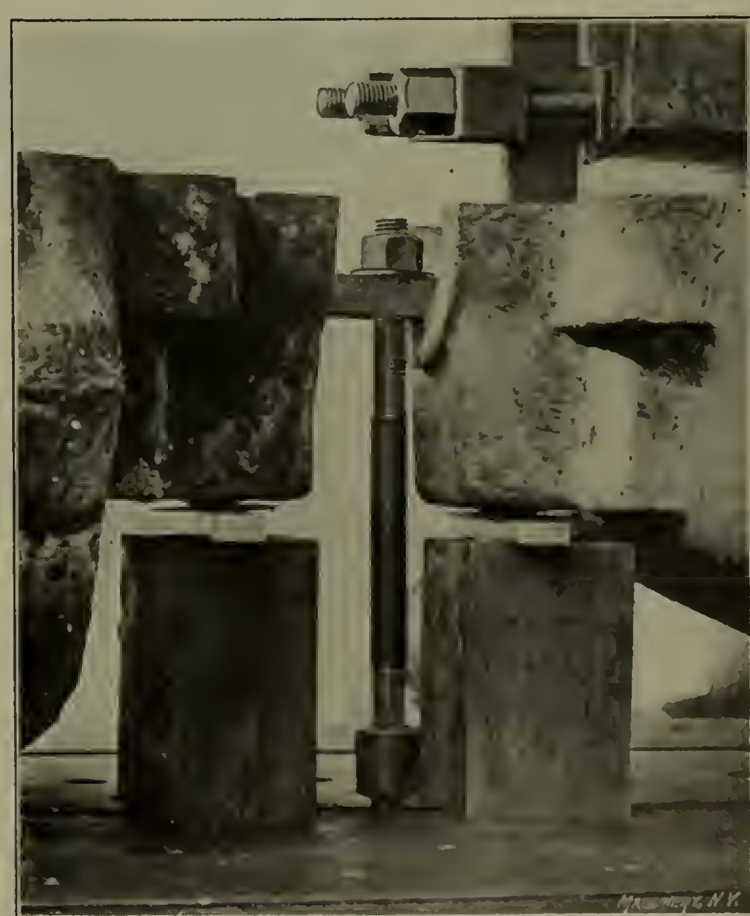
table of the machine. Consequently they are sometimes difficult of adjustment and improper bolt heads very often are injurious to the sides of the slots.

To obviate the difficulty encountered with odd bolts a standard "T" bolt head has been devised for use with studs. These heads are faced and fit properly and, being made of steel, do not bend out of shape. The heads are so constructed as to accommodate one end of a stud having a standard thread.

When a head is once placed in a slot of the machine table it is not necessary to remove it whenever a bolt of different length is required. The stud first in place is simply unscrewed and another of desired length inserted. As a usual thing slots become obstructed with borings, turnings or shavings, which cause the loss of more or less time to remove and replace a head bolt, so that applying bolts of various lengths without the necessity of removing the head represents a considerable saving in time.

Studs may be manufactured more cheaply than head bolts, and the manufacture of the requisite number of studs represents greater economy than the manufacture of an equal number of bolts with heads.

Again, when head bolts are used, the heads should be especially made for this class of work and should be properly fitted to the slots. When not properly fitted they tend to impair the



USE OF T HEADS, FOR CLAMPING WORK ON PLANER.

sides of the slots by wearing off the corners, so that slots sometimes have to be reshaped after having been ruined by the use of improper bolts. Obviating this expense represents further economy in addition to increasing the life of the machine table.

The time consumed in setting up work usually represents the efficiency of machine and operator in providing output, especially where a large number of pieces are machined each day and frequent changes are necessary. When the class of work varies continually the length of bolts required for clamps naturally varies, and a device whereby the bolts are changed and adjusted quickly represents a material saving in time and a considerable increase in the output of the machine.

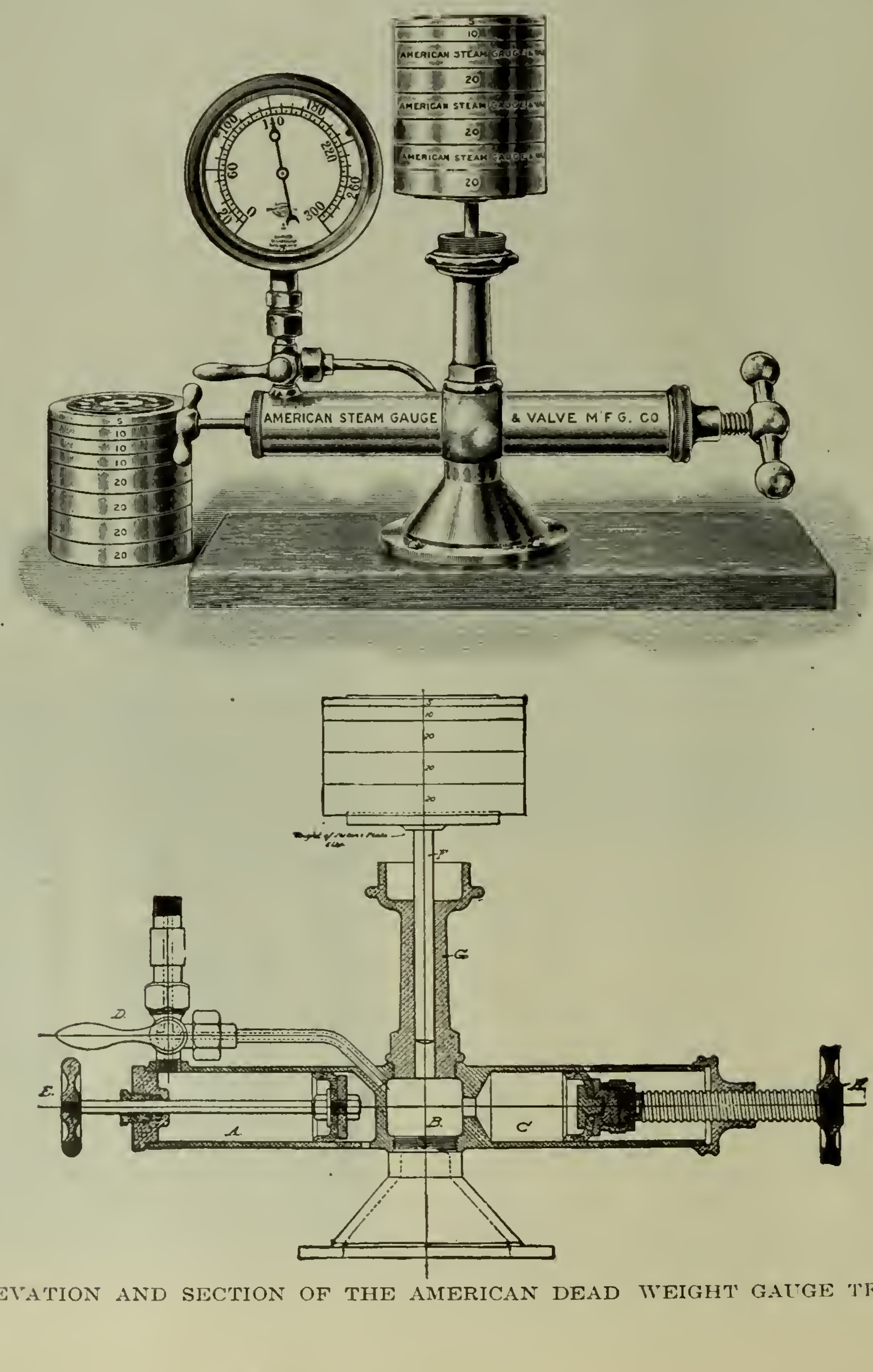
One of the accompanying engravings illustrates the form of the "T" head and the other shows it in service as a 72-inch planer. The "T" heads are manufactured of steel, drop forged, and consequently are of much better grade of material than the ordinary bolt. Consequently there is little danger of the thread stripping, and each head is guaranteed for one year by the manufacturers, the G. R. Lang Company, Meadville, Pa.

The American Dead Weight Tester

The functions of the steam gauge are such that its adjustments should be carefully made and its readings correct. Gauges in service should be tested periodically and after repairs they should be accurately set and adjusted according to a recognized standard. Many shops are equipped with repair departments for the care of gauges, pop valves, injectors and other auxiliaries and complete gauge testing apparatus should be included in the equipment.

The American dead weight tester has been devised for such service and possesses many features of advantage. It is compact, thus occupying little space; it is accurate as a testing apparatus, and it is claimed to possess all the advantages of the mercury column. The general appearance of the tester together with the details of construction are clearly shown by the accompanying illustrations.

The apparatus is simple in its construction and precise in the results obtained. It consists of a cylinder for storing the oil used by the apparatus, a main pump for applying pressure to the weights and a three way cock with proper connection for attaching gauges to be tested. The main pump includes a cylinder B which is connected directly with cylinder G and piston F of a known area, operated by weights conforming to the area of the piston. Cylinder C is connected with cylinder B and is provided with a screw plunger for raising the piston F under weights. The auxiliary oil chamber A has a plunger for filling the connection to the gauge as well as for delivering oil to the main pump cylinder through the three way cock D. Oil is contained within the pump at all times thus eliminating the necessity of pouring oil in and out before and after testing.



ELEVATION AND SECTION OF THE AMERICAN DEAD WEIGHT GAUGE TESTER

This device is manufactured exclusively and marketed by the American Steam Gauge & Valve Manufacturing Company, 208-220 Camden street, Boston, Mass.

Vacuum Cleaning for Passenger Equipment

The Chicago, Milwaukee & St. Paul Ry. in a series of striking advertisements in the November magazines is calling itself "The Sanitary Way." And the reason therefor is the recent installation at the "Milwaukee" yards in Chicago of an "Aero" vacuum cleaning equipment.

This vacuum system which is made by the American Air Cleaning Co., of Milwaukee, Wis., is used for cleaning the upholstery, carpets, curtains and bedding of the C., M. & St. P. cars. "By its tremendous suction force," read the railroad's advertisements, "it removes dust, dirt, grit and germs as no other method can."

The "Milwaukee" road adopted this vacuum system after a series of tests lasting for several months. Comparisons were made showing the relative cleanliness of cars cleaned by the "beating" method and the vacuum system. In other tests, after cars had been blown by compressed air, they were "vacuumized" and the dirt sucked out was weighed.

CLEANING SLEEPING CAR BY THE VACUUM SYSTEM.

It was found that even after the most thorough beating or compressed air cleaning, from one to 2½ pounds of dirt could be "vacuumized" out of the plush and carpets.

Since the vacuum system was installed it has been found that thorough cleaning of sleepers and coaches is necessary only about one-third as often as with the old method. A thorough "vacuumizing" once every third or fourth trip keeps the car in better condition than if it were "beaten" or blown every trip. A rapid dusting on intervening trips is enough to keep the dust from accumulating.

The labor-saving nature of the device is shown by the fact that the first machine installed at the "Western avenue" yards of the C., M. & St. P. enabled the yard foreman to cut down his payroll $100 a month.

Under the Aero air-cleaning system, as it is called, the vacuum is produced by means of a compressed air aspirator, drawing its power from the air pipes which are laid through the yards for testing brakes.

When the workman using the vacuum apparatus passes the cleaning tool or nozzle over the surface of a cushion or carpet the dirt is quickly sucked through the vacuum hose into the dust tank.

This tank is strongly mounted on wheels and is readily brought alongside the car to be cleaned. The aspirator is attached at one side of the tank. Inside is a separator which collects all the dirt. The cleaning is all done inside the car and without raising any dust.

CLEANING PARLOR CAR BY THE VACUUM SYSTEM.

Notes of the Month

Sipp Railway Equipment Company, Chicago, Ill., has changed its name to the Central Railway Equipment Company.

American Locomotive Company will hold its annual meeting at 111 Broadway, New York City, on October 15.

Crocker-Wheeler Company, Ampere, N. J., has removed its Birmingham, Ala., office from 2119 Third avenue to the Woodward building.

Bryant Zinc Company, New York, has established a downtown office at 1320 West Street building, 90 West street, New York, where all mail, messages, etc., should be addressed.

Southern Purchasing Agency, Valdosta, Ga., has been incorporated under the name of Southern Locomotive & Car Manufacturing Company. It will continue business along the same lines as heretofore.

McMyler Manufacturing Company, Cleveland, O., has received orders for two large car dumpers, one to be built for the Baltimore & Ohio at Lorain, O., and the other for the Hocking Valley at Toledo, O.

Mr. Ira C. Hubbell has resigned the presidency of the Locomotive Appliance Company, Chicago. He is succeeded by Mr. C. A. Thompson.

F. P. Huntley has been elected vice-president and general manager, and George G. Milne, secretary, of the Gould Coupler Company, New York.

Link Belt Company, Chicago, has opened an engineering and sales office at 440 New York block, Seattle, Wash. Ernest G. Brabrook is in charge.

Schoen Steel Wheel Company, Pittsburg, Pa., has had plans prepared for four 30-ton basic open-hearth steel furnaces, to be built at McKees Rocks, Pa.

B. F. Sturtevant Company, Boston, Mass., has been awarded the contract for the heating plant in the new repair shops of the Hocking Valley at Columbus, O.

Greensboro Air Brake Company, Greensboro, N. C., has been incorporated by Samuel L. Trogden, Neil Ellington and W. Z. Brown. The company will manufacture air brakes. Capital stock, $125,000.

Kansas City Car Building & Contracting Company has been incorporated in Missouri with a capital stock of $2,100; incorporators: C. C. Mills, E. O. Brown, R. F. Ralon, John Cox and E. W. Hare.

At a special meeting of the board of directors of the Gould Coupler Company, New York, F. P. Huntley was elected vice-president and general manager, and George G. Milne, secretary.

E. W. Buechling has been appointed to the new office of assistant manager of sales of the Pittsburg Automatic Vise & Tool Company, Pittsburg, Pa.

Pittsburg Art Glass & Mosaic Decorating Company, Allegheny, Pa., has been awarded a contract for 4,000 copper deck lights by the American Car & Foundry Company. These lights are to be used in the steel passenger cars being built for the Pennsylvania Railroad.

Safety Appliance Company, Montgomery, Ala., will increase its capital of $100,000 to $2,500,000. Its manufacturing plant will be enlarged. This company manufactures a patented device to prevent derailment of trains, broken axles and trucks.

Ridgway Dynamo & Engine Company, Ridgway, Pa., announces the re-opening of its Chicago sales office at 824 Marquette building. F. S. Hickok, who has had extensive experience in the electrical and power plant fields, is in charge.

Anderson-Lacy Electric Headlight Company, Houston, Tex., has been incorporated with a capital stock of $10,000. The company proposes to manufacture a patented electric headlight which is the invention of B. B. Lacy, manager of the company. T. J. Anderson, general passenger agent of the Galveston, ton, Harrisburg & San Antonio, is president; H. T. D. Wilson, vice-president, and Harry Holmes, secretary and treasurer.

The Falls Hollow Staybolt Co., Cuyahoga Falls, Ohio, announces that the fire on the 13th ult., which destroyed the building in which was housed the rolling mill plant, did very little damage to the machinery and the mill is now again running in better condition than before the fire.

Jones & Laughlin Steel Company, Pittsburg, Pa., will begin the erection of four additional open-hearth furnaces at its south side plant. The improvement is said to involve an expenditure of $1,000,000, and will increase the production of the plant about 1,000 tons a day.

C. A. Ralston, formerly general sales agent of the Lima Locomotive & Machine Company, and more recently general superintendent of Hicks Locomotive & Car Works, has opened an office at 702 Fisher building, Chicago, and will deal in new and second-hand railway equipment. He has also been appointed representative of the Russell Car & Snow Plow Company for this territory.

The Samson Cordage Works, Boston, Mass., is putting on the market a signal cord with a galvanized steel wire metal center.

W. P. Cosper, Chicago, has resigned at general sales agent of the Garton-Daniels department of the Electric Service Supplies Company, to engage in the manufacture of hot water heaters for steam and electric railroad cars.

The Barker Mail Crane Company, Clinton, Ohio, has contracts with the Harriman Lines for the use of the company's all-iron mail crane. The crane is now standard on the Northern Pacific, Chicago, Milwaukee & St. Paul and the New York, Ontario & Western. They have been installed on thirty railroads.

The increase in capital stock of the Westinghouse Air-Brake Company, Pittsburg, Pa., from $3,000,000 to $14,000,000 and the distribution of a 25 per cent stock dividend were considered at the annual meeting of the stockholders, but it was decided to act finally at a special meeting called for December 3.

The Washburn Steel Castings Coupler Company, Minneapolis, Minn., will exhibit at the American Street & Interurban Railway Association's convention at Atlantic City a number of types of traction couplers. Only a few of these have heretofore been offered for sale, but the company is now ready to put them on the market in large amounts.

Niles-Bement-Pond Company, New York, N. Y., has received an order from the General Electric Company for one 15-ton crane and one 30-ton crane, both with a 65-foot span. These cranes are to be installed in the General Electric Company's storage warehouse at Schenectady.

George Callahan & Co., 128 Front street, New York, report a steadily increasing demand for their various products, which include non-corrosive soldering fluid, steam joint iron cement, anti-slip belt grease, rubber roof cement and Elastica liquid coating. These are now being sold regularly to more than 400 railways.

Bonney-Floyd Company, Columbus, Ohio, will manufacture steel castings weighing from a few pounds up to two or three tons. The company uses the side-blow converter process and is in position to furnish any kind of carbon steel desired. At present the monthly tonnage will be about 250 to 300 tons. The company has its own railroad siding and can furnish castings promptly.

The Pilling Air Engine Company of Detroit, Mich., manufacturers of pneumatic hoists, locomotive turntable motors and compressed air hoisting machinery, will change its name to the Detroit Hoist & Machine Company, a new corporation with capital stock, fully paid, $50,000. The Pilling corporation will be retained with a nominal capital to protect the name and good will. Both companies will be controlled by the same management.

This company has just installed and are now operating their new plant. Other improvements will be added in the near future, provision having been made by the purchase of three acres of ground on the Grand Trunk R. R. at Milwaukee Junction, considered one of the most advantageous shipping points in Detroit.

Technical Publications

Railway Storekeepers' Association. Proceedings of the fourth annual convention, held at Chicago, Ill., May 20, 21 and 22, 1907. J. P. Murphy, Secretary, Collinwood, Ohio.

The proceedings of the fourth annual convention of the Railway Storekeepers' Association include reports on: Should the Jurisdiction or Responsibility of the Storekeeper or Supply Agent Extend to the Time the Material is Actually Used on the Railroad? Modern Supply Car as a Factor of Economy in the Distribution of Material; Material Classification, Benefits to be Derived From; When a Storekeeper's Accounts Are Handled by an Auditing or an Accounting Department Should the Storekeeper be Held Responsible for His Receipts and Disbursements? Has not the Unit by which He is Measured Been Taken from Him? Is the Store Department Deficient without a Traveling Storekeeper? Importance of Proper Loading of Material at General Storehouses to Conserve Cars and Expedite Delivery; Best Record for Material Received and Passing Invoices; Reports and Statistics that Are of Value to the Store Department; To What Extent is the Store Department Beneficial to the Motive Power Department? Most Practical Railway Store Department Organization.

Grinding and Lapping, by Joseph V. Woodworth. Published by the Hill Publishing Company, New York. Cloth binding. 162 pages, 6x9 ins.; illustrated. Price, $2.00 postpaid.

This book describes and illustrates the use, design and construction of machines and attachments for grinding and lapping The volume shows that the author has a thorough understanding of the subject. He has written this volume in a clear and concise manner so as to be easily understood by the apprenticed mechanic.

Gas Engines and Producers, by Lionel S. Marks, S. D., M. M. E., and Samuel S. Wyer, M. E. Published by the American School of Correspondence, Chicago. Cloth binding, 138 pages, 6½x9½ ins.; illustrated. Price, $1.00.

The book is divided into two sections, the first dealing with the construction, operation and maintenance of gas and oil engines, and the second covering the construction of gas-producers and their accessories. The first part was written by Lionel S. Marks, and the second by Samuel S. Wyer.

A careful study of this volume will give one a satisfactory understanding of the present stage of gas engine and gas-producer design and also a knowledge of the method of operating the modern plant.

THE BLACKSMITH'S GUIDE, by J F. Sallows. Published by The Technical Press, Brattleboro, Vt. Cloth binding, 160 pages, 4½x7 ins., with 165 illustrations. Price, $1.50 cloth, and $2.00 leather binding.

This volume is written by a man whose experience covers a period of 27 years at blacksmithing. Actual experience is the foundation of the material published in the book.

The several chapters include machine forging, tool forging, hardening and tempering, high-speed steel, case hardening and coloring, brazing, general blacksmithing and appendix of drawings and tables.

All descriptions of jobs are illustrated with line drawings, making the explanations clear and concise. The charts for hardening and tempering are colored, showing the various degrees of heat required for the several tools and purposes.

DEVELOPMENT OF THE LOCOMOTIVE ENGINE. By Angus Sinclair. Published by the Angus Sinclair Publishing Company, New York City. Price, $5.00.

This book is a history of the growth of the locomotive from its most elementary form, showing the gradual steps made toward the developed engine, with biographical sketches of the eminent engineers and inventors prominent in bringing it to the perfected form of today. Many particulars, including railroad development, are included also.

The work is the result of careful and painstaking effort on the part of the author, and the information presented is based on material collected during diligent search after data absolutely correct. Much of the text has been published in the columns of Railway and Locomotive Engineering Criticisms were invited upon the articles that appeared in this journal, and the exhaustive replies provided a broader field for gathering facts.

Chapters are devoted to the origin and growth of the steam engine; early attempts at locomotive construction; development of locomotives in Great Britain; genesis of American railways; connecting the ocean with western rivers; first links of the Pennsylvania Railroad; the Philadelphia and Columbia Railroad; how the United States worked into locomotive building; the work of Matthias W. Baldwin; pioneers in locomotive building; early construction of the New York Central Railroad; first railroad construction and locomotive in New England; critical period in railway and locomotive construction; locomotive building in New Jersey; the Erie Railroad; development exemplified by the Philadelphia and Reading Railroad; the Lackawanna Railroad; the Lehigh Valley Railroad and its motive power; multi-coupled engines; westward movement; boilers; smoke preventing appliances; spark arresters and draft appliances; valves and valve motion; curiosities in locomotive design; growth of the train brake; special forms of locomotives; locomotive accessories; locomotive building establishments; railway development in Canada; the locomotive of today.

Chief Joint Car Inspectors and Car Foremen's Association

Eighth Annual Convention

The eighth annual convention of the Chief Joint Car Inspectors and Car Foremen's Association was held in Chicago on September 4th and 5th.

President H. Boutet, of Cincinnati, called the meeting to order at 10 a. m., and announced that as the minutes of the last meeting had been read by all, they would stand approved if there was no objection. After which he addressed the convention as follows:

ADDRESS OF PRESIDENT H. BOUTET.

Members of the Chief Joint Inspectors and Car Foremen's Association:

It is with a great deal of pleasure that I again address you as your president at this, our eighth annual meeting, for which I am thankful for your kindness in re-electing me to preside over you.

I trust this meeting will be as industrious and as interesting as the last one, which was the most interesting and instructive series of meetings that I ever attended, and I believe that this meeting will be much better than last year's, as we will have more papers presented, and, of such a nature as to be very interesting and instructive. We also have a larger membership.

We have had one of the busiest years we have ever experienced on railroads, and it has been a serious problem to maintain the light equipment to meet the heavy traffic we have had to contend with, in larger trains and heavier engines, each person trying to get them over their road and give them to the other fellow, causing a congestion at large interchange points. where, as a rule, facilities are short on account of room and scarcity of labor, which latter is probably the cause along the lines that forces them to take the action they are taking.

A decided improvement in the maintaining of safety appliances is very noticeable and is the source of much gratification to all of us, as well as the government inspectors, but this is a matter that we have to keep after very diligently at all times, as eternal vigilance in this matter is the only way to protect our companies from being prosecuted in the United States Court for failure to comply with the interstate laws.

Our constitution needs to be changed somewhat, paying the secretary and treasurer a salary. I trust you will see your way clear to do this.

Your executive committee held a meeting in Chicago on April 21st and among other things selected the following persons to serve on the entertainment committee: Messrs. Bruce Crandall of the Railway Master Mechanic, W. E. Sharp of the Armour Car Line, C. M. Garrett of the Farlow Draft Gear Co., J. A. Jaschka of the National Malleable Castings Co., and W. M. Walsh of the Galena Signal Oil Co.

I feel that each of you will find that they have acted very wisely and that our ladies will be given quite a treat while we are in session.

Just what your committee have devised I am unable to tell you at present, but from my knowledge of the gentlemen on the committee I feel that all of us, ladies especially, will feel that there is at least some pleasure in this life.

I wish to thank the officers and members of this association for their help in making this meeting a success, especially the ones who have prepared papers to be read at this meeting, and the members of the entertainment committee, who have devoted their time and thought to help our stay in Chicago to be a pleasant one.

I also desire to thank each of the different firms for their aid in providing the funds to assist the entertainment committee.

DISCUSSION OF M. C. B. RULES.

Mr. Skidmore: I move that we go over the rules as changed, discuss any changes that have been made in the rules, and afterwards if any member wishes to take up any one rule, that can be discussed. Seconded by J. B. Malone, and carried.

Vice-President Cressey read Rule 2.

Mr. Wohrle: I notice they vary and do not specify any size, so they will probably put them into effect and have a size of their own.

President Boutet: I presume that will remain a great deal with the railroad company. As long as they adopt a form they can get up any size of card. I presume they will get up one suitable for filing.

Mr. Skidmore: I think the change or addition to that rule a very good one. We have been using a card at Cincinnati somewhat similar to this one, and it avoids marking of cars which become washed off during rains. This card, I suppose, will be enforced all over the country. I presume it is intended to make standard size 3½x8, the same as the other card. I think it will facilitate the movement of cars somewhat, and there will not be that condition after a car has been sent back that all repairs have not been made, because they will have this card to hold showing all repairs for which the car is returned.

W. T. Wilbur: I want to say that one of the roads I am connected with has a return card that is on the principle of the M. C. B. defect card. It has a head, "M. C. B. return card." It is 3½x8 and has a single stub filled out the same as a defect card. The stub remains in the paper cover as a file for future references.

Mr. Peck: I move you that this association recommend to the M. C. B. Association that the size and color of this return card should be the same as a defect card, 3½x8.

Mr. Wohrle: I second it, but I would not have the ink the same color—the M. C. B. is red.

President Boutet: How would it do to designate this card as red or yellow?

Mr. Wohrle: There would be some objection, as the pencil mark would not show as well as on a white card.

Mr. Trapnall: I would amend the motion that the color of the card be yellow and the printing black.

Amendment seconded by Mr. Stall.

President Boutet: So far as the lettering is concerned. they have adopted a standard. We only recommend it to be of a certain size and color.

Mr. Lynch: I can hardly see the use of such a card. At Cleveland we have cards printed and this return card would be useless to us. If we desire to send a car to the shops for repairs we would have to have the regular M. C. B. card. I really do not see the necessity for it, but there may be different conditions. Here we would be obliged to carry two sets of cards.

President Boutet: I would state that so far as any local agreement may exist between the different railroads, that is a matter over which we have no control. We are using what is known as a refuse card. The return card does not necessarily say that we are going to return the car; it can be used to send a car to the shop with. You simply send it to your own shop. That card is a shop record and will answer the same purpose. if you become accustomed to it, as a refuse card that you are using now.

Mr. Lynch: Of course it is a superior card to this. This has been adopted, but I do not see the necessity of it.

President Boutet: Let us first understand what the objection to this refuse card is. From my own experience, I realize that if we mark a car to our own shop, or to return it to the line. we have to have some means of putting on it the defects. If they are written on with chalk, there is danger of rain washing it off, and there is danger of some person getting hurt on that car; they will see the car marked with defects on the side and will make a claim against the company. The object of the refuse card was to designate the defects so that the shop would have a record and not, after a car has been repaired, go again to the receiving line and have it rejected for some other defect. This compels the person to put all the defects on and return the car so that everyone will know what the car is shopped for.

Mr. Peck: One of the objects of the return card was that we are blamed a great many times for returning a car and do not do it; the yard master would return the car. This return card is gotten up to protect the car department. We have cars returned every day by the agent and yard master.

The amendment is accepted by the mover of the motion.

Mr. Wohrle: I would not agree to the color of the card.

The amendment was carried, which carried with it the original motion.

Rule 21 omits "from wheels cast after Aug. 1, 1907." No discussion.

Rule 22, "Pitted journals," added. No discussion.

Mr. Lynch: What is meant by pitted journals? Is it when they have been exposed to the weather and become rusted?

President Boutet: I do not know what the majority of you understand, but my understanding is that a pitted journal is one that has been pitted from use, but it is not a pitted journal when they become rusted.

Mr. Wohrle: Pitting of a journal is what we call honeycombed and becomes that way from service. In a journal full size it may not be discovered, but after they wear a little they show up.

Mr. Cressey: I should judge a pitted journal to be one that, after it had worn some time, it developed lamination seams. It is composed of bars hammered together, and there are places where the weld is not complete. Sometimes in turning an axle down it will show a good full journal, and it will develop that there are lamination spots that will cause a defect and cause heating.

Mr. Wohrle: The rules always did provide for a seamy journal. This pitting is a new one in the rules, and I take it that it is these honeycombed holes.

President Boutet: What are laminated seams?

Mr. Hitch: Isn't a pitted journal one that has small flaws in it? Occasionally there is a hard substance found in iron journals; you will find that there will be some hard pits in the journal—a hard substance—causing the journal to heat.

Mr. Duncan: Isn't most of it caused by rusting and lying around on the side track?

President Boutet: Not from my experience. My experience is that a pitted journal becomes so from unequal welds. or something of that kind. Little pieces of iron drop out and cause a pit; but rain or rust produces a different condition entirely.

Mr. Duncan: I have seen journals that have been removed that have not run over 15 miles, and I will safely say that these journals become heated causing the parts to cut, and in my judgment it is due to rust eating. I think there are a number here who will bear me out in my statement.

President Boutet: In discussing any rule or any condition, we should eliminate all personalities. Just say a certain road; do not mention any name or any road.

Mr. Gainey: I think you will find the greater number of what you call pitted seams in wrought iron axles and not so much in steel. After a man has had considerable experience in inspecting axles, and watching them being turned up, he will find at least 50 per cent of them have seams and holes in them caused by not welding on account of dirt; simply pieces of steel or other substances getting in there. I remember at one time I wanted 12 axles for two passenger cars, and the car works where I was inspecting turned up 96 axles before they got those 12 that were fit to go in passenger cars, though of course they would do for other cars. Since we have got to using steel, especially the soft steel, we do not see so much of that.

Mr. Skidmore: My understanding of a pitted journal is that it is entirely different and distinct from a seamed journal. The pitted parts fall out. as has been stated. from defects of welding while making the axles. I do not think it was ever intended to make a car owner responsible for an axle that has laid out in the weather and become rusted. and small rust eating holes develop in the journal. which were there when the axle was put in. In removing axles it has ben my experience to find a large number with small particles falling out. There may be two or three pitted holes in a journal and maybe 30 or 40, but it hasn't been caused by seams. There isn't any seam where the pitted places are, but it is a defective weld and these particles fall out, and I do not think you will confuse it with seamy or rusted journals, because there is a rule that covers the seamy journal.

Mf. Burge: I would like to ask Mr. Skidmore, suppose that some company delivers a car to him, with probably one of these rusted journals, what would you do? We have seen them pretty deep from rust.

President Boutet: In my territory, if a person received a journal from a connection, showing defects caused by exposure to the weather, a card would be given against the delivering line for it, and if that journal was to be removed on the road they should charge themselves with it instead of the owner from the company.

Voice: Until they got authority from the party applying the wheel?

President Boutet: If they could get that it would be all right.

Voice: As we asked for information on this pitted question, I would like to offer the suggestion that perhaps the journal had been running hot, and cooling the journal off with water had scalded it, causing the pits.

Mr. Dyer: It seems to me that it would be advisable if this rule could be taken to distinguish pitted journals caused by rust and exposure to the weather. It does not seem proper that a car owner should stand responsible for an axle that is put in under their cars under pitted conditions, and there is no question but what the owner of the cars would not be responsible under such conditions.

President Boutet: To get this rule properly understood so that we would all have the same understanding, it would appear to me that a motion should be made that it is the sense of this meeting that the proper interpretation of the rule is so and so.

Mr. Dyre: If it is pitted by rust and exposure to the weather, the owning company would not be responsible.

Mr. Seiberling: It is a very important question. There is a whole lot that would cause pitted journals. We should get down to it and have a lengthy discussion on that. On the road I represent we have had seven journals break off in the last eight months, and we find that the forging is not done properly, and they break right off without twisting; they are hollow inside and pitted inside.

Mr. Laughlin: In order to get the question before the house, I offer a motion that the interpretation of the rule by this meeting is that a pitted journal is a journal that is pitted on account of the impurities in the iron or defects in the manufacture. Other pitted journals are delivery line defects. Seconded.

Mr. Lynch: It seems to me that would be unnecessary. The rule is clear and it does not say that it must be from any particular cause that a journal is pitted. If it is pitted, that is sufficient.

President Boutet: For the benefit of myself and the rest of the association, we will take a car that comes in on the Lake Shore at Cleveland to be delivered to the Big Four. When the car came in on the Lake Shore it had a rough journal or some other defects; they applied a new pair of wheels to the car at Collingwood or other shops, and they applied an axle that had been exposed to the weather for a year or so. When it got over on the Big Four, they found the journal rough and pitted by exposure. Do you think it fair that the owner of the car should be charged with that journal for a pitted journal?

Mr. Lynch: It does not say from what cause the journal would be pitted, and to start to make a distinction between them—one pitted by forging and one on account of the weather—is hardly necessary.

President Boutet: The opinion of the man from Kansas City is that this rule is intended to cover any pitted journal caused from the infirmities of the material or poor workmanship. The opinion of others shows that there is a difference of opinion here.

Mr. Dyre: I do not think we are quite broad enough. Are we going to make the handling road responsible for the pitted journal caused by rust? The rule is all right as it stands and there is no necessity for changing it. The arbitration committee would leave it that way.

Mr. Peck: It is up to the inspector. It is only one item added on to the rule. He would not take a rusted journal and call it a pitted journal. It is a mere item for the inspector. It is an item in there to protect the line that handles cars from the parties who use bad journals.

Mr. Harvey: Rule 2 refers to journals and would take care of pitted journals caused by weather. That would make the delivering company responsible. You would not discover that defect unless the car runs hot. I think Mr. Laughlin's motion is all right.

Mr. Dyre: I think the members should consider well whether they would like to make their road responsible for a pitted journal caused by exposure to the weather when they receive it from a connecting line in that condition.

President Boutet: Would you like your company to be billed? A. has one of your cars and puts in a journal that has been exposed to the weather for two or three years and has not taken care of it. A. delivers it to B., and when he receives that car he finds that the journal has been running hot; takes out the journal and finds the trouble to be caused by exposure and lack of care on the part of A. Do you think he should charge you for a new journal?

Mr. Dyre: I think the arbitration committee took that stand. There was a case where wheels claimed to have been applied were taken out after the car had run a hundred miles and they claimed that the wheels were all right.

President Boutet: We will have no trouble with a journal with defects caused by rust after a car has run successfully 100 miles. The motion is that it is the sense of this meeting that to be chargeable to the owner, the defects should be caused by defective material in the journal or defective workmanship.

Motion carried.

Rule 29.

Mr. Dyre: How should an air hose missing be treated?

President Boutet: One coupling remaining on the pipe and the hose torn loose from it attached to the angle cock, I would consider that owner's defect, just the same as any other torn hose.

Mr. Trapnall: Wouldn't the delivering line be responsible for the coupling?

President Boutet: For the missing material.

Mr. Dyre: Isn't the hose missing, too?

President Boutet: This is charging on your own road.

Mr. Seiberling: In regard to air hose being torn off of the coupling, that it is not fastened on sufficiently to hold, I consider that faulty construction. An air hose is supposed to become uncoupled when switching cars. I think it should be car owner's responsibility and not delivering company, as long as it shows for itself that the coupling is there.

Mr. Skidmore: I do not believe that is proper in the case of a torn air hose. If the hose is entirely off of the coupling it is not torn. If the car comes in off of the line or is delivered to you with a torn air brake hose, and there is evidence attached to the fittings that the hose has been torn off, it would be proper to get a defect card against the delivering line for one coupling missing and only be charged for the torn hose. But in case of no evidence that the hose was torn, just had been pulled off from the attachment not being securely fastened. I think with the hose and one coupling missing the delivering line would be responsible.

Mr. Wohrle: I do not see that we could do anything except what the rules say we should carry out. If the hose is torn off on the line and the company puts one on, it should charge the other. If they elect not to do that, issue a defect card for an air hose torn off, because Rule 29 says "Torn air brake hose is owner's defect, except missing material on cars offered in interchange." We carry out the rules and say, "Air brake hose torn off."

President Boutet: If the car bore evidence of the hose torn off, Cincinnati would give a card for the coupling missing.

Mr. Dyre: I understand that the hose is torn and not pulled off.

Mr. Trapnall: Suppose that the hose is torn off of the nipple and gone, it is faulty construction because the clamps were not properly adjusted, and should only be handled when offered in interchange card for one coupling gone.

Mr. Fifer: How did you say you did at Cincinnati?

President Boutet: If the car was offered in interchange at Cincinnati with an air hose torn off, a card would be given for the missing coupling and the receiving line would be told to charge the owner of the car for the air hose alone. A car not equipped, or having been equipped with air, has part of its appliances in bad condition; yet if that car is put in a train that has 75 per cent of good air, it is not a penalty defect—a defect for which the United States government could report that company and make a case and prosecute them.

Question: It would be an air brake defect?

Answer: It would be an air brake defect. One portion of it is chargeable to the owner, the torn air hose; the coupling being missing is chargeable to the delivering line.

Mr. Wohrle: Would that be a penalty defect?

President Boutet: My understanding is that if 75 per cent of the cars in that train have the air brakes in good condition, that it is not a penalty defect to deliver a car with a defective air brake.

Mr. Brown: If that train has 75 per cent of air, you could call it nothing but a safety appliance defect. I do not understand that it is a penalty defect.

President Boutet: Our practice is not a penalty defect as long as the train has 75 per cent of its cars in good working order. There has been prosecutions where they did not have 75 per cent of the train equipped with air.

Mr. Waughop: We cannot call on a railroad for a penalty defect until such time as we put that car in a train.

Mr. Wohrle: You can handle a car with a defective air brake in yard service, but when the train is made up you must have 75 per cent of air. But a car offered in interchange, that would not be a penalty defect to have the air hose torn off. It would not be considered a defect that the government would impose a penalty.

Mr. Dyer: I move that where a coupling and the rubber part is missing, that it be considered as missing material and not torn air brake hose.

President Boutet: The motion is that where a car is delivered with the air hose pulled off from the nipple and the hose coupling that it be considered delivery line company defect, missing material.

Mr. Skidmore: The only objection I have to the motion is that it states air hose torn off and in no place says slipped off. Torn and slipped off are two different questions. Air hose becoming torn off must leave a part of the hose attached to the nipple. The fact of a hose slipping off the nipple does not take any part in a torn air hose. A band may become broken and allow the hose to pull or slip off; then it becomes missing material and not torn air hose.

The question was put upon the motion and carried.

Rule 35. No discussion.

Rules 35 and 36. No discussion. Rule 37. No discussion. Rule 40.

Voice: I would like to ask the members how they would treat a case where there are both kinds on and also what constitutes charges, if you cannot read the names of the parties who applied them?

Mr. Neiber: I think that is covered by 106.

President Boutet: To start the discussion, I would state that at Cincinnati if a car has one or two tacked signs on, or a dozen pasted signs on and is interchanged a card is given for that car reading "Pasted advertisements," which means a charge of $1.00 against the delivering line; that is if it has two or more signs, some pasted and some of them tacked. If it has nothing except tacked signs, a card is given for tacked advertising, and that allows a charge of 50 cents. We have taken the view that $1.00 would remove all pasted signs on a car, and we did not think it any more trouble to remove a few signs that were tacked than if they had all been pasted. Before we get through with this rule I want to hear from each member as to what is being done in their territory. An effort is being made by all lines to remove every sign on their cars before they are interchanged, and our understanding is that the signs must be removed down to the paint so as not to leave the car in a defaced condition.

Mr. Waughop: Did it ever occur to you that some of us might be wrong?

President Boutet: Yes, I simply stated the view that Cincinnati has taken with the hope of getting an expression from different parts of the country.

Mr. Waughop: I would like to have the vice-president read the circular I have on the subject.

East St. Louis, Ill., Aug. 30, 1907.

To All Interchange Car Inspectors and Car Foremen,
St. Louis, Mo., and East St. Louis, Ill.

I am handing you today and tomorrow, revised M. C. B. Rules for 1907.

I wish to particularly call your attention to Rule 40 regarding Advertisements on car. As this is a cardable defect against the delivering line on and after Sept. 1, 1907, you will be careful to note whether Advertisement is pasted or tacked on the car. You will also make report of whether the Advertisement is old or new. I interpret the rule to mean that temporary Advertisements are only to be considered unfair usage and delivering company responsibility, when tacked or glued to the car proper. Advertisements tacked to the load and not the car, you will not consider or hold. You will not consider as Advertisements, any card found on car such as car movements, "This car loaded with Explosives," or "This car loaded with Southern cattle," as that is not, in my opinion, an Advertisement. Things of that nature you will not consider. An Advertisement is to be strictly of some firm.

Wish also to call your attention to Rule 65 regarding Splicing of Draft Sills. As I interpret the Rule, Two Draft Sills may now be spliced once.

Any question arising from the rules which is not understood by you, if you will make it known to this office, we will endeavor to set you straight on it.

Wish to particularly call your attention to reporting pool marks found on cars. Pay more attention to this as it expedites the movement of cars by giving proper pool marks.

Yours truly,

CHAS. WAUGHOP,
Chief Interchange Inspector.

I have interpreted that rule this way: If a car comes in from the Vandalia and is delivered in interchange to the Terminal with two or three posters tacked on to the car and also two or three pasted posters, I think it is right and proper that the line removing them should charge $1.50. I think everybody is against me on that, but the law is very explicit on it. The law says that a pasted poster can be removed by a receiving line at the expense of the delivering line of $1.00. It also says that a tacked poster on a car can be removed for 50 cents. If there are two kinds on a car I claim that we can give a card for both of them, $1.50.

Mr. Lynch: That is Cleveland's interpretation of the rule. We are holding the delivering company responsible if the advertising is tacked and has one or more pasted ones.

Mr. Wohrle: I would like to have our circular read.

Columbus, O., Aug. 24, 1907.

To Joint Inspectors:

Your attention is called to Rule 40 of the M. C. B. Rules effective Sept. 1, 1907, covering temporary advertisements on cars, and in order that this rule may be uniformly carried out by all lines, you will be guided by the following instructions:

Defect cards must be issued against the delivering lines and cars shipped, for all cars bearing advertisements either tacked or pasted or both.

When advertisements are tacked on, the defect card must read tacked; when pasted on, the defect card must read pasted; but in case the advertisements are both tacked and pasted, the card should only read pasted.

A combination of advertisement and switching card, bearing the firm's name and destination as well as the car number, initials, etc., is considered an advertisement, and defect card must be issued for same.

The authorized cost of the removal of advertisements is per car; hence it will not be necessary for you to specify on defect cards the number of advertisements found on the car.

This rule applies to all cars, including private line cars.

No defects cards should be issued for the following:

Advertisements which have been obliterated or faded to such an extent as to be illegible.

Temporary advertisements placed on temporary stakes on open cars or placed on the lading.

John Wohrle,
C. J. I.

Mr. Peck: I can probably enlighten you. When the committee was revising the rules last May, our recommendation was that it was the transportation department's place to take care of that. When we got to the convention we got telegrams from all over the country wanting that in. The arbitration committee did not wish to take this in. They called representatives to come to the hotel, and there was over half of the car lines in the country represented there. The question was put to them what to do, and they voted that they would remove the advertising. After they had agreed then the price was discussed; some said ten, some fifteen and some twenty-five cents, and finally one man moved that they make it fifty cents for removing tacked signs and a dollar for the pasted advertising, and they agreed that the dollar would cover the whole thing. This price of fifty cents or a dollar was put on as a penalty, so that in a short time there will be no advertising on cars. One dollar will cover all advertising on a car.

President Boutet: To get the matter before the Association, it is your understanding as a member of the arbitration committee that one dollar will be the limit that they can charge if it has a dozen signs pasted on.

Mr. Peck: Yes, because the next car would only have one or two on. That is my individual opinion.

Mr. Waughop: Whenever I write an order, it means something. I am talking to Mr. Peck now. The Master Car Builders have put that in their rule, and we should abide by it. They put two prices up to us. How are you going to get around that?

Mr. Peck: The arbitration committee has so far tried to be fair. If one dollar is enough to take that advertising off of the car in the most extreme case, you have no excuse for charging a dollar and a half.

Mr. Gainey. To get this thing properly before the meeting, I move that it is the sense of this meeting that if there is one pasted advertisement and one or more tacked advertisements, that only one dollar can be charged; if there is just one or a dozen tacked, then only fifty cents can be charged.

Motion seconded.

Mr. Waughop: Personally I am very agreeable to that, but I think that the Master Car Builders should write their rules plain enough so that we can understand them.

Mr. Dyre: I do not think that this motion should prevail. It leaves a separate charge in each case.

Mr. Trapnall: Kansas City's interpretation of that is—any signs on a car, if they are glued and tacked on one car, any number, the price would be one dollar. But there is no charge of a dollar and fifty cents for removing signs from one car.

President Boutet: I would state that the reason Cincinnati took that view of it is we thought that one dollar was the maximum charge; that it was ample, and fifty cents was to be charged when there were only tacked signs on the car.

Voice: I think that the rule is all right. The dollar covers one case and fifty cents the other. Mr. Wohrle's instructions covered it. It is not for the inspectors to do the charging; they make out the defect card.

Mr. Skidmore: I am rather surprised that representative car men should come here and disagree on a question of this kind. As Mr. Peck stated, the arbitration committee has always decided where the labor is not increased in removing parts, no additional labor charge should be made. I do not see how we can understand from this ruling that if one or more advertisements are pasted on, and one or more tacked, the charge could be a dollar fifty.

Mr. Dyre: I think if it is made as heavy as possible, better results could be obtained. I say make it as high as you can.

Mr. Peck: This was a committee called by all car men. Any man could have his say, and it was announced in open convention that there was going to be a committee and there was a great number of lines represented.

Mr. Gainey: Mr. Waughop stated a few minutes ago that the rules should be written so that everybody could understand them. As a body of foremen, we are supposed to understand all rules and give all orders to the men under us. It is our duty to read the instructions as we understand them. I cannot see why it is not just as plain as any rule could be written.

The question was put upon the motion and carried.

Rules 48, 50 and 53 were read.

Mr. Skidmore: There may be a little misunderstanding as to what a combined front and back coupler stop may mean. My interpretation of the rule is that it would require the front and back coupler stop broken, being joined together with follower strap. They are combined just the same as one solid casting, and I would like to see how the other members understand that part of the rule.

Mr. Bird: I do not understand that a front and rear stop combined means that it is connected with a strap. It is one casting. I understand that a front and rear combined is something similar to a minor.

Mr. Gainey: I believe if you will follow that up closely that two check plates fastened together with two check straps will give you the same answer that the solid casting will give you. The front and back check block, if one or both are broken, would cause a combination just the same as a solid casting would.

President Boutet: It is about time to adjourn. Mr. Sharp of the entertainment committee has a few remarks to make and after he is through, we will adjourn.

Mr. Sharp: Looking around, I believe that about every one has registered. The entertainment committee is anxious to make your stay in Chicago as pleasant as possible. We will have some kind of an entertainment tonight. Last year at the very last moment, there were some twenty or thirty to be provided for, who had not registered. We have decided that the badge will be the only thing by which we can recognize the members.

Thereupon the Convention adjourned to meet at two o'clock.

AFTERNOON SESSION.

Mr. Gainey: What is your understanding of the meaning of combined coupler stops?

Mr. Wohrle: I understand that they wanted to cut out that short stop and not consider it in a combination defect.

President Boutet: Do you understand the rule to read that a combined coupler stop must be cast in one piece.

Webster's definition of the combined is that it must be cast in one piece or it may be joined together in another way. The stop is joined together first by being bolted to the draft timber, and in addition to that, it has a strap both top and bottom and that is bolted together. I may be wrong. If they are joined together, either with those in one casting or with straps, or bolted to the same draft timber, that is a combined coupler stop. If you would break two on one side, it would be a combined stop.

Mr. Wohrle: I understand that the committee made that distinction between the old stop and the new, and they wanted to cut out the old short stop and insert the combined stop, in casting.

Mr. Dyre: I am a member of one railroad club that discussed this. The idea was to put the old style coupler stop out of the question so far as the combination of damages was concerned.

Mr. Wohrle: The old rules and the old sill, front and back stop, included combination defects, and they wanted to cut that out, so that if you broke them, with other defects, it would not include that stop. They would not call it a combination, but if it is a combined casting, they would consider it a combination defect.

Mr. Lynch: My understanding of the rule is about the same as Mr. Wohrle's. There must be a combination of the front and back coupler stops. We do not call it combination where the stops are connected, the front and back. I call that a connection. In order to be a combination, there must be a combined front and back coupler stop broken. I take it to mean that there must be a combination of the front and back stops in one piece; not two pieces connected up with stops.

Mr. Wohrle: That is the way I understand it.

Mr. Skidmore: While we all know that one solid piece is a combined coupler stop, Webster in his definition of "combined" states it somewhat differently. I do not know what the intention of the framers of the rule was, but we have certainly got to take into consideration the definition of the word combined, and work accordingly. It may be their intention to discourage as much as possible the use of separate castings as coupler stops but if that was the intention it should have been so stated. Until something of that kind is done I cannot see my way clear to put two separate castings in the back as combined coupler stops as long as they are connected together.

Mr. Dyer: What would be their object in making a change?

Mr. Wohrle: I move that it be the sense of this meeting that a combined stop is understood to be connected or in one casting, before it would enter into a combination of defects.

Second by Mr. Harvey and carried.

Rules 48 to 56 were read.

It was moved by Mr. Hitch that it is the sense of this meeting that any defects on one end of a car under rules 48 and 56; that one may be broken this year and one next year, it still creates a combination. Seconded by Mr. Wohrle and carried.

Rule 56 was read.

Mr. Wohrle: That is a very important subject. The only difference is that they enter the rod with a key.

President Boutet: Your understanding is then that the draft rod and key has been added to make a combination.

Mr. Wohrle: Last year the key did not enter in.

Rule 65 was read.

Mr. Wohrle: Under the old rule you could splice one and under the new, you could splice two.

President Boutet: This association last year recommended the splicing of two draw sills, and now they make that cut on the end square with the sill instead of the bevel like it was last year. Here is a car with two draw sills and one end sill broken, three broken sills. How could you repair it?

Mr. Lynch: I think all sills other than center sills can be spliced.

Mr. Trapnall: I am of the opinion that the intermediate sill can be spliced at the same end as the two draft sills. It says two adjacent sills can be spliced, except center sills.

Voice: I think as long as the draft sill and one inter sill is broken, the inter sill is adjacent to the draft sill, and that you would have a right to repair it.

Mr. Skidmore: I do not understand that you can splice two adjacent sills except center sills. If you splice two center sills and the intersill at the same end of the car, you are splicing two adjacent sills other than center sills. If there were eight sills and the outside inter sill required splicing, I believe it would be perfectly proper to splice that one, but to splice the inside inter sill, adjacent to the center sills, I believe would be wrong repairs, and it would be necessary to put a defect card on there for wrong repairs.

Mr. Dyer: With a freight car in interchange with three sills broken, I should have a defect card applied as it is spliced against the rules.

President Boutet: If that car was delivered with these sills broken, such as to necessitate the replacement of them, but it might be owner's car delivered to home line; you would accept that and let it go to home shop in that condition, with the center sill and inter sill spliced adjacent.

Mr. Dyre: I would issue joint evidence card.

Mr. Peck: Three sills broken is a combination, I don't care what they are. Make the owner accept it. With two center sills and the inter sill broken, it is a combination.

President Boutet: It is your personal opinion, as a member of the arbitration committee and as an individual member, that if I had one of A's cars on my line, I broke two draw sills and one inter sill—the inter sill is adjacent to the draw sill, that I can splice all three of them and the owner will accept it?

Answer: If they accept it you have got to pay for it.

Mr. Goodman: I think if three sills are broken you have a combination and can not charge for it. If you splice two center sills and inside intermediate sill, you are going contrary to the rules. I just came in and I do not know really what the question is.

President Boutet: Could you splice the inside intermediate sill adjacent to a draw sill and have the owner accept it?

Mr. Goodman: No, sir; you are splicing adjacent sills there.

President Boutet: I don't know where you are located, but I can hardly realize how Cincinnati and Chicago could be so near alike. At the meeting we had at Cincinnati, it was about the same.

Voice: I think the rules are plain on that because it says adjacent sills.

President Boutet: You differ with your neighbor Peck.

Mr. Peck: All I stated was the way the rule read. It says the splicing of two adjacent sills except center sill. You can splice the next one to it. That is my opinion, that is all. Splicing two adjacent sills and center sill, the center sills are adjacent; if they are both broken on the same end of the car, that would not be allowed.

President Boutet: According to my idea: no.

Mr. Gainey: It says that the splicing of two adjacent sills except center sills at the same end of the car is not allowed. I claim that where there is an inter sill and draw sill broken that you cannot splice them. You can splice your draw sill but you cannot splice the adjacent sill—even that one inter sill—is next to the draw sill. If the draw sill is broken on one side and the inter sill on the other side you can splice those; but you cannot splice two adjacent sills except two center sills.

Mr. Peck: He is right.

Mr. Skidmore: Our friend has put the question. Could you splice one center sill and another sill adjacent to it? That brings it out in a different light: that isn't a combination of defects. Could you charge the owner if you splice one inter sill and the adjacent center sill? I say, no, you cannot splice them; that you would have to give a defect card for wrong repairs.

Mr. Lynch: It is permissible to splice two center sills; that would be according to the rules of replacing a broken center sill. You could in my judgment splice the intermediate sill next to the draft sill, because the splicing of two center sills is permissible by the rules.

Mr. Gainey: According to his idea you can have four splices right there together. If you can splice one on one side, you can on the other side, and the first thing you know you will have all the sill on one end spliced.

President Boutet: At the same end?

Answer: No.

Mr. Bunting of Cleveland: In my opinion if you splice the center sill and the inter sill next to the center sill, it is wrong repairs. To splice even the one center sill and the sill next to it, intermediate or the one next to it, is wrong repairs.

Mr. McGreevy: I agree with Mr. Lynch that you can splice two center sills and adjacent intermediate sill at the same end of the car and it would not be wrong repairs.

Mr. Harvey: I do not see where there is any ground in the world for an argument on this question. The rules are as plain as they can be. You can splice two center sills, but you cannot splice two adjacent sills.

Mr. Sternberger: I think the rules are interpreted all right, and I would not splice two center sills, and the adjacent inter sill, because I do not think it is allowed according to the rule.

Mr. Schultz: I have handled it just as the rule reads. We would splice the draft sill and put in the new inter sill. If we did otherwise, we would expect to apply a M. C. B. defect card for the spliced inter sill.

Mr. Beebe: I think the rule is very plain. We cannot splice two sills adjacent to one another, except center sills, and of course it is just as Mr. Harvey said, you cannot reverse it.

Mr. Ackin: I interpret this rule the same as Mr. Harvey. You can splice two center sills and put in a new inter sill.

Mr. Burge: I do not think an intermediate sill can be spliced next to a spliced draw sill.

Mr. Allen: We do not splice three sills together on one end of the car. I never understood it that way.

Mr. Rivet: My opinion is that the rule is plain and that you cannot splice an inter sill when it is adjacent to the center sill.

President Boutet: Have you changed your views any, Mr. Lynch?

Mr. Lynch: I do not know that I have exactly, so long as the rules permit the splicing of the center sills, that can hardly be considered as an adjacent or intermediate sill.

Mr. Trapnall: You haven't been able to convert me for the reason that there is that "except" in there.

President Boutet: But the intermediate sill is not a center sill.

Mr. Trapnall: I consider that intermediate sills should not be taken as adjacent sills to a draft sill.

Mr. Merriss: If we had a car of that kind, we would give joint evidence for wrong repairs.

Mr. Brown: My interpretation of that rule is that it uses the exception, that the center sills of course can be spliced at one end, not more than two can be spliced, except the two center sills. The two center sills can be spliced, while one center sill and two inter sills cannot be spliced.

President Boutet: In your opinion, you could splice one draw sill and the intermediate sill next to it.

Mr. Brown: No, sir, that isn't what I referred to. What I referred to was the exception taken by the center sill.

Mr. Fifer: The word "exception" in that rule refers to center sills alone. If you splice an intermediate sill adjacent to two center sills, it is wrong repairs.

Mr. Packing: It doesn't seem to me that there can be any question at all about splicing the three sills.

Mr. Gainey: I move that it is the sense of this meeting that two adjacent sills cannot be spliced except center sills.

President Boutet: It is exactly like the reading of the rule. Motion seconded by Mr. Wohrle and carried.

Mr. Gainey: I would like to make a recommendation to still go further with that.

President Boutet: In opening the meeting this morning, we said that we would discuss the changes in the rules as they appeared first.

Rule 72 read and no discussion.

Rule 94 read.

Mr. Wohrle: Do I understand that if they apply a malleable coupler, it would be considered wrong repairs.

Mr. Millburn: There is no charge for malleable coupler in the rules.

Voice: The price for couplers has been omitted from 94 and it is the opinion that to apply a malleable coupler to a foreign car would be considered wrong repairs.

President Boutet: I do not know that it would be wrong repairs. What would prevent a person putting a malleable coupler in another person's car and billing the coupler at the market price? How would the owner get out of paying for it?

Answer: There is no open market price.

President Boutet: Have any of you been able to find any M. C. B. rule that makes a steel coupler or any other kind of material standard?

Answer: No.

Why can't you go to any manufacturer, buy a malleable coupler and put it in another man's car and bill him for the the price?

Voice: I believe Mr. Peck ought to enlighten us as to why it was omitted in the rules.

Mr. Peck: They did not think it was good enough to be in the rules.

President Boutet: Can they charge him?

Mr. Peck: I do not think so.

President Boutet: What is there in the rules to prevent?

Mr. Peck: If I buy at M. C. B. prices, and if they eliminate the price, they eliminate the article.

Mr. Harvey: It seems to me that would be wrong repairs. If you charge for a good bolster and do not put it in, it is wrong repairs, and I think the same thing applies to couplers. I think that is the reason for leaving the price out.

Mr. Fifer: My opinion is that the malleable coupler is no longer an M. C. B. standard, and in that case any one who applied a malleable coupler would have to be covered by rule 59.

President Boutet: We all know that we have quite a number of malleable couplers running in the country yet, and if A. breaks a malleable coupler on one of B's cars, why isn't he at liberty to replace that coupler with the same kind?

Mr. Peck: I do not suppose that he would keep malleable couplers in stock. They are not M. C. B. standards.

Voice: I think Rule 103 covers that.

President Boutet: I do not think there is any road in the country but what has malleable couplers.

Mr. Dyre: Where A takes out a malleable coupler he can put in a new or second-hand malleable coupler and charge it up at the price allowed according to new or second-hand material.

Mr. Wohrle: I understand that some of the roads are applying steel couplers, and the malleable couplers left in their stock they apply to foreign cars.

Mr. Skidmore: What would you credit that to? You would have to apply them the same as you would with a new malleable coupler. Mr. Wohrle would consider the malleable coupler scrap.

Mr. Peck: You might as well go out of the standard of wheels. These are standards and they have standard prices for them.

President Boutet: They are getting at what I have been trying to bring out all the time. If a malleable coupler has been discarded after being recognized as a standard all the time, there should be something in the rules to tell us so, so as to guide us. It will bring forth a recommendation from some one later on.

Mr. Peck: The steel was made standard.

President Boutet: When?

Mr. Peck: I think at the last convention because they eliminated the price.

President Boutet: I do not understand it that way. Here is an M. C. B. coupler, conforms to certain contours, and has been recognized; the custom has been to use malleable steel.

Mr. Peck: You might put in cast iron.

President Boutet: There is something in the rules that prohibits cast iron being used.

Mr. Fifer: If the malleable coupler is no longer a standard, the rule should so state. Whatever the proceedings are, I do not know. I cannot say whether they made the steel couplers standard or not.

Mr. McLaughlan: In regard to that, I think Rule 58 would throw some light.

President Boutet: I would like to entertain a motion that it is the sense of this meeting that the malleable iron coupler cannot be used and charged for on a foreign car.

It was moved by Mr. Wohrle that an M. C. B. coupler of malleable make cannot be applied to a foreign car and charged for.

Mr. Harvey: If you cannot use a steel coupler, put in malleable and charge for it. If a car had been equipped with malleable, you could put in malleable and charge for it. I would like to amend that motion to cover that.

Seconded by Mr. Burns.

Mr. Wohrle: If a car has been equipped with malleable, you cannot replace with malleable; it must be a steel coupler.

Mr. McLaughlan: The idea I had in mind was that Rule 58 was not exactly in accordance with the motion as put. Rule 58 gives permission to use grey iron in place of malleable and malleable in place of grey. And I move that it is the sense of this meeting, under Rule 58, that a malleable coupler could be substituted for steel and charged for at the makers' price.

Seconded by Mr. Burns.

Thereupon Mr. Harvey withdrew his former amendment.

Mr. Skidmore: I don't understand why we should make it at the maker's price; why not make it at the price given in the rules? There is a price at so much per pound, and it looks to me that it should be charged for at prices given for malleable iron.

Mr. Peck: We have a good many steel couplers and I should like to see a man put in a malleable coupler and charge for it. It isn't a standard coupler and he has no price to charge.

President Boutet: You are a member of the arbitrating committee who passes on these things. You would not pass on the malleable iron. Do you think you would have enough of the rest of the committee with you to carry your point?

Mr. Peck: They are not to the standard car; I would call it wrong repairs.

President Boutet: Our brother thinks there should be something inserted, discarding the malleable coupler before discarding the price.

Mr. Goodnow: I believe it isn't the intention to discard the malleable coupler, but not to recognize it in the way of M. C. B. Where the car has been equipped with a malleable coupler, I do not think the owner could object to having a malleable coupler put in in case it were broken, and it can be charged at manufacturer prices. In case of doubt use a steel coupler as that is the recognized M. C. B. material for couplers.

Mr. Peck: Suppose a railroad had cars equipped with malleable iron couplers and a company broke it and put in steel and another man got hold of it and put in a malleable. Was it a standard to this car?

Voice: I believe it is the practice of a great many roads to stencil cars and to protect the standards. It should be done; otherwise you are taking chances.

The question was put upon the amendment to the motion and lost.

Mr. Harvey: The question came up the other day and we said that we would consider it wrong repairs. I wanted to see what others thought about it and am glad it came up. I do not understand what price malleable was to be charged at.

Mr. Skidmore: On page 38 the price is stated.

Mr. Harvey: That would make a malleable coupler cost more than a steel coupler. I think we should use the manufacturer's price for the malleable coupler.

Mr. Fifer: If a malleable coupler is a patented article it should be charged at manufacturer's price; otherwise at the malleable rate, 3½ cents.

President Boutet: I think it would be a good idea to ask the joint inspectors how they would treat the malleable coupler that was applied to a car equipped with a steel coupler.

Mr. Dyre: Has the steel coupler been adopted as a standard?

President Boutet: I have been unable to find anything in the rule saying that it has. If it has not been I would pass a malleable coupler in a car that has been stenciled "Steel" without a defect card.

Mr. Costly: There is nothing in the rule which says we cannot use them, and still the rule does not give us any price except for common malleable iron. That at 3½ cents would run it clear up.

President Boutet: If you had one of your cars come home equipped with a malleable coupler that had been equipped with steel, how would you treat it?

Answer: I would pass it.

Mr. Wohrle: We would consider it wrong repairs and pass it, but we would not issue a defect card. We would issue a joint evidence card.

Mr. Trapnall: If a car was stenciled as to the steel couplers we would issue a joint evidence card for it. If the car were not stenciled we would pass it.

Mr. Lynch: I think about the same as Kansas City.

President Boutet: If Mr. Trapnall had a card and the inspector had a record in his office that it had a malleable coupler in one end, I do not think there is a joint inspector in the country that would give joint evidence without seeing the case.

Mr. Gainey: I would like to ask the members here whether a coupler was steel or malleable before this rule went into effect. We have cars that are equipped with malleable iron, but out standard now is steel, but I will venture to say that we have 5000 cars that I do not know what kind of couplers they have in. You do not know what you are talking about. Probably you have put in malleable couplers two or three years ago yourself, and you will take joint evidence. If all cars were stenciled either iron or steel it would be different; but there are only a few marked.

President Boutet: If they billed you for a malleable coupler in one of your cars, what would you do?

Answer: I would pass it.

Mr. Gainey: The bill would be passed.

Mr. Burge: I would pass it.

Mr. Peck: I would not accept the bill at all, if the cars were stenciled.

Question: How many of your cars have malleable couplers?

Answer: None of them.

Mr. Burge read Rule 42.

Mr. Skidmore: If they wanted to except the malleable coupler they should have included it in that rule.

Mr. Gainey: Rule 63 bears on that too.

Mr. Peck: I told you how to dispose of the malleable iron coupler. If I had a malleable iron bar I would put it in there.

President Boutet: You would recommend putting in a malleable coupler under clouded conditions?

Mr. Peck: That is the only thing that will stop the malleable coupler, to charge M. C. B. prices for it.

Mr. Skidmore: We have lost sight of part of the question which refers to open knuckles; that would come under the same head. There is no price given for open knuckles and railroads have possibly thousands of open knuckles on hand. And I would like to move that under the present rules it would be proper to use malleable iron couplers and open knuckles and charge the car owner for the replacement under manufacturer's prices.

Seconded.

Mr. Peck: I hate to see you crawfish. The knuckle is standard.

President Boutet: Has there been any rule of the M. C. B. Association, making the open knuckle not a standard?

Answer: I think there is.

President Boutet: I am under the impression that there never has been anything changing the open knuckle.

Mr. Peck: I think it is.

Mr. Skidmore: I think it would be advisable to leave the question open until tomorrow morning and ask Mr. Taylor to come here and give us that information.

Thereupon the motion was withdrawn until the following day.

There was no discussion on Rules 97 and 105.

Rule 106.

Mr. Gainey: The rule says, 1 center sill spliced 16 hours; what time should be required for 2 center sills. We have had several arguments on something similar to that at the Car Foreman's Association at Cincinnati. I did not agree with some of them at that time, but the majority of the association ruled and they won me over, and before I get started wrong in this I want to be right.

Mr. Harvey: On page 17 it says, "1 center sill spliced, when other center sill has to be replaced, 6 hours."

Mr. Gainey: I charge 22 hours for it.

President Boutet: If you splice one it should be 16 hours, and for the second one six hours. Is there anybody in the room that would do it differently?

Mr. Harvey: I move you that it is the sense of this meeting that 22 hours be the proper charge for splicing two center sills.

Seconded by Mr. Schultz.

Voice: I do not believe you can splice two draw sills in 22 hours.

Question: Can you splice one in 16 hours?

Answer: Yes, but you cannot splice two in less than 26 hours.

Mr. Skidmore: The rule has stated the number of hours for each operation and the price for doing the work. They made them uniform, and it makes no difference whether it takes 10 hours or 30 to do the work. If you do the work in 10 hours, you are lucky. If you cannot do this work in a specified time it is the duty of the roads forming the rules to increase the price, which they have done on a number of things this year.

The question was put upon the motion and carried.

There appeared no discussion on Rule 112.

Rule 113 was read.

Mr. Gainey: Here is another argument. Suppose we fix a train line, are we not entitled to 5 cents for testing the air after we get it repaired? We had that up at the car foremen's meeting and they voted me down on it.

Answer: Yes, sir.

Mr. Boutet: I decline to answer. We settled that so far as Cincinnati was concerned.

Mr. Gainey: I would like to hear from the others on that.

President Boutet: Suppose the C. B. & Q. had a broken train line on foreign car; would you be entitled to charge for testing the air after you repaired the train line?

Mr. Harvey: I should say not. Does anybody make a charge for testing air brakes after repairing them?

Mr. Wohrle: I would.

Mr. Seiberling: I would not make an extra charge.

Mr. Dyre: The foreign road is put out of commission so far as the air brakes are concerned by the handling road. There is a question that the brakes need testing; the handling road is responsible, and to make a charge for testing does not seem right.

President Boutet: Sometimes it might be a seamy pipe and that might be chargeable to the owners. Suppose the air had not been cleaned within a year?

Mr. Dyer: Then the owner would be responsible, and you could charge for testing the brakes.

Mr. Malone: We always made a charge for testing air and it has never been turned down.

Mr. Wohrle: In Rule 112 it gives the price, and I think we can charge that amount.

Mr. Dyer: The question is whether the handling company is responsible or not for the damage of the train line. If any other repairs are made then the handling company should stand the expense of the testing. If the owners are responsible for the repairs; then the owner should stand the expense.

Mr. Gainey: On page 54 it says "Cleaning, testing and stenciling 20 cents." The rest of the rules do not say anything about testing. It says so much for making repairs and at the top it says "Testing air after repairs 5 cents."

Mr. Harvey: On page 54 it says:

"The following basic units were used in determining the details of prices given below. These units are not to be used in rendering bills, but may be used in the determination of cost of other combinations of air brake repairs not mentioned above."

Mr. Skidmore: It says, "Unions disconnected and connected." Would it not be proper and should it not be tested after these connections were made? It gives the price of unions disconnected and connected at 3 cents. If it is the understanding that the test should be made after the union is made and connected up again, the 3 cents would not be the price that is given for testing alone, and if it is a fact that the test should be made in all cases, I think that price should be used for testing air in connection with it.

Mr. Fifer: Where we make repairs on train lines that are due to owner's defects, or where we make repairs on a defect card for train line work, we add the item of 5 cents in with the labor for testing air.

Mr. Penn from Cleveland: I would like to ask how, in making repairs to air equipment you know you have made the proper repairs without testing?

Mr. Trapnall: If, as Mr. Skidmore says, they disconnect the union and connect it again for the purpose of making repairs, I certainly think they are entitled to 5 cents to see that their work is done. They are not entitled to any charge after they have cleaned the triple valve and cylinder, but if they have any additional work to do they should be entitled to 5 cents for testing the brakes.

President Boutet: You mean to say that if I would put on a piece of train pipe, or connect a union, that I would test that car for the purpose of finding out whether the job that I did was correct or not, and I could charge the owners for that job?

Answer: Yes, if it is owner's defect that you are repairing.

Mr. Skidmore: I certainly would not want to do a job and charge 3 cents for it and then not charge 5 for testing.

I move you that it is the sense of this meeting when a union is disconnected for the purpose of replacing a worn-out gasket, that it would be proper to make an additional charge of 5 cents, a total of 8 cents for testing and removing, disconnecting and connecting unions.

Seconded by Mr. Combs.

Mr. Dyer: That it is the sense of this meeting that air brakes tested when repairs have been made for which the owners are responsible, that the owner shall pay for the testing.

Mr. Skidmore: I would not want the motion to carry that way for the reason that there is other testing that is provided for in making repairs.

The question was put and motion lost.

Mr. Gainey: I would like to have one of the persons who voted "No," to tell me why "testing air after repairs" is put on page 112.

Mr. Burt: I do not see why there should be a charge.

Mr. Seiberling: Two-thirds of the repairs are made in the yard and there is no test to be made on them. That is the reason I voted "No."

Mr. Wohrle: I voted "Yes" with the understanding that when you test the air you charge 5 cents.

Mr. Lynch: I do not think it necessary for either side to explain why they voted "Yes" or "No." The question has been decided in the negative.

President Boutet: I will have to answer you as I have answered others; that in discussing these rules, we deviate from parliamentary usage in a good many cases. I felt if we adhered strictly to rules we would lose a great many good points.

Mr. Lynch: I object as we are losing so much time.

Mr. Gainey: I came from Cincinnati to learn, and I thought I could learn by asking questions.

Mr. Hacking: I voted "No" for the reason that this note says that the units are not to be used in rendering bill; but for determining the details of the prices given above. As I understand the rules the prices given covers all the work that is necessary on the cars.

Question: Am I to understand again, that there should or should not be a charge for the triple end cylinder after the work has been done?

President Boutet: The motion was, after a union was replaced on a car that 5 cents should be charged for testing the air.

Mr. Dyer: I move that it is the sense of this meeting that where repairs have been made to air brakes on account of owner's defects that the owner should pay a charge of 5 cents for testing the air.

Seconded and carried.

President Boutet: Now how much better off are you? How much different is that? We ought to be consistent. If it is right in one, it is right in the other, especially the latter. The same thing occurred here this morning. Mr. Dyer makes a motion of one kind and it is voted down. Mr. Skidmore makes a motion that is practically the same thing and it is carried. I would suggest that some one who voted in the first instance, move to reconsider the vote.

Voice: I voted against the one because it referred to one special item.

President Boutet: We will have to class a worn-out gasket as owner's defect.

There was no discussion on Rules 113, 114 and 115.

Rule 129.

Mr. Gainey: If you write to a company for material for their car, according to this rule they would have to furnish it to you. There isn't any road in the counutry that carries all kinds of roofs. If you would ask for a Murphy roof, they could not tell you to get it in the open market.

President Boutet: Under the rules, wouldn't they have to furnish that?

Voice: No, they could tell you to buy it in the open market.

President: If there is no further discussion, I would like to bring up a question under passenger interchange rules. A rents to B one of his coaches, clean and ready for service on a passenger train. It is returned by B to A in a filthy condition; should there be a charge against B for the cleaning of that car and if so, how should the charge appear. By an M. C. B. card or otherwise?

Mr. Dyer: I have had considerable experience in the interchange of passenger cars, and they are not sent in a clean condition and usually returned in the same condition, and no charge made.

Mr. Brown: We are connected with roads and operate each other's cars and many times find it necessary to hire coaches for excursions, and we have never billed any company, nor have we been billed for cleaning cars. That question has never come up. In many cases the cars come to us dirty, and we turn them back in the same condition.

President Boutet: That isn't the question. That is interchange under equal conditions. If a car goes out in clean condition and is returned filthy, should there be a charge made?

Mr. Dyer: There is no provision for it, but in my opinion there should be.

Mr. Brown: If we hired a car from a road and it came to us in a dirty condition, I do not think we ought to clean it. But if it came to us in good condition, then we ought to return it in as good condition.

Mr. Gainey: One of those box vestibule cars and if you clean it thoroughly; take all the cushions out and blow them with air, scrub and oil it. You rent that car for $5.00 a day, and turns it back to you dirty, I will venture to say that there isn't any company that can clean it for $5.00.

Mr. Wohrle: Isn't that a transportation charge? It should be settled between the transportation departments.

Mr. Hitch: I think it is a transportation matter, and that the charge received from rental should cover cleaning; yet the car should be returned in good condition.

Mr. Harvey: It is a transportation matter entirely. We rent cars quite frequently; we do not clean them up; they take them just as they get them, and they clean them. We charge $10 a day.

President Boutet: How is A going to bill?

Voice: He cannot make a bill against B unless he has some authority.

Mr. Harvey: The Preface covers that.

Mr. Wohrle: The passenger rules outline what is owner's defects and your company defects, and it says that owner's defects are those due to ordinary wear and tear; wouldn't that come under that?

Mr. Dyer: It is up to the car inspector to look after the condition of a car that comes in filthy. It sems to me that the delivering road should be made to put the cars in good shape.

Mr. Fox: Our road does quite a little interchange in coaches and we aim to have the cars in clean condition when they leave our line, and we except to get them back in same condition, but our road makes bills and receives bills for cleaning coaches; they are doing that right along.

President Boutet: The question was put up to me and I declined to give a card stating that I did not consider it a part of a mechanic's duty. The cars were rented by the transportation department, and if they were returned in a changed condition, it was the place of that department to take it up. I believe there is work enough now in interchange for the mechanical department, and I do not think we ought to complicate it any further.

Mr. Gainey: I have made a bill for $1.50 for cleaning those cars and sent it to the company.

President Boutet: Is there any joint inspector in the country that would give a card under those conditions?

Replies of "I wouldn't" came from all sides.

MISCELLANEOUS DISCUSSION ON RULES.

Mr. Trapnall: Rule 126 reads: "A car which is safe to run, but unsafe to load on account of serious damage caused by wreck or accident, shall be reported to the owners for appraisement and disposition, and disposed of as provided in Rule 125, if the owner so elects."

The owner elects to have the car sent home, but annuls that part of Rule 125 which says that M. C. B. card shall be furnished and renders his bill under the appraisement of damage to the car and ignores M. C. B. prices in the cost of labor and material.

I move that it is the sense of this meeting that we recommend to the next session of Master Car Builders that at the end of Rule 126, we add the clause: "M. C. B. prices for materials and labor shall apply." Seconded.

Mr. Cressey: I think I know how this came up and that I have had as much trouble on this score as has Mr. Trapnall. You cannot compel the owner to take it home and repair it on M. C. B. prices, unless he so elects. If he says that he does not want to receive the car, what can be done then? There is one private line that claims they cannot make repairs to their own cars on the M. C. B. prices, and that they must have additional prices for material and labor if they make the repairs themselves. Mr. Trapnall and I are frequently in the same territory where this company exists and that is a question that arises quite frequently.

Voice: Isn't the rule plain enough?

President Boutet: The owner does not have to receive the wrecked cars unless he so elects to repair at M. C. B. prices. If a R. R. Co. damages a car by wreck or accident of any kind, the owner does not have to receive that car home and make the repairs unless he so elects, and he is at perfect liberty to refuse to take it home and repair at M. C. B. prices. Mr. Trapnall wants it changed so that he must take it home and repair at M. C. B. prices.

Mr. Trapnall: If he so elects at his own volition. It is up to the owner to say whether it shall be or not. If he elects, let him stand by the rules.

President Boutet: If he agrees to accept the car without any provision, how can he expect to do so under any other condition?

Mr. Trapnall: They do it.

Voice: You are mistaken about that.

President Boutet: He has to repair at M. C. B. prices, if he agrees to accept it.

Mr. Trapnall: He will return you your defect cards and tell you he does not want them; that he will bill according to his appraisement, and when you get your bill it is higher.

Mr. Skidmore: I have been studying on these rules myself. It isn't only Rule 126, but it is 125, 126, 127 and 128. They appear to be unsatisfactory to all roads in the country. I will cite a case that occurred last week. At Cincinnati, an Erie car was unfit for service owing to age and decay. They requested home cards which were furnished, routing it by the way of St. Louis. Probably the car would travel not less than 800 or 1000 miles to get home. While it was at Cincinnati it was within 56 miles of the road owning the car. I would like to read a proposition I have on these rules for the members to consider, to avoid sending home cars in that manner, and such changes as Mr. Trapnall suggests can be added to the rule if the members choose to accept it.

Rule 125.

A car unsafe to load on account of general worn-out condition due to age or decay, should be reported to its owner, who must be advised of all existing defects. He shall furnish two home cards by the most direct route which may be designated by the owner; the owner to pay any freight charges that may accrue after it leaves the line on which it became unserviceable.

Rule 126.

A car which is safe to run but unsafe to load on account of serious damage caused by wreck or accident, shall be reported to the owners for appraisement and disposition and disposed of as provided for in Rule 125, except that the road damaging the car shall pay any freight charges that may accrue. Car owners shall accept their own cars when properly covered by defect card. Bills for repairs shall be rendered at specified M. C. B. prices for labor and material.

Rule 127

In case of cars of private ownership sent home on account of general worn-out condition due to age or decay, such cars shall be billed home by the most direct route and owners pay any freight charges that may accrue after the car leaves the line on which it became unserviceable; no mileage to be paid to owners by the line on which it became unserviceable.

Rule 128.

Private line cars sent home to owners on account of being wrecked or damaged in accident, shall be regularly billed home free of charge by the most direct route and owner notified; any freight charges that may accrue to be paid for by the road damaging it. Car owners shall accept their own cars when properly covered by defect card. Bills for repairs shall be rendered at specified M. C. B. prices for labor and material.

My reason for suggesting this change was to avoid sending cars such a round about way to get home. I have been six months getting that car out of Cincinnati. The owner lost the use of his car, and the road on which it goes probably hauls it two or three hundred miles unnecessarily. If a car is sent direct home and it has owner's defects, I think the owner should pay any freight charges. And if the road damaged the car by unfair usage, the road so damaging the car should pay the freight charges. Mr. Trapnall suggested what I omitted. I do not see any reason why, if a car has a sill broken and siding damaged, that the railroad companies should be compelled to pay anything outside of the M. C. B. prices for making these repairs. We want to be fair with the private lines, and I do not think we should ask or expect anything from the private lines but what is reasonable and just.

President Boutet: With all due respect to the members present, I will venture to say that there will not be a recommendation made more important that this one. You have all met with the same conditions, and this motion is made to get the cars home in the shortest way. I think it well worthy of consideration by all of you, and I suggest that you keep it in your minds till morning, as it is now time to adjourn.

Thereupon an adjournment was had until 9 o'clock.

WEDNESDAY MORNING SESSION.

President Boutet: In my address yesterday I recommended that the constitution be changed so that the officers would consist of a secretary and treasurer both. If a man is secretary he has enough to do. Would like to have article 4 read.

Mr. Skidmore: I think the best way to handle that would be to give it to somebody to write up.

President: Mr. Burns, will you look after that?

Mr. Skidmore: When a car is being sent home on account of defects due to worn out condition, age and decay, the owner should pay any freight charges that may be incurred. On the other hand, if a car has been damaged on the line through accident or any unfair usage, the road damaging the car is to pay any freight charges.

Mr. Harvey: I think that the changes recommended by Mr. Skidmore are the best that I have ever heard in connection with worn out cars, and I would like to see Rule 126 make it obligatory on the part of the owner to accept these cars.

I move that the paper be received; that the recommendations be acted upon separately, and that rule 125 be accepted as a whole. Seconded by Mr. Wohrle.

President Boutet: Under present conditions we are liable to run a car from 1,000 to 2,000 miles out of its nearest route home. It keeps a car out of service that much longer and compels somebody to haul a car over their line that is not serviceable.

Voice: A car does not get home a great many times when home route cards are furnished. I want to ask if the billing should not be furnished?

Mr. Skidmore: I just want to say that that is covered in this. While the owners cannot furnish the billing it must be made out at the starting point. The agent at the starting point must fill it out, and the starting point is the one to see that the card is properly filled out. The car will be billed home by the most direct route designated by the owner. That is as far as the owner can go. He has to pay the freight charges, and I think he should have the choice between parallel lines.

Mr. Hogsitt: The owner has no option at all.

Mr. Skidmore: I did not intend that they should have any option. There has been too much of that and cars have been six months getting home. The road at Cincinnati that had a car; it was routed by the way of St. Louis, while if it had gone direct home by way of the Big Four or C. H. & D. it would only have had to go 56 miles. The owner could have had his car and the other road saved the long haul.

Mr. Trapnall: I want to corroborate the statement of Mr. Skidmore in the matter of home route cards. The cards are placed on the cars at the terminal; they will go 20 miles out of the way to get to a certain line. The Santa Fe brings in a car and it goes to the Frisco and it has to be handled five or six days to get the car from the Frisco back to the Burlington.

I think it is a good thing and I move that it be referred to the arbitration committee with the recommendation that the same be made an M. C. B. rule.

Mr. Stahl: I would suggest that they embody in it the sized card as there might be some question about it. The present size is 3½ x 8.

Mr. Skidmore: I do not know but that the gentleman is right to add the home card on it. That is a part of Rule 125 which says that such card shall be tacked to each side; that could be added to the rule without any trouble.

The original motion was amended by having the portion of rule 125 as it now reads added on to the rule as recommended by Mr. Skidmore. Seconded and carried unanimously.

Mr. Harvey: I move to amend Rule 126 making it obligatory on car owners to accept their own cars, defects covered by defect cards.

President Boutet: If we compel them to receive their car, they have to repair it according to M. C. B. prices.

Mr. Harvey: The owner has to receive his car any time when the defects are covered by card. If you wreck a car the owner does not have to accept the car. You report it to him for appraisement and disposition as to Rule 125. This makes it obligatory to take the car when it is covered by card. We have a great deal of trouble and would like to get rid of it.

Mr. Skidmore: I will read the rule again to see if that point is not covered. I catch Mr. Harvey's idea all right. I believe 125 covers that.

Mr. Harvey: I want to avoid what we ran up against in discussing the rules yesterday. It seems that the M. C. B. haven't made the rules plain enough. They should be so plain that there can be no question. I know what would be the result with one party I have in mind unless the rules be clear.

I would like to see it amended so that the car must be accepted by the owner, car carded for the defects with M. C. B. defect card.

The amendment to the motion was seconded and carried.

Mr. Skidmore was asked to properly word the rule and supply same later.

Rule 127 was read. It was moved by Mr. Hitch and seconded by Mr. Bailey that the recommendation as read be adopted.

Mr. Pierce: I am interested in this point. Let us say the Armour people have a load going up to the Northwest, and from the Northwest it goes to Kalamazoo; there it has been in a wreck or something of the kind and the car is damaged. Isn't it a good excuse to pass off the car as worn out, decayed and send it home. There is one question that I want to ask. I feel that I am not a spring chicken in railroading, and I want to know how many there are who do not belong to an Ananias Club. There isn't one when it comes right down to the interests of his own line, because the first law of nature is implanted in a man to that point. I believe in being as liberal as possible, but you have too fine a chance right there to palm off under that excuse. You are not all situated as we are in St. Louis; there we have joint inspection. There will be no end of correspondence to prove that a car is not in a decayed condition. I am opposed to it.

Mr. Skidmore: I want to say that if there is one drop of lying blood in me I want it taken out. I came up here with the feeling, and I am satisfied that you are all honest men. The railroads do not pay you one cent for stealing for them, neither will they encourage you in doing it. The officials do not want anything of the kind. I have known men to be discharged for doing that very thing and they all should be. I believe we can come up here and say that we are just as honest and good as they are. This is a representative crowd and I do not believe there is a rascal among us. If I thought there was I would get out of the room as soon as I could. We came here intending to treat others as we ought to be treated. Never ask a man to do anything that you would not do yourself under the same circumstance and do not ask him to take a car that you would not take yourself under the same conditions. That is what causes contention at interchange points, because you want all the best of it. Give the other fellow a little bit more and he will come back the next time and do you one better. If you wreck a car, do not say that it is due to age and decay. Say just what caused it. If the company found out that you misrepresented a case they would probably discharge you, which they should.

Mr. Cressey: We have been discussing M. C. B. rules. There is another rule that ought to be taken into consideration and that is the Golden Rule—on the line of Mr. Skidmore's talk. At our place there are four or five private lines that I do business with (I believe there is only one representative of the lines present) but I feel safe in saying that in the seven or eight years that we have been doing business we have not had a dispute on a private line car.

Mr. Gainey: I think the private line has as much as the railroad company. All it has to do is to get joint evidence. After the car comes to Chicago he can get joint evidence that the car was damaged and not rotten, and you have to furnish him a card. I cannot see where the private line isn't protected as well as the railroad company.

Mr. Harvey: It seems to me that the private lines would win out on this proposition. They will get the car home and get the repairs made. Under the old rule their cars are not earning any money if they are standing around on the side track; they get money for mileage. I think Mr. Gainey covered that.

Mr. Pierce: I suppose I hit the tender spot. It was unintentional, but from my experience I must say that I have found conditions that warrant me in speaking as I did. I believe in calling a spade a spade when occasion requires. There is not one, I may say this for myself personally, who would step forward and cross the line to meet any man in this crowd sooner than I would on any proposition. I look at the Master Car Builders' rules very much as the marriage certificate. They are to bind the roads, but were we to attempt to do business in America and attempt to do so strictly in accordance with the rules, how much would we do? I wish to convey to your minds this idea: That the conditions of which I speak are conditions that I have been up against more than once. Some will stand up and blow the golden rule; they will talk this and talk that; what we should do and all this, but facts remain facts; they cannot be fixed, and for that reason, in order to avoid a lot of correspondence, I think we should let the old rule stand.

Mr. Peck: That has been discussed in the Superintendents' Association and other organizations. Returning a car home is strictly in the transportation department. When Chicago and all these roads have asked by what route a car is to be sent; instead of taking it 700 or 800 miles when it can be sent in 30 or 40, we do that. But I will have to take exceptions to the brother here in regard to M. C. B. rules. If it were not for the Master Car Builders' rules, how much business would we do in this country? We would have all kinds of sills, axles and all kinds of oil boxes. The rules are the only things that can move freight. The more standards we have the better we are off. I claim all cars should be standard. Rule 127 should come under the transportation department.

Mr. Waughop: I did not expect to talk on this subject, but the discussion has brought up things so that I just want to say a word, and you are listening now to the oldest chief inspector in the country. I read a book some years ago by an eminent author, "If Christ Came to Chicago." Brother Skidmore has struck the key note when he talks of honesty in home routing cars. I have seen so much of monumental liars in home routing cars that I am surprised that they could go to bed at night and sleep. In fact I haven't seen one this year that was correctly made out. If they will only confine themselves to the truth when making out a home route card there would be no trouble, but they won't I have always taught inspectors that it made no difference what defects were on a car; give it as it is. The company does not pay you one iota for being dishonest. As I said before, I have not seen a card this year but that the man who made it out was not a monumental liar, and I am going on record that way.

Secretary Taylor: Whose fault is it that these cars are routed wrong? There are many cars routed wrong, the defects being misquoted. There is more devilment done in the master mechanic's office than any other point in home routing cars. Some claim that they do not understand the rules. It is a frequent occurrence that they are wrong, and whose fault is it? Not the car department.

Mr. Peck: I am afraid he is misinformed as to the master mechanic's office. We do not route cars; we get authority to route from somebody else. We ask for the routing of a car from the transportation department. We do not specify the route at all.

President Boutet: In answer to your remarks a few moments ago that it is a transportation matter, and that we should not attempt to dictate how it should be done, I will say that it is a proposition that we are up against, I might say, every week in the year. We have cars in our territory that are not in a condition to be loaded. As chief joint car inspectors and car foremen it is our duty when we find these conditions to point them out to our superior officers. There is nothing for us to do except to take it up with the master car builders. Let us get some relief for conditions that exist. As Mr. Skidmore says, he had an Erie car in Cincinnati that was within 56 miles of home, routed by St. Louis. I have known cars whose home was in California that would be routed by way of Boston. There is probably 8,000 or 10,000 miles that that car is being hauled unnecessarily. It costs the railroad companies money to haul that car, delays the car in traffic and keeps them from hauling something that they could get revenue from. When we know that such conditions exist we should try to recommend some remedy, and the only thing we can do is to recommend to the association above us.

Mr. Lynch: I heartily agree with the recommendation, and I think something should be done to get these bad order cars home and relieve points like Chicago, Cincinnati, St. Louis and Cleveland. In Cleveland we have very much need to complain of the system of getting cars home.

Cleveland, O.

22273. A. & V. From L. S. & M. S. July 19th, 1907.

Home route from Lake Shore & Michigan Southern to A. & V., via L. S. & M. S., N. Y. C. & H., D. & H., L. V. Wabash, W. & L. E., L. E. & W., T. St. L. & W., Pa. Co., A. & B. P., C. A. & C., P. R. R., N. P. N. & P. B. L., S. A. L., Southern.

6-22-07 A. & V. R. R. R., B. F. Hines, Head of Car Department.

Car has following defects: 2 broken center sills and end sill, "B." 2 door stops broken, A-L, 1 broken center sill and end sill split and broken side sill, A-L, 1 side door gone, A-L. 1 damaged center sill, "A." Carded by N. Y. N. H. & H., at Readville shop, 3-8-07.

14210. M. K. & T. From Erie, 7-26-07.

Home route from B. & O., to M. K. & T., via B. & O., Erie, Big Four, W. & L. E., L. S. & M. S., N. Y. C. & H., D. L. & W., M. C. and Wabash Rys. Shopped for 1 center sill broken and draft bolt holes in other center sill worn oblong and one center sill damaged on "B" end.

Signed, W. A. Mitchell, M. C. B., Sedalia, Mo.

One draft sill broken and one end sill damaged, "B," carded by H-V at Fostoria, 7-6-07.

President Boutet: That car will make 5,000 miles before it gets home.

Mr. Lynch: Yes, whereas it should get home by a few hundred miles. The temporary repairs that were made have given out once and it has been temporarily repaired again.

I think some action should be taken somewhere in order to get these cars home the most direct route possible so as to save all this mileage and the possibility of not getting them home at all. I think Mr. Skidmore's resolution should be adopted and some action taken.

Mr. Taylor: In connection with what Mr. Lynch says in regard to the M. K. & T. car, it happened that I handled that case personally. If that had been routed home it would have gone 7,900 miles. There is quite a history connected with the car. We were watching for it four months. It was gone from home nine months. Mr. Mitchell requested that it be sent home its direct route. Some of the officers refused to permit it to move as he recommended. When he did finally move the car he could not move it the way it was routed. When Mr. Mitchell did finally get the car home, it took four months to get the pay.

Mr. Dyer: It was not embodied in a regular recommendation by the Pittsburg Railway Club or Master Car Builders' Association, but they did make a suggestion. When I made the motion that this be considered as a recommendation, it was stated to me that the railroad had made a recommendation to the American Railway Association to that effect.

I would like to ask Mr. Peck if the recommendation reached the master car builders and if any action was taken on it?

Mr. Peck: The minutes are not out yet, but there was something of that kind referred to. There was a mistake made in the home route card for two broken sills. There was a car went thousands of miles for two broken end sills.

Mr. Waughop: The two sills should be repaired rather than let the car go around the country. That would stop all argument. You are not playing good ball with your neighbor if you refuse to repair that car.

Mr. Gainey: In answer to Mr. Waughop, I would not issue a home route card for two broken sills, and it isn't in accordance with these rules. The car must be in a general worn out condition due to age and decay. Two broken draw sills is owner's defect; if they are broken at both ends they should repair it.

Mr. Lynch: When a car has two broken center sills we have no alternative but to receive the car if it is in serviceable condition. If we turn it back they will want to know why. They didn't damage it and they will say, "We have enough cripples of our own."

President Boutet: What we learn in infancy stays with us. I learned when quite small that when I asked my mother for a piece of bread and she would say "No, you cannot have any now; we will soon have dinner," if I was real hungry I would ask again until I got it. I believe that is the way we ought to do with this rule. We have been at this matter for three or four years. The chief joint inspectors realize the need of it. We get cars billed home from some road; the cars have probably made one to two thousand miles before they reach us and may have 500 to 5,000 miles to go after they leave us before reaching their destination. Our manner of interchange and facilities down there are short the same as at all other roads. They haven't the room to store cars nor facilities for repairing all the cars and the consequence is that they have to pass that car up and get it through; where if it had a more direct route it could have been home. This association is trying to get the car home by the shortest route. Many people haul empty cars when they ought to haul it loaded.

Mr. Skidmore: Several here have said it was a transportation matter. The transportation department has very little to do or say about it. The mechanical department asks the mechanical department of the other line for a home card. The mechanical department will get the route of that car from the car service, and he will send these home cards to the route ask for. The mechanical department receives them will ask their car accountant at what junction point they are to be delivered. That is as far as the transportation department is connected with it. The mechanical department will then make out billing for that car. Where does the transportation department come in any more than to see that that car leaves the line at a certain junction point? The way it is done on the Big Four, I would ask my master mechanic to get home cards; when he gets them they come to me showing at what junction point they leave the line. I make out the billing order and send it to our agent. He makes a regular bill for that car and bills it home according to my billing. The home cards are then put on the car and the billing furnished to the yard master who starts the car out on the train with that billing. Where is that a transportation matter?

The superintendent of the road nor any one connected has had nothing to do with it except the superintendent of car service, so I cannot see how any one can come here and say it is a transportation matter.

Mr. Peck: Probably you misunderstand me. In regard to a car going back the way it came, if an owner wants to pay the milenge on a car he can do so; otherwise it has to go back the way it came. If you get it back freight free, you may have to send it 7000 miles instead of 50.

Mr. Waughop: How many home route cards have you seen in the last year that were made out correctly? I will venture that you have not seen one made out according to the rules.

Mr. Pierce: That is right.

Mr. Jones: It is absolutely necessary that some steps be taken by somebody to stop the abuse of this rule. I think it is strictly up to the association to make the recommendation. The idea presented by Mr. Skidmore is the best one on this question and I think it ought to be adopted.

The question was put upon the motion to adopt the recommendations offered by Mr. Skidmore on Rule 127. Carried. Mr. Pierce voted "No."

Mr. Skidmore: In regard to Rule 128, I want the people representing the private lines here to listen when I say that I think I have given them a little the best of it. If that isn't as good for the private lines as they could expect, then I do not know what they want. (Applause)

Mr. Harvey: I move that the rule be adopted as recommended.

Mr. Peck: I am afraid it will conflict with Rule 126. You cannot force a car on a private line that has been damaged in a wreck unless they say so. You cannot force it on anybody else.

President Boutet: In regard to private line cars, it is almost impossible to repair a car satisfactory to the owner, and if we can get that car home to the owner and have the owner repair it according to his own manner, it should be at prices that are satisfactory. If the prices are not satisfactory, that is a matter for the arbitration committee to put the private car line on an equal basis.

Mr. Peck: The way we handle that here—there are so many private car lines in Chicago—if we damage a private line car we would so much rather they would make the repairs. We have been here twenty years, and I do not think we have had any trouble. But this is forcing a badly damaged car on him.

President Boutet: Does it ever occur to you that this country is very large and that there are a great many of us situated thousands of miles from the home of the private car lines? We are only asking the same conditions that you people have who are right at home with the private lines. You send it home; you do not repair it. We are asking the same privilege, except that we are going to pay the expense of getting that car home.

Mr. Peck: That isn't exactly the case.

Mr. Skidmore: Mr. Peck isn't consistent. He says if he has a private line car damaged in accident that he does not want to repair it. He wants to send it to the private line people and let them repair it, and on the other hand he says that if they have damaged a car they ought to repair it. He does not want to make it compulsory to send it home. We do not want to repair them; we want to send them home under the same privilege.

Mr. Peck: That isn't the way I understand it. I treat the private line just like the railroad. If I damage a railroad car badly I send it to the railroad company and the same with the private line.

If we do that we will have to have two set of rules, one for the private line and one for the railroad companies. You cannot force a railroad to take a car if you damage it unless they want to.

President Boutet: In the recommendation we adopted, it covers the railroad companies, and now we want to cover the private line cars.

Mr. Skidmore: Mr. Peck is with us on this because he says if he damages a railroad car he makes an appraisement and wants them to take it and repair it, and the same with the private line. That is what we are getting at; we want it made compulsory. I do not believe that a road that damages a car must repair it when it is so far away. We all want the same privilege.

Mr. Pifer: Our experience with damaged private line cars has been that the private lines would rather take the cars home and repair them than to have somebody else repair them.

Mr. Gainey: On Mr. Skidmore's line of talk, the rules that he is trying to get adopted are carried out at Cincinnati at the present time. If the Big Four wrecks a C. N. O. & T. P. car we take that car and repair it and vice versa. If that thing can be worked out good at Cincinnati, I do not see why it cannot be done all over the country. I would not issue a home route card for two draw sills. I hope every member will vote for Mr. Skidmore's recommendation.

Mr. Wohrle: For my own information I would like to ask why the M. C. B. rules specify that private line cars should be billed home, but do not say that railroad cars should be billed home. My experience that in order to facilitate the movement of that car, if a bill were made out, it would go.

President Boutet: Private line cars travel on a mileage basis; railroad companies cars are paid for per diem.

Mr. Hall: Are we not losing time talking about such a matter as private line cars. Inside of six months the private line cars will be per diem cars. I think it behooves every railroad company to repair a car when he gets it. Don't try to send it home. Repair it and send it home after it is repaired.

President Boutet: Did you ever realize in repairing a private line car that we haven't the material.

Mr. Hall: We are the biggest kickers in the world on wrong repairs. If you haven't the goods, send for it and make the proper repairs.

Mr. Long: Our company always aims to send a private car home for the simple reason that we haven't the material to repair it.

Mr. Harvey: In regard to the private line cars, you are not treating the company a good square deal by making the repairs to foreign cars. If we have an Armour car in a wreck on the Burlington; they are under per diem. We take that car in the shop. The first thing we do is to order a lot of material. We stop paying the per diem on it and hold it there from a week to two weeks. Then we cannot make the repairs as good as Armour can. The Armour people are out of the use of that car all this time. When we get through we have made a lot of wrong repairs. We would lots sooner turn the car over to them. As soon as you ask for a home route card, you cut out the per diem.

Mr. Pierce: May I ask, is there any private line that has refused to accept their cars when damaged? We prefer any time to get our cars home and do our own repairing. We have the proper material and can do it cheaper and easier. I am proud to hear Mr. Harvey talk as he has. He has hit the nail on the head.

President Boutet: It is not only trouble with refrigerator cars. There is a lot of very large cars, and when we get the cars home they get joint evidence and try to get a bill against them to offset the price, especially some of the large tank line cars.

Mr. Barns read the preface to the rules.

The question upon the motion to adopt the recommendation was put and carried.

Mr. Peck: There was a question left open for me to bring before the meeting.

EXTRACT FROM LETTER TO J. W. MARDEN.

"Neither open knuckles, malleable couplers or dummy couplings are standards of the association, and therefore prices have been eliminated from the Rules of Interchange.

"Rule 59 provides:

"When using materials for repairs to foreign cars for which the M. C. B. have adopted specifications as a standard, the materials must comply with the requirements of this specification."

Jos. W. Taylor, Secy.

Both the steel coupler and the closed knuckle is M. C. B. Standard.

Mr. Waughop requested that rules 59 and 94 be read.

Mr. Waughop: The point I want to bring up is that we may not think we have anything to do with the different inspectors on that point, but we have. A car comes in from the East and some one has applied a malleable coupler. It is our duty to give joint evidence as to wrong repairs. You cannot repair a car and charge it to the owner unless you use a steel coupler.

Mr. Skidmore: I do not understand it in that way, if a car was originally equipped with a malleable coupler. If a car was originally equipped with a steel coupler and it arrived home with a malleable coupler in it, it would be wrong repairs and proper to give joint evidence.

Mr. Waughop: Brother Skidmore, you are entirely off your trolley. The Master Car Builders have made steel couplers the standard. You must apply a steel coupler, regardless of what was originally applied, or you cannot make any charge.

Mr. Dyer: Why could a road have to give something better?

Mr. Waughop: You get your pay for it.

Mr. Dyer: Has the steel coupler been adopted as a standard?

Answer: It has been.

Mr. Dyer: I would give joint evidence in case a malleable coupler had been applied to a car originally equipped with steel, but I would not give joint evidence if a malleable coupler had been put in where a malleable coupler had been taken out.

Mr. Waughop: We will force you to do it.

Rule 58 was read.

Mr. Skidmore: Some roads have cars equipped with 4½x7½ journals, which are not standard axles. If you apply a standard axle to that car it is wrong repairs. You have to conform to the original construction and apply a 4½x7½ journal. I do not understand why you will take the opposite with a coupler. When you conform to the original construction of the car, under the present rules, it is all that can be expected or demanded.

Mr. Waughop: I do not agree with you. Any M. C. B. axle can be used provided it will fit.

Mr. Skidmore: The arbitration committee has decided that you cannot use these journals and also that the journal bearings are wrong.

Mr. Waughop: It might occur to you once in a while that the arbitration committee gets off their trolley.

Mr. Taylor: They admit themselves that they are wrong sometimes.

Mr. Waughop: For the purpose of setting you all straight, so far as St. Louis is concerned, the chief inspector will give any road joint evidence for any coupler applied to any of their cars that is not steel.

Mr. Gainey: The car foremen at Cincinnati have said that no car shall leave the repair track without an M. C. B. repair card on it.

Mr. Dyer: In case of a combination of defects and a road took out a broken malleable coupler and they replaced it with a malleable coupler, they would have to make a betterment and get nothing for it.

Mr. Waughop: They are not entitled to charges. It is the great American privilege of any road to put on anything they want to on a car, but when that car goes to a foreign line and breakages are made, such as a coupler, that road has to repair that coupler and cannot repair it and charge it to the owner except he puts in an M. C. B. standard.

Mr. Dyer: In a combination of defects, they are bound to make a betterment.

Mr. Hall: I would like to ask how many roads are using the malleable coupler today; if they are not all using the M. C. B. standard steel coupler, and what is the use in talking about the malleable business? When the M. C. B. rules tell us that is a M. C. B. standards and must be used and they are steel couplers, I see no necessity for argument.

Voice: I cannot agree on that. I think 60 per cent of the roads in the west are using more or less malleable.

Mr. Hall: How do they get in the game?

Mr. Waughop: They are not in the game.

Mr. Harvey: In order to dispose of the matter I move that in reference to Rule 94. it is the sense of this meeting that while Rule 58 permits the use of malleable couplers and open knuckles on cars originally so equipped, we believe the use of both malleable couplers and open knuckles should be discouraged and that steel couplers and closed knuckles should be used in making repairs to foreign cars.

Motion was seconded.

Mr. Waughop: I move that it is the sense of this body that where repairs are made to a foreign car, so far as the coupler is concerned, Master Car Builders' standards must be used to warrant a charge.

Seconded by Mr. Hall.

Mr. Harvey: The amendment is practically like the motion with a slight exception.

Mr. Lynch: I am of the opinion that the amendment is wrong in using the word "must" in view of the fact that there are a great many of the roads at the present time using the malleable coupler and I think it should be "may."

Mr. Hall: We have to come to the standards and you must put the word "must" in there or you cannot get results. There is no use to modify anything; you want to bring these roads to terms that are using the old malleable couplers which are breaking; get them in line. It doesn't cost them a great deal more. Any old car that comes down our way we don't put in a malleable coupler. We haven't any. We give them something good.

Mr. Harvey: While I agree with Mr. Hall, on the steel coupler, we have the open knuckle that comes in under the same line, and there are a number of cars running with the old coupler that has practically gone out of use, but they are still in the cars. We have more or less stock and I believe we ought to be permitted to use it.

Mr. Waughop: There is no question about using anything you want to, but you cannot charge for a malleable coupler on a foreign car.

Mr. Harvey: We ought to be permitted to. I think we all had open knuckles and there are a great number of the old steel couplers.

The question was put upon the amendment and carried.

President Boutet: We have with us today Mr. Bennett who desires to invite us to hold our next meeting at Buffalo.

Mr. Bennett: I am here to give you a most cordial invitation to come to Buffalo to hold your next annual convention. It is not necessary for me to go into details as to the beauties of that part of the country. You are almost as familiar with them as I am, but there is one thing that has come to my attention, and that is the fact that your association is inclined to be a little bit weak in the East, and you should come down there and show what few brothers you have in that section what you can do. You can do no better than by holding your convention at Niagara. We have 25 lines and a great big membership to draw from. We have 250 trains a day and you can easily reach your Canadian brothers if you want to interest them.

Regarding hotels, Niagara Falls has service equal to any city in the country. Our largest and best is what is known as the old C———, that has 600 rooms, meeting rooms, committee rooms, etc., which will be placed at your disposal free of charge. The regular rates have always been $3.50 a day to $6.00, but they have authorized me to make you a special rate of $5.00 a day, American plan, if their hotel is selected as headquarters.

We have other hotels, the Imperial has 300 rooms, charges from $2.00 to $3.00 a day. The Clifton, $2.50. As a special inducement to you, the Bureau of Publicity, wishing to establish a reputation for making Niagara Falls a convention city, will be glad to arrange a series of entertainments at our expense. We will take the ladies on an automobile ride, stopping at all the principal points of interest; the gentlemen we will take on an inspection of the power houses; we will try to take you to the vaudeville one evening, also give you a ball if you wish. And next year will see something at Niagara Falls that you never saw before. We have appropriated $100,000 and next year Niagara Falls will be illuminated at night. You will see one of the grandest sights you ever saw in that line. We have one billion candle power and 500 colors are going to be shown. I witnessed a test of that Saturday night last and it is worth going 5,000 miles to see. I do not know whether we can do anything more. We will open up our hands and meet you with warm hearts if you come there next year, knowing that we can make your stay very pleasant.

If there are any bachelors among you who are fond of women, a half a mile outside of Niagara Falls we have an Indian reservation and every gentleman will be presented with one squaw and two papooses. We want you there next year and we extend to you a most cordial invitation. I hope you will have a recommendation at this meeting that your committee be instructed to meet with us next year. (Applause.)

Mr. Harvey: In regard to our record on Rule 112 I move you that both those motions be expunged from the record and I would like to substitute this one, that it is the sense of this meeting that a labor charge of five cents for testing air after making repairs is permissible in cases where this charge is not included in the specified labor charge, such as in cleaning triples and cylinders.

Seconded by Mr. Gainey.

Mr. Skidmore: I do not see where there could be any objections to the motion as carried, as I understand it, and I believe I made that motion. If when an air hose was pulled off from the nipple caused by a defective band or bolt, it should not be considered torn air hose.

Mr. Trapnall: That is not the subject under discussion; it was five cents for testing that brake.

The question was put and carried.

Mr. Dyer: There was a motion yesterday that air hose pulled out from the nipple was not considered as torn out, and it was voted down. The same motion was made a little later by Mr. Skidmore and it prevailed. I should think that similar action should be taken in that case, and I move you to that effect.

Seconded by Mr. Brown.

Mr. Skidmore: If the motion was one and the same, I would have no objection, but it appears to me that it either was not understood or was a different motion, or it would not have been voted down in one case and in a few minutes carried. I am perfectly willing that the motion made by me and carried should be expungned from the minutes and our friend's substituted, but I am not in favor of considering the motion as passed, then making the same motion again.

Mr. Gainey: I think that the rule was thoroughly discussed yesterday and put to a vote and almost unanimously carried.

Mr. Dyer: Does the association want placed on their minutes a matter showing the rejection of a motion one minute and the next minute the adoption of the same motion.

The question was put upon the motion and lost.

Mr. Gainey: I would like to make a recommendation to have Rule 65 read as follows: Draft timbers must not be spliced, all longitudinal sills may be spliced once except center sills, which may be spliced at both ends of car. All the rest of Rule 65 to read same as present. Take for example a 50 foot furniture car. You splice two center sills at A end of car, later you break two center sills on B end. Why would it not be economy to splice those two sills, this would be center sills spliced at both ends of the car, which would be a great saving for the companies and would be just as strong as the original sills.

Mr. Waughop: I cannot see any reason why both sills cannot be spliced on both ends. If it is good on one end it should be on the other. If you will make that a recommendation for both sills to be spliced on either end, I will second it.

Voice: Rule 65 was read.

The question was put and motion carried.

Mr. Gainey: We had quite a lengthy argument here yesterday on malleable and steel couplers, which was put to a vote and carried. After Mr. Peck had made some explanations they voted just opposite.

President Boutet: It was left open to decide this morning, and that portion of the record will be omitted.

Mr. Harvey: There is one rule that I wanted to speak on in regard to the use of repair cards, Rule 76. Mr. Gainey mentioned about the Cincinnati Car Foremen taking up the question and I believe that every car ought to have a repair card on it. I think we ought to provide cards and that we members should take a personal interest in the matter and try to bring some pressure to bear on the car foremen to have repair cards applied to each car. That rule is practically a dead letter.

President Boutet: Don't you think that we could recommend that some penalty be attached for not applying the repair cards?

Mr. Harvey: I believe that the companies are getting repair cards on 80 per cent of the foreign cars. If any of our repair tracks are neglected, we ought to get after them just as soon as we find it out.

Mr. Gainey: I think that every car foreman attending this meeting ought to appoint himself a committee of one to see that these repair cards are put on. They see these cars interchanging every day. They see repairs being made; they surely ought to call each other's attention to the fact that repair cards are being left off. They are all careless; it is a case of hurry up, and they do not wait to get them. I think if we all started in the same line that Cincinnati has been following for the last eight months, we will not have so many joint evidences to sign up. This will be joint evidence on the car.

President Boutet: Yesterday evening our ex-president asked the privilege of the floor to discuss some matters pertaining to Rule 106. Mr. Waughop may have that privilege now.

Mr. Waughop: I have already talked about 106 and I do not wish to say any more on the subject now.

Mr. Burke: I would like to hear some discussion on Rule 83. If you make wrong repairs to a car, if you have two draft timbers and a dead wood brake on a car, and if you repair the two draft timbers and make a bill for it, and we do not bill the butted draft timbers, I say we would not give the owner anything. The owner comes back and wants a defect card for the two draft timbers butted, and I tell him that we didn't make any bill for the two butted draft timbers. What can be done in such a case?

Mr. Waughop: If you do not properly repair a car, then you are responsible for the cost of changing it back to its original condition. If you improperly repair these draft timbers, you are wrong and you should pay for them.

Mr. Burk: I maintain that the rule gives the company the right to repair any way they want to, but if you repair them wrong, you cannot make a bill for them. But do you have to pay the owner?

Mr. Dyer: It should be a case of temporary repairs.

Mr. Waughop: Under Rule 83, improper repairs made by a railroad company is subject to charge to the party doing the wrong work, regardless of whether they charged for it or not.

Mr. Gainey: Rule 65 says draft timbers must not be spliced. Butted is about the same thing.

Mr. Waughop: It is worse.

Mr. Burk: If you repair owner's defects, when you make a bill on them, then you are responsible, but when you just fix a car up temporarily to pass it back to another company, I do not see what difference it makes.

Mr. Dyer: I have seen cars with draft timbers broken and it seems to me that to bill that railroad for defects for which the owner is responsible and in addition to that putting in a number of temporary repairs for the purpose of getting the car home, that rule will apply.

Mr. Gainey: I do not think the M. C. B. rules will permit an old car to be patched up in that manner. If the rules permitted them to be butted, it would not be long until cars would be running all over the country butted.

Mr. Skidmore: The rules provide that when you make wrong repairs, you should place on the car an M. C. B. defect card; that being wrong repairs you can not escape responsibility by saying, "I did not intend to make out a bill." You must put an M. C. B. card on that car at that time.

Mr. Pifer: The M. C. B. rules I believe are plain enough that any man should understand them. If you make wrong repairs to any man's car, you are wholly responsible.

Mr. Burk: That is all right if I put a wrong pair of draft timbers in; that would be a different proposition providing I billed them for those draft timbers. We simply patch them to get rid of them. If that rule does not mean what it says, why is it in the book?

Mr. Skidmore: It goes further and says that an M. B. C. card must be placed on for improper repairs.

Mr. Dyer: I would like Mr. Skidmore to explain when this rule does apply or what it applies to.

Mr. Waughop: It applies all the time. If you make wrong repairs on a car I will give joint evidence against you.

Mr. Dyer: A bill isn't made.

Mr. Waughop: It doesn't make any difference.

Mr. Burke: What is that rule for?

Mr. Waughop: Just for a joke.

Mr. Burke: The rule is in the book and very plain.

Mr. Skidmore: The rule is all right; the trouble is when we try to evade part of the rule. If I put wrong repairs on a car and do not put an M. C. B. defect card on it and the car goes home, the owner gives joint evidence. If a bill is presented he uses his joint evidence in making a rebuttal bill. If no bill is presented he cannot make a bill against any one. That is where this rule applies. When the bill has been presented, the joint evidence comes in to rebut the bill.

Mr. Lynch: It seems to me that Rule 83 does not come under the head of repairs. Some men try to hide under Rule 83 to make wrong repairs. If they performed their duty, they would not have to hide behind 83, which is under the head of instructions for billing.

Mr. Pifer: Skidmore and Lynch are right. Rule 83 is given to protect any one billing for repairs that were made wrong, provided they were given joint evidence. When this bill comes in, the man holding the joint evidence is able to protect the man making wrong repairs.

Mr. Dyer: Admitting that A butts two draft timbers on B's cars, the car comes home to B without a defect card;

what should B do to A under this rule? A doesn't make a bill.

Mr. Waughop: He will hunt for it and never find it.

Mr. Dyer: Admitting that it is found.

Mr. Burke: We admitted that we did the work and we did not see what difference it made whether we repaired the car properly and made the bill or whether we passed it. I think the rule is plain.

Mr. Skidmore: The gentleman is right. It does not make any difference whether he evaded the rule in the first place, and that fact that he made no bill would relieve the company or owners of the car from making a bill against him. At the same time it is an evasion of the rule and causes considerable correspondence and looking out for a bill to come in. Whereas if it is done properly, he could have billed to the owner, applied his card and the owner would have had no authority to rebill him.

Mr. Sharp: If a remark from me would be in order, I would like to agree with Mr. Skidmore. We seldom agree in a dispute of this kind, but it seems to me that the rule is plain, and we all should understand it. Some man has asked for a definition of the rule and when it should be applied. I would suggest that when he goes home, that he ask the auditor, the man who handles the expense account, when the rule applies and I think he will get a very fair definition. The gentleman here represents that he made wrong repairs to a foreign company's car and in lieu of the fact that he knew that he had made wrong repairs, he did not render a bill. I suppose the man knew at the time that he did that that he lost just so much money for his company. Had he made the proper repairs, he would have been entitled to render a bill. Whatever the bill amounted to, he lost just that much to the company for which he was working. That is happening every day, and if you look at it from the standpoint of the company that has to explain the increased cost of labor, you will take an entirely different view of this rule. There is no reasonable grounds that I can see for making wrong repairs.

The rules have been made so as to enable you to collect, as you properly should for making repairs, provided a combination due to unfair usage is not the case. It is a well-known fact that everybody has more work than they can take care of, and the first thought is, "How quickly can I get rid of that car?" In many cases improper repairs are made in order to get the car off of the track, when a little more time would enable one to make the proper repairs.

There is another way of looking at it: You have delayed that car so long in making the wrong repairs. When the car is turned over to your connecting line it is subject to another small delay and the car owner loses money, the company for whom you are working loses money and there is no reasonable excuse for it. I am inclined to think that if Mr. Skidmore's version of this rule were put in force it would put a stop to making wrong repairs, because some one at the head of the department would be attracted to the fact that you are making repairs to the cars, and then paying somebody else for making the repairs which must be recognized as a waste of money. And to get out of the fact that you have made the wrong repairs, you say nothing about it. You have lost money, passed the car along. The matter gets up to the inspector's office and he issues a joint evidence card, and everybody knows that they are not worth the paper they are written on. They cost four times what the bill would amount to.

The question was put and motion carried.

President Boutet: It is the rule of the association that the executive committee decide the place for holding the next meeting. This is usually done in the latter part of the winter or early spring; but it is the desire of the committee to get an expression from the different members, and the secretary will prepare a ballot box, and each member will be expected to cast his ballot for the place he prefers for the meeting next year.

Important things to be considered are: First. Can we get the co-operation of car men in that section of the country? Second. Can proper hotel arrangements be made at a satisfactory price; and, can we get that point to come forward and say they will take care of a certain amount of our entertainment? It may seem that that is a selfish motive, but it has to be considered if we take our ladies, and if we do not take our ladies we will not be able to attend our meetings on account of our going so early to bed in the morning. And these things enter into the matter.

Thereupon an adjournment was had until afternoon.

WEDNESDAY AFTERNOON SESSION.

President Boutet called the meeting to order and announced that Mr. Seiberling had a matter he wanted to take up.

Mr. Seiberling: I will read Rule 19. I want to be right in it.

President Boutet: That same matter was brought up by the Chief Joint Car Inspectors at Cincinnati and they decided that a slid flat wheel must be 2½ inches long. The gauge must be set down flat, and the length must not be measured cross-wise; it must be lengthwise.

Mr. Seiberling: That is my understanding, and I would like to have Mr. Taylor read the rules and I will give an outline. The matter was up before the car foremen. It seems that the wheel was not slid flat straight 2½ inches, but it was slid flat on a 15 degree angle. There was a lengthy discussion and a number concluded that it was the delivering line's responsibility.

Mr. Waughop: I move you that it is the sense of this meeting that the meaning of the rule on slid flat is that the gauge must set perfectly level on the slid flat wheel 2½ inches from point to point without any rolling of the wheel, parallel with the line of the flange.

Motion seconded and duly carried, Packing and Cressey voting "No."

Mr. Burke: I do not believe anybody has said what constitutes a proper home route card. I do not consider any made out properly that I have seen here.

President Boutet: I do not believe the recommender on Rules 25, 26, 27 and 28 is here, and I would suggest that you let the matter drop until he comes in.

Mr. Burke: For 15 years I have only seen one card that was properly made out. We have had cars come in and the owner furnished a card just saying "Home route." I said, "I cannot furnish the route." And they said, "Send it home any old way; I don't care."

Mr. Seiberling: I am in the same fix myself. I took the car and repaired it and put it in service. I got tired holding the car on the repair track.

President Boutet: I would suggest that the matter remain open until Mr. Skidmore's return. We have adopted a home route card and I think it should all be included in one recommendation. There appears no further discussion on M. C. B. rules. I believe Mr. Lynch has a paper.

Mr. Lynch read his paper as follows:

ADVANTAGES OF JOINT INSPECTION IN CLEVELAND.

Prior to the establishment of joint inspection in Cleveland, there existed a system of interchange inspection, known as straight inspection. For example, the Big Four delivered to the B. & O. a car having delivering company's defects, which were overlooked by the B. & O. inspector. On return of the car, two or three days later, to the Big Four, the Big Four inspector discovered the defects and refused to accept the car unless a B. & O. defect card was forthcoming.

Each of the railroad companies placed its own inspectors at all interchange points, and these men were instructed to look out solely for the interests of their respective roads.

Bad order, loaded or empty cars, when offered to a connecting line, were refused and set back to delivering company for transfer, repairs, or defect card, as the case might be. This caused very serious delay to freight, a great deal of expense and annoyance to the transportation department on account of extra switching of the cars through congested yards. The fixing of responsibility for damaged and settlement of disputed cases often caused much unpleasantness, and unfriendly feeling between the local foremen of the different roads, and also among the local inspectors. These conditions became so annoying and expensive that the heads of departments were forced to act, the result of which was the agreement of the present system of joint inspection, entirely under the supervision of a chief joint inspector, whose duties were to see that all cars received or delivered by each company respectively, shall be carefully and impartially inspected and to keep a record of all cars passing in interchange, and his decisions as to the fitness of a car to run, and questions as to liability for repairs shall be final and binding on each company.

Any of the roads who are parties to this agreement may appeal from the decision of the chief joint inspector, to an executive committee of three, and their decisions shall govern the chief joint inspector in future cases, the claims made in accordance with the M. C. B. rules in force. This relieved the local foremen from all responsibility regarding the interchange of cars. The inspectors no longer known by the name of the road they were working for, but as joint inspectors, neutral men, as it were, working honestly and justly for the best interests of all concerned.

This agreement further provides that no loaded cars shall be sent back to the delivering company, except such as do not meet the requirements of the safety appliance laws; exceed clearance dimensions of receiving company, or other special order. The receiving company to make all necessary repairs, if such repairs can be made while car is under load. If a loaded car can not be put in safe condition to run within 24 hours, while under load, it shall be transferred at the expense of the delivering company, and returned to the delivering company, in bad order, if it is a foreign car.

The chief joint inspector has the authority to decide by what company any repairs of loaded cars, or transfer of cars, shall be done, it being understood that it is the intention to always take such action as to least delay the freight.

A further advantage of joint inspection was the reduction by almost one-half the inspecting force, as one inspector may work for two or more roads if conditions permitted.

I think you can readily see the advantages this joint system of interchange inspection has over the former. Being all under one head, it relieves the local foreman of all responsibility; removes cause of friction between the local foremen, and also between the local inspectors; it facilitates the movement of freight; no turning of cars back, and freight kept moving forward in the direction of its destination, something which the promoters of joint inspection most desired.

(Signed) Geo. Lynch.

It was moved that the paper be received and incorporated in the proceedings. Seconded and carried.

Mr. Harvey: I do not know as I have much to say on the paper. Local conditions govern to a great extent. I have no doubt but that the conditions in Cleveland were such that the chief joint inspector undoubtedly did make considerable improvement in the interchange of cars. The same thing might apply to other points. But there are other points where the matter is handled under local agreements, where I see no advantage in having a chief joint inspector. I believe that the interchange in Chicago keeps cars moving as good as any other terminal, and it is done with as little friction as any other point. I do not know that I have heard of a dispute between two companies but what could be readily settled by the foremen getting together and agreeing on the proper mode of procedure. A few years ago there was considerable friction, but the Car Foremen's Club has been organized and there is very little friction now.

In regard to loaded cars being sent back, they are not sent back for any cause whatever except penalty safety defects or leaky tank cars. It makes it obligatory to accept the load instead of the car. There is no question about charges. The receiving line has the privilege of transferring the load at his own expense or making the repairs and forwarding the car. I know that we have some bad movements on cars and I think that we will have that just as long as we live.

At some of our terminals they have chief joint inspectors and I do not know that we have any less trouble at these points than we do at other large terminals where they have agreements.

President Boutet: In answer to Mr. Harvey, and with all due respect to the interchange of cars in Chicago, I happened to be a member of the Chicago Foremen's Association and I read quite a discussion they had up there on the interchange of cars, a paper written by Mr. Buchanan. According to Mr. Harvey's theory they are not having the trouble set forth by the other men. He cites several cases where it has cost the company many dollars to get rid of a car.

Mr. Schultz: I am with the Burlington. We have 25 inspectors and I have no recollection of having trouble. We accept loaded cars from connecting lines. If it is necessary to procure cards, we ask for them. In case of our own cars coming home, we make the repairs and ask for defect cards. My idea of proper joint inspection is that when a car moves from one road to another with a cardable defect that the card should be immediately applied by the joint inspector. That is the way I handle it.

Judging from the correspondence I have seen in the office, I do not think the matter is handled that way in places like St. Louis. You should apply the defect card and make the proper report.

President Boutet: I think you are in error: they should put the card on the car right there.

Mr. Schultz: Is it the practice to apply a defect card in each case where the cars pass from one road to another with a cardable defect?

Answer: Yes.

Mr. Schultz: What is the cause of it?

President Boutet: I attribute that to places like Chicago where they run it over to other places and they come back afterward and found out that they got that car at some other place and wanted to see if they could get rid of carding it.

There is no point in the country that the M. C. B. rules are lived up to and the car passed on, but a car is passed in interchange from one line to another, carded for defects, and when it comes back to the line that carded it they take off their card. If it is a foreign car carded by them, and they remove the card, it is up to the other fellow to find the defect when it is delivered to him.

Mr. Schultz: What necessity is there for chief joint inspection at the large junction points where there is a man designated to do the same work, provided the men were supplied with defect cards to card the defects? The chief joint inspector must necessarily rely upon the records taken by this inspector.

President Boutet: Did you ever stop to realize that Tom Jones is inspecting for the Burlington? At an interchange point somebody has compelled Jones to card for something that he did not think cardable. He says the next time a car comes in I will make him card for two sills.

Mr. Schultz: We aim to work according to the M. C. B. rules. I must admit that I do not understand.

Mr. Waughop: The railroads employ master mechanics and superintendents for the reason that they want to centralize all ideas for the running of that road in one man. I left Chicago in 1881. I thought when I got to St. Louis that there was nothing like Chicago, but I found I was mistaken. I want to say to Chicago that if you will employ as chief inspector the poorest man or the best man, if you will give him authority to control that business and make him the Czar of that business; take away from the foreman and inspector any authority for sending back a car; put all authority in that man and hold him responsible, and you will move cars in Chicago that you are not moving today. It comes to me from the general manager that the rottenest inspection today in the country is in Chicago. Why? Because it is not centralized. St. Louis interchanged five millions of cars last year, and out of that number there was but 29 sent back except for safety appliances. Chicago is thirty years behind the times. I left Chicago twenty-six years ago. I am not prejudiced because I am chief inspector, but I know what I am talking about when I tell you that you do not know how to move cars in Chicago.

Mr. Harvey: I want to correct one mistake. He said we did not move cars in Chicago. I want to tell you that there is no loaded cars sent back in Chicago. We accept the cars and transfer them at our own expense. There is only one reason for which they are sent back, and that is for penalty safety appliance or leaky tank.

Mr. Waughop: You do not mean to tell me that the minutes of the meeting of July of the Car Foremen's Association, of which I am a member, misstate the facts?

Mr. Harvey: The general superintendents have ruled that no empty cars shall be sent back, and that has been lived up to so far as I know. That was brought out by Mr. Beecham's paper, a car accountant.

Mr. Taylor: Mr. Waughop has reference to the proceedings of the Western Railway Club.

Mr. Waughop: No, sir: Car Foremen's.

Mr. Taylor: That, as I understand it, was an empty car. Mr. Harvey is talking about loaded cars.

Mr. Harvey: I am talking about loaded cars: we are not delaying freight.

President Boutet: I believe Mr. Harvey is about right as far as loaded cars are concerned, but from the tone of Mr. Beecham's letter the matter of interchange, the movement of cars, is certainly a problem. The cars are worth so much a day to the owner and they should be kept in service.

Mr. Pierce: May I ask when you adopted that rule among yourselves not to reject a car unless for safety appliances?

Mr. Harvey: Five years ago.

Mr. Pierce: The conditions in Chicago today are not so much, I suppose, the movement of freight, although I am going to tell you that you are not in a position to move freight as rapidly as we are in St. Louis; conditions are such that you cannot. The chief inspector has told you that he is Czar of St. Louis. So he is to a certain extent, but he is nothing more or less than the servant of all the roads. He is watching every foreman of his division, and if there is any decision given that is not proper he has the executive committee of the central association to appeal to, and his decision is very often reversed. You will readily see the advantages of a chief joint inspector. You can close your books on the next day.

Mr. Harvey: I want to ask Mr. Pierce about cards. I would like to lay down the rules alongside of St. Louis rules of interchange. I say the Chicago rules are equally as good as St. Louis.

I want to say that if the defect card could be applied to the car at the start it would be a fine thing, but when they are issued two or three days after the car is passed on and the car follows the car, you might just as well rest upon the record first as last. We have a bushel basket full of cards. They are no good to us.

Mr. Waughop: I want to say to Mr. Harvey that there isn't a road in St. Louis, Chicago or any other city that can live up to the M. C. B. rules and do business, and I speak from the standpoint of a man who has been in the business thirty-four years.

Mr. Harvey: I agree with Mr. Waughop, and that is the chief reason why you may as well put them on the record. You should put the card on the car on the connection.

Mr. Waughop: Who do you report to?

Mr. Harvey: We have an arbitration committee.

Mr. Waughop: You should put one man in there to interpret them.

Mr. Taylor: The key to the Chicago situation is this: They have a car foremen's club and it is one of the strongest and best in the United States. The boys meet and fraternize and get along. You have a bunch of good fellows and that is what makes it possible to get along. They know one another personally. All that Chicago needs is a man at the head. You fellows have too much patience. You ought to live up to the sixty-days' clause. There doesn't seem to be any concerted effort to make the members live up to the rules. There is a great deal in the disposition of the foreman. I have a high opinion of Chicago. You have a fine club.

Mr. Schultz: I can corroborate what Mr. Taylor has just said. The conditions in Chicago are 50 per cent better than they were a year ago, and I do not see that we ought not to have any trouble at all. The article in the Car Foremen's paper was in reference to the handling of empty cars, which we have taken care of nicely in the several resolutions that we have passed here. We do not refuse any freight except, as Mr. Harvey has said, defective safety appliances or leaky cars. We are getting along nicely. I remember when we did return cars in years gone by.

Mr. Waughop: Isn't it true that the car inspectors, car foremen, master mechanics and the superintendents of motive power of all Chicago are prejudiced against joint inspection?

Mr. Schultz: I do not believe so. I have not heard of it.

Mr. Wohrle: When a car is offered in interchange at Columbus the inspector starts it right, then he applies a defect card. We have a little association there and we take our inspectors in and we talk over the rules so that we understand them uniformly, and we get along very well. We have to watch the inspectors and see that they carry out the rules. We have no trouble and no complaints of delay.

Mr. Trapnall read a paper as follows:

Mr. President and Gentlemen, Chief Joint Car Inspectors and Car Foremen's Association of America:

The question chosen by the Kansas City Southwest Car Foremen's Association of Kansas City, Mo., is as follows:

First, Our method of handling loaded cars in interchange at Kansas City, Mo.

We have a rule that no loaded car shall be set back except for penalty safety appliances, and cars that have defects which it is not necessary to repair are run on record, and if at some other point it is necessary to repair or card car for the damage, request is made for defect card, and if the request is in accordance with the record, a defect card is furnished. The request is a check on the inspection, although the defects are not inspected by a representative of the chief interchange inspector, but as the original inspection is checked against the claim on car from the repair point, it is good evidence that the defects exist and the road is entitled to the defect card.

At this joint all the inspectors carry the defect cards of the connecting line and issue the same for missing material, and in some instances they issue card for other defects, but this practice is discouraged, as so many of the cards have to be corrected, and in some instances cancelled after personal inspection. All cards issued for defects outside of missing material are checked by the chief interchange inspector or his assistants.

As we compel all lines to receive the loaded car, the association has made provisions for certain commodities to be transferred at the expense of the delivering line, but before the same can be done, the chief interchange inspector or his assistants must see car and decide if the repairs can be made in twenty-four hours by one man. If so, no transfer order is given, and if the road elects to transfer the car they do it then at their own expense. By a system of pool marks the inspector knows when car is returned that it belongs to his line and handles same by marking car to his repair track for repairs.

The trouble in large terminals is principally with first movement empty cars, and they are usually set back for small defects which do not impair the car and could be run. Instead each road does not desire to take the car, then the switching commences, with the great liability of increase damage, which could all be obviated by the road receiving the car for the mechanical department, and if not wanted by the transportation department it could be set back by them. Another source of trouble in handling the empty car situation is caused by the inspectors in a majority of instances not knowing what class of freight is to be loaded in car. This is a fault of the transportation or traffic department. When giving an order to a road for cars for loading, they should give the foreman of the car department an order showing what these cars are to be loaded with; as, for instance, a car to be loaded with rough freight could be accepted if the running gear and draft gear was in good order; but if it was to be loaded with a high-class lot of freight better cars would have to be used than for rough freight, and the foreman would exercise more care in the selection of cars that were to be delivered to avoid this setting back. That would make less work for all concerned and create a better feeling between the car department and transportation department and lessen the cost of handling cars in terminals.

Second, What would be the advantage of having all interchange inspectors placed under the chief interchange inspector?

It would be a great saving in expense, as follows: Each line maintains from one to four inspectors on a connection to receive their cars. In a great many instances cars are only moved a very short distance when they are delivered to another company and the same is again inspected. For instance, at one point in this terminal there are seventeen inspectors employed and all the connections are within a stone's throw of each other. Cars are brought in by one line and inspected by the inspector of the receiving line and the cars are taken and set on the next track, and that will constitute a delivery to the next line; their inspectors go over the same lot of cars and they have scarcely been moved twenty car lengths.

This is useless inspection. If the inspectors were employed by an association they could make the one inspection; then in place of one lot of inspectors being idle while the others are inspecting, they could take care of the cars offered in interchange with a reduction in force. A uniformity of instruction to inspectors would save the setting back of cars on the assumption that the other inspector will not receive them, also would save delay to freight and prevent congestion in the terminals and switching cars back and forth. A uniform set of instructions would be issued to all inspectors if under one chief, and they would only have one object in view, that is, handling the cars without any prejudice against any line, as they would be accountable to the chief car inspector for the competency of their work, and in that manner I believe more efficient inspectors could be obtained. Some would possibly raise an objection that they were deprived of their rights, as the receiving road should be the judge of the cars. That, I think, could be easily overcome after a trial, as no inspector would receive a car not in condition to run or serviceable. Rule No. 2 gives a lot of technical excuses for not handling cars which would be done away, as at this day and age the railroads have to move the business offered to them as quickly as possible or their yards would become congested.

Third, A uniform interpretation of the M. C. B. rules among the chief interchange inspectors.

The chief inspectors know probably better than any one else that there is a lack of uniform understanding or interpretation of the M. C. B. rules. Some live close to the rules, others are more broad in their views. Some of you have probably ruled that certain defects were owner's responsibility, and on the arrival of car at another interchange point the chief inspector would authorize a card against the delivering line. For instance, "A" delivered to "B" a foreign car with three boards from corner roof gone, no evidence of being struck, and the chief inspector rules that it is an owner's defect account of nails rusting off or boards decayed. "B" passes car along and in a day or so it is offered to another line, and the joint inspector at that point cards against "B" for the three roof boards gone, because Rule 41 says material missing from cars offered in interchange is delivering line's responsibility—to use no judgment but literally interpret the rule.

Again, it has been that cars offered in interchange with slid flat wheels, the receiving line was refused a card. At the next interchange point wheels were condemned and defect card issued against the delivering line at that point for the same wheels with the old slid flat spots. No doubt numerous similar cases could be cited, but this is sufficient to satisfy all that a more uniform interpretation would be desirable and cause less friction and trouble and expense.

The chief inspector should also keep up to date with the rules and decisions so that he could intelligently decide all questions or disputes referred to him. He should at all times be courteous to the inspectors and show them where they were in error and help them in any rule or question they don't understand, and that would give us a more intelligent class of inspectors and cause less friction, as they would be more conversant with the rules, and thereby save time and money for the various lines that employ them.

Yours truly,

Southwestern Car Foremen's Association.

Per F. W. Trapnall.

Chairman Committee.

It was moved that Mr. Trapnall's paper be received and placed in the minutes. Carried.

Mr. Burns read his report, as follows:

To the Officers and Members of the Joint Inspectors and Car Foremen's Association, Assembled:

I recommend that Article IV of the constitution be changed to read: "The officers of this association shall be a president, vice-president, secretary and treasurer, and three elective members, who shall form the executive committee.

Most respectfully submitted to the action of this association.

Note—After due consideration I recommend that our president and past president be one of said committee.

(Signed) L. J. Burns.

President Boutet: There is nothing said about pay and I believe that you ought to pay our secretary and treasurer $20 a year.

It was moved by Mr. Dyer and seconded by Mr. Schultz that the secretary and treasurer be paid $20 a year. Motion carried.

Secretary Taylor: I want to make announcement of the death of Mr. Fred W. Daly, Foreman, Street's Western Stable Car Lines at Ft. Worth, Texas, May 8, 1907.

It was moved by Mr. Waughop that resolutions be drawn up on the death of Mr. Daly and copy sent to the family and incorporated in the minutes. Seconded and carried.

Messrs. J. W. Hogsett, Trapnall and Waughop were appointed on committee and presented the following:

OBITUARY.

Mr. Fred W. Daly, Foreman, Street's Western Stable Car Lines. Died May 8. 1907, of pneumonia.

Mr. Daly was 39 years of age and was born in Wallpool, Canada, February 29, 1868. At the age of 15 he entered the shops of the Wells-French Co. at Chicago and remained with that company from July, 1884, to 1892, when he entered the service of the Street's Western Stable Car Lines at Fulton. Illinois, remaining in Fulton until 1894, when he was transferred to Fort Worth, Texas, where he remained until his death.

In the death of Mr. Daly the Chief Joint Car Inspectors and Car Foremen's Association of America has lost a valuable member and his family a loving and devoted husband, with whom we join in sympathy and sorrow.

J. W. Hogsett, Chairman.
Chas. Waughop.
F. W. Trapnall.

Mr. Cressey: I will also state that another member of this association has died, H. Johnston. The resolution should cover both.

Messrs. Cressey, Richmond and Stimson were appointed a committee to draft a resolution in regard to the death of Mr. Johnson.

The committee submitted the following resolutions:

Whereas. The Supreme Ruler of the Universe has, in His infinite wisdom, removed from our midst our esteemed member, Henry Johnson, Foreman of the Swift Refrigerator Lines at South Omaha, on October 24, 1906;

Resolved, That the ability and business relations and his upright dealings with all in whom he came in contact will be held in grateful remembrance, and his sudden taking away from our number will leave a vacancy that will be deeply realized by all members of our association;

Resolved, That the deep sympathy of all members be extended to the wife, children, relatives and friends, and we express our hope that so great a bereavement may be all for the best;

Resolved. That a copy of this resolution be transmitted to the wife of our brother and friend.

W. H. Cressey,
O. P. Richmond,
October 10, 1907. Committee.

ELECTION OF OFFICERS.

President Boutet: We have come to the time of the election of officers. I will vacate the chair and let the vice-president occupy it, and you can proceed to the election of officers, if it is the will of the association.

Mr. Waughop: It has been the custom for the past president to make a nomination. Last week I got on a street car with a single dime in my pocket; it was well worn, but the conductor took it. I think that we have a president now that is pretty well worn, but you ought to take him for another year. He looks to me like a smooth dime. I therefore take pleasure in nominating for president H. Boutet, of Cincinnati, for our next president. And unless I hear another nomination, I move you that the nominations close and that the secretary be instructed to cast the ballot of the association for Mr. Boutet.

Nomination seconded by Mr. Gainey.

Mr. Lynch: I move you that the nominations close. Seconded and carried.

Mr. Hitch: I move that the secretary cast the ballot of the association for Mr. Boutet. Seconded and carried.

Thereupon Mr. Cressey announced the name of Mr. Boutet as president for the ensuing year.

President Boutet: Gentlemen, I can only say, as I have said before, that I am very thankful for your appreciation. I have worked hard for the association because I have a selfish motive in the matter, not altogether your welfare; I believe in lifting up this association, and in doing so I am lifting up myself a little higher than the rest of you. I felt that we had room in this country for a car association, and I believe that we have the best car association in the country.

We have the Master Car Builders, which is composed of master mechanics and superintendents of motive power, but there are few practical car men connected with the associations today, and there are very few practical car builders outside of the Master Car Builders' Association. I believe that this association can be and is a valuable auxiliary to the Master Car Builders' Association, and I believe every one of us should make up our minds on what we want brought out; have it on a piece of paper—some puzzling question—and when you come to the convention be prepared to bring it up.

I will endeavor to do as well in the future as I have in the past. I trust that each one of you will jot down anything that is of importance, and next year when we meet together you will have it in such shape that you will not forget to bring it up. (Applause.)

For first vice-president the names of Messrs. Lynch, Trapnall, Skidmore and Cressey were placed in nomination. The ballot resulted in favor of Mr. Cressey, and he was duly declared elected.

Mr. Cressey: I did not expect to be elected vice-president; I did not prepare any speech, and it is so seldom that a Democrat ever gets elected to anything anyhow, so I will say that I think it a compliment and I thank you.

Mr. Gainey: For secretary and treasurer I would like to place before you the name of one of our best members in the association, a man I voted against for vice-president because I thought that the president and vice-president ought not to be in the same city. I think that the president and secretary and treasurer should be in the same city to save a lot of annoyance, and I place before this body the name of Stephen Skidmore.

The names of Mr. Gainey and Mr. Taylor were also mentioned for the secretaryship, but they withdrew same.

It was moved that the nominations close and that the secretary be instructed to cast the ballot of the assocation for Mr. Skidmore, which was accordingly done, and Mr. Skidmore was declared the duly elected secretary and treasurer.

Mr. Skidmore: I might talk a little bit on car work, etc., but I cannot make a speech. I am not thankful for being elected, because it is considerable work and responsibility, but I am willing to do what I can to help out in the association work, and that is the only reason why I will accept this office at all. (Applause.)

For the three members of the executive committee the names of Messrs. Hall, F. W. Trapnall, Geo. Lynch and A. Berg were placed in nomination. The ballot resulted in favor of Messrs. Trapnall, Lynch and Berg.

It was moved by Mr. Waughop that the past president and secretary be authorized to select a badge similar to those given to the past president to be presented to the past secretary at the expense of the association.

The motion was seconded and carried.

The President: Before we adjourn I would like to call your attention to the entertainments that have been and will be furnished to our ladies and ourselves, for which we should thank our friends, namely: The Galena Signal Oil Co., The National Malleable Casting Co., W. H. Miner Co., The Buckeye Steel Casting Co., McCord & Co., Westinghouse Air Brake Co., The American Steel Foundry Co., The Farlow Draft Gear Co., The Grip Nut Co., The Standard Coupler Co., The Railway Equipment Co., Symington & Co., United States Metal Co., Bettendorf Axle Co., Latrobe Steel Co., H. E. Tucker, Gould Coupler Co., Chicago Railway Equipment Co., Buda Foundry Co., The Bliss Electric Co., The American Brake Shoe Co., T. Madill, G. S. Wood, Columbia Brake Shoe & Foundry Co., and others, also the entertainment committee.

Mr. Skidmore: I move that we show our appreciation to our friends for their courtesies by a rising vote of thanks and that their names appear in the minutes of this meeting.

Seconded by Mr. Gainey and carried unanimously.

Thereupon an adjournment was had, to meet next year at the call of the executive committee:

The following is a list of active and associate members:

J. I. Bailey, C. F., C. & O. R. R., Russell, Ky.
F. M. Brown, F. C. D., Erie R. R., Cleveland, O.
L. J. Burns, F. C. D., C. & O. R. R., 1615 Holman St., Covington, Ky.
A. Berg, F. C. I., L. S. & M. S., Erie, Pa.
J. V. Berg, L. S. & M. S. R. R., Collinwood, O.
G. M. Bunting, F., P. R. R., 613 White Ave., Cleveland, O.
H. Boutet, C. I. I., 11 Carew Bldg., Cincinnati, O.
F. B. Boutet, Asst., C. I. I., 809 Carlisle Ave., Cincinnati, O.
F. B. Black, Foreman, C. C. & L. R. R., Brighton Station, Cincinnati.
J. L. Brady, F. C. D., L. & N. R. R., 1708 Greenup St., Covington, Ky.
W. Bowden, M. M., T. R. R. A., Union Station, St. Louis, Mo.
V. Baltz, C. I. I., W. & L. E. R. R., Wheeling, W. Va.
J. C. Burke, F. C. D., Mo. Pac., 422 W. Davis St., St. Louis, Mo.
Frank A. Barbey, Acme Ry. Eq. Co., Brown Bldg., Boston, Mass.
J. H. Bendixen, Vice-Pres. Bettendorf Axle Co., Davenport, Ia.
S. P. Bush, Buckeye Steel Casting Co., Columbus, O.
J. H. Brown, Westinghouse Air Brake Co., 1102 Traction Bldg., Cincinnati, O.
W. E. Coffin, National Malleable Casting Co., Cleveland, O.
J. W. Caine, Western Sales Agent McCord & Co., 1435 Old Colony Bldg., Chicago, Ill.
W. L. Crossman, care the Beckwith-Chandler Co., 355 Breckenbridge St., Buffalo, N. Y.
O. Cabee, J. C. I., Kankakee, Ill.
C. Charleton, F. C. D., P. C. C. & St. L. R. R., Cincinnati, O.
J. M. Costley, C. J. I., Cairo, Ill., care M. & O. R. R.
W. H. Cressey, C. I. I., South Omaha, Neb.
J. Coleman, Asst., C. I. I., 651 Kenyon Ave., Cincinnati, O.
R. L. Combs, F. C. D., W. F. Co., 1018 Illinois Ave., East St. Louis, Ill.
F. M. Combs, F. C. D., M. B. T., 4267A Blair Ave., St. Louis, Mo.
J. Dyer, C. I. I., Youngstown, O.
H. N. Denarest, G. C. I., P. R. R., Williamsport, Pa.
J. B. Duncan, L. S. & M. S. R. R., Collinwood, O., Box 39.
W. A. Dixon, F. C. D., B. R. & T. R. R., 43 Essex St., Rochester, N. Y.
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Contents

Leaks and Signals

WITH the approach of the winter season it is highly important that all steam leaks around locomotive boilers and cylinders be stopped as far as possible. A small leak, scarcely noticeable in the summer time, is turned into a cloud of condensed steam by the lower temperature of winter weather. When coming from pistons or points near the head of the engine, this escaping steam may form in sufficient masses to interfere with the engineer seeing ahead.

Where trains are operated by signals the engineer must have an unobstructed view ahead at all times. Climatic conditions sometimes make it unusually difficult for the engineer to observe signals in winter. A cloud of steam in the engineer's face is apt to make this impossible.

Blowing piston and valve stem packing contribute the largest share of escaping steam. Cylinder cocks are frequently the cause for a certain amount. Blow-off cocks and washout plugs generally leak more or less except when kept up in good shape. Leaky boiler seams and dome saddles are more or less frequent. Open channel cocks supply a large volume of condensed steam, but this can be prevented by extending the channel pipes outside the frames with valves to close the exhaust after all the water is out of the passages.

It is believed that close attention to the matter of leaks around a locomotive will result in economy, increased safety and comfort to enginemen. It is unquestionably the duty of the round-house organization to reduce these leaks to the least possible amount.

Practical Coal Distribution

AN unusually interesting and original paper was presented before the November meeting of the Western Railway Club by Mr. J. G. Crawford, fuel engineer, C. B. & Q. Ry. While dealing with fuel for locomotives, the paper considered the economical purchase and supply of coal before it reaches the locomotive tender, rather than the economical combustion of coal, and pointed the way to considerable saving by proper distribution. The author believes that the cost of fuel will be much less when purchased and distributed according to its heat value and cost than if purchased and distributed at random.

The paper makes no claim for an exaggerated rate of economy, but outlines a practical method whereby a saving can be effected and shows that even a small saving is worth going after. Average comparative figures selected from the records of several leading western railways show that the cost of lubrication of locomotives is only 2.5 per cent of the cost of fuel, from which the inference may be drawn that if some of the energy expended in reducing the cost of lubrication should be directed toward effecting economy in the purchase and distribution of coal, the resultant saving would more than pay for the entire amount of oil and waste used in locomotive lubrication.

Mr. Crawford's paper is presented in abstract on another page of this issue.

The Utilization of Scrap Wood

THE Forest Service of the United States Department of Agriculture advocates the wise utilization of the whole tree to forestall all shortage in timber. This department states that not more than 50 per cent of the tree as it stands in the forest comes to the market in the form of valuable materials. It has been realized for some time than an enormous waste of valuable substances has been going on.

The car department of railways has felt the shortage in lumber and indications are that it will be felt even more seriously in the next few years. Prices are gradually becoming higher and higher on account of the demand for lumber and the scarcity of the supply. The demand for lumber continues even in the face of the fact that steel is entering more and more into the construction of cars.

As there is no apparent immediate relief of the timber situation the alternative is the reduction of waste and the utilization to the utmost of second-hand material. At most railroad shops where a planing mill is situated, refuse lumber is delivered to the boiler room to be used as fuel. At some shops, old timber removed from cars is sawed to convenient lengths for hand firing and delivered to the boiler room. This provides for economy in the fuel bill, but does it affect a saving in the use of lumber? The use of shavings from the planing mill as fuel in the stationary power plant seems to be the most economical disposition of such material; yet is it not possible that much material which must be cut down in length if used as fuel, could be used to advantage in the manufacture of products requiring comparatively small pieces of wood, for instance car furnishings, furniture, etc.

A step toward advancement in the utilization of second-hand lumber removed from cars, is represented by the practice of one company in saving old wooden brake beams and other material from which useful lengths may be cut. From every brake beam two lengths of nearly two feet each may be cut between the holes at center for the brake lever fulcrum and the holes for the flange guard. This material is of thoroughly seasoned oak and much of it has been improved by age. Arrangements have been made to supply a furniture manufacturing establishment with proper lengths for making chair rounds, and much good usable material heretofore destroyed will be disposed of in this manner.

The selection of material for this purpose suggests the possible utilization of second hand timber for various uses by railway companies, and also its disposition to industries in the territory fed by the different lines.

Concerning Side Sheets

A TEST made some time ago on the Delaware, Lackawanna and Western Railroad to investigate the presence of a film of steam against the firebox side sheet and referred to during a discussion before the recent convention of the Traveling Engineers' Association, is one of the indications of interest in the ever live subject of improving boiler design.

In preparing for the test referred to a gauge cock was applied to each side water leg of a high pressure boiler on a locomotive in freight service. The gauge cocks were inserted in the outside sheets and so adjusted as to reach within ⅛ inch and ¼ inch of the side sheet on each side respectively. The gauge cocks were placed 22 inches above the mud ring and at about the center of the length of the firebox. Each gauge cock was introduced into a washout plug which was in turn screwed into the outside sheet.

Careful observation of these gauge cocks while on the road showed that, upon opening a gauge cock through one-quarter of a turn, steam would be discharged while the engine was working with full throttle and the safety valve unseated, while a solid stream of water would be drawn off when the throttle was closed. These observations indicate very clearly that water does not remain in contact with side sheets when an engine is working hard, but rests solidly against the sheets when the throttle is closed. Evidently the intense heat developed by the increased rate of combustion of the fuel on the grate at a time that the engine is working hardest causes an insulating film of steam between the firebox sheet and the water. After the throttle is closed and when the heat from the fire becomes less intense, it seems that this film of steam disappears and the water is allowed to come in contact with the sheet again.

This test corroborates in a measure the results obtained by similar tests made on the A. T. & S. F. Railway and referred to by Mr. George R. Henderson, in his remarks before the convention of the Railway Master Mechanics' Association in 1904, when he said that from experiments made by gauge cocks put through the outside sheet so as to extend within different distances of the inside sheet, apparently a film of steam about ¼ to ⅜ inch thick was found against the side sheet. (See Proceedings of American Railway Master Mechanics' Association for 1904, page 247.)

The presence of a film of steam between the side sheet and the water is injurious to the metal as it causes the sheet to crack and to bulge between staybolts as well as to leak at staybolts. By displacing the water immediately adjacent to the sheet, the metal is allowed to reach a temperature higher than that of the surrounding water, when the rate of combustion is highest and the heat from the fire is most intense. When this film is dissipated the water comes in contact with the overheated sheet, reduces the sheet to the temperature of the water and causes sudden contraction in the metal. Continued repetition of this process naturally causes the sheet to deteriorate materially.

That these cracks which develop in side sheets have their origin in expansion and sudden contraction due to the metal being subjected to an intense heat and then suddenly cooled seems to be evidenced by the fact that sheets begin to crack on the water side.

It is believed that the presence of a film of steam against the firebox side sheet of a locomotive boiler cannot be eliminated entirely even though the depth of the volume of water surrounding the sheet should be increased beyond practical limits. The ill effects of this insulating film of steam are aggravated by poor circulation and by bad water which has a tendency to foam and prime. Alleviation, then, may be looked for with good water and with good circulation.

In the last few years much attention has been directed toward improving circulation by widening the mud ring and by so designing that the water leg is wider at the top than at the bottom, as well as by increasing the width of bridge between boiler tubes. It would be instructive to learn to what extent longer lives of firebox sheets have been obtained by improvement in design of boilers to provide for better circulation. Systems of treating boiler feed water and systems of washing locomotive boilers with hot water have produced very beneficial results, and with the advantage of such improved conditions, it would be interesting to know to what extent the railways at large have profited by the investigations and reports of the Master Mechanics' commit- on improvement in boiler design.

Locomotive Terminal at Chicago

Chicago and Western Indiana Railroad

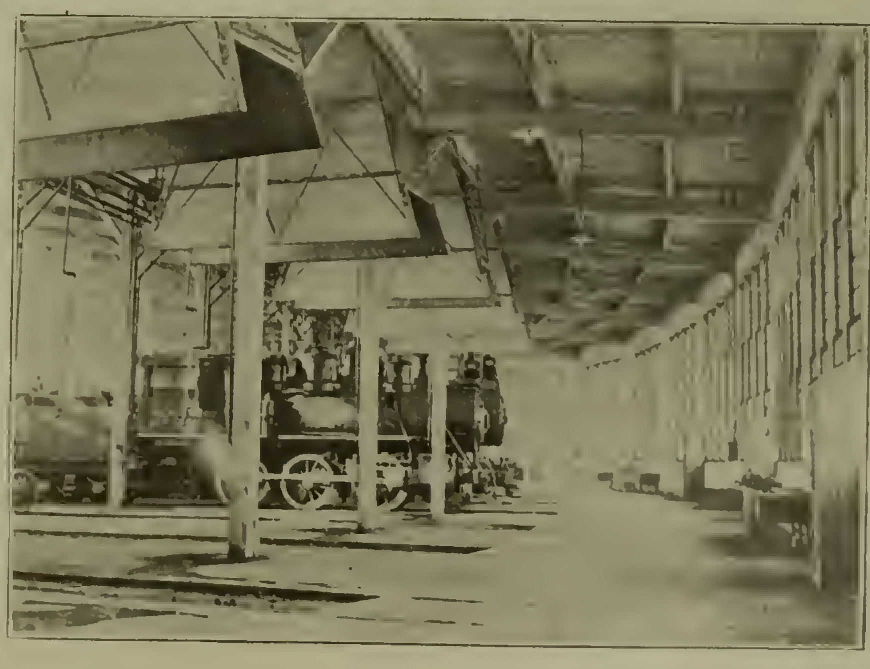
THE new locomotive terminal of the Chicago and Western Indiana Railroad at 49th Street, Chicago, has been in operation since January 1, 1907. This terminal has attracted considerable attention on account of its modern construction and compact arrangement on a tract of land limited in extent and defined by fixed boundaries. The operation of the terminal during the past year has been attended with excellent results in regard to both economy and rapidity of movement of locomotives. Without attempting to describe this terminal in full, the features and arrangement which have contributed largely to the showing made will be taken up as illustrating good practice in terminal construction.

The Chicago and Western Indiana Railroad is an operating company for five different lines entering Chicago—the Erie, Grand Trunk, Wabash, Monon and Chicago & Eastern Illinois. In order to provide facilities for handling the fluctuating business which is liable to occur under such conditions, the roundhouse and yards have been planned on the largest scale permissible by the size of the property. This explains the elliptical shape of the roundhouse and the somewhat unusual location of some of the buildings.

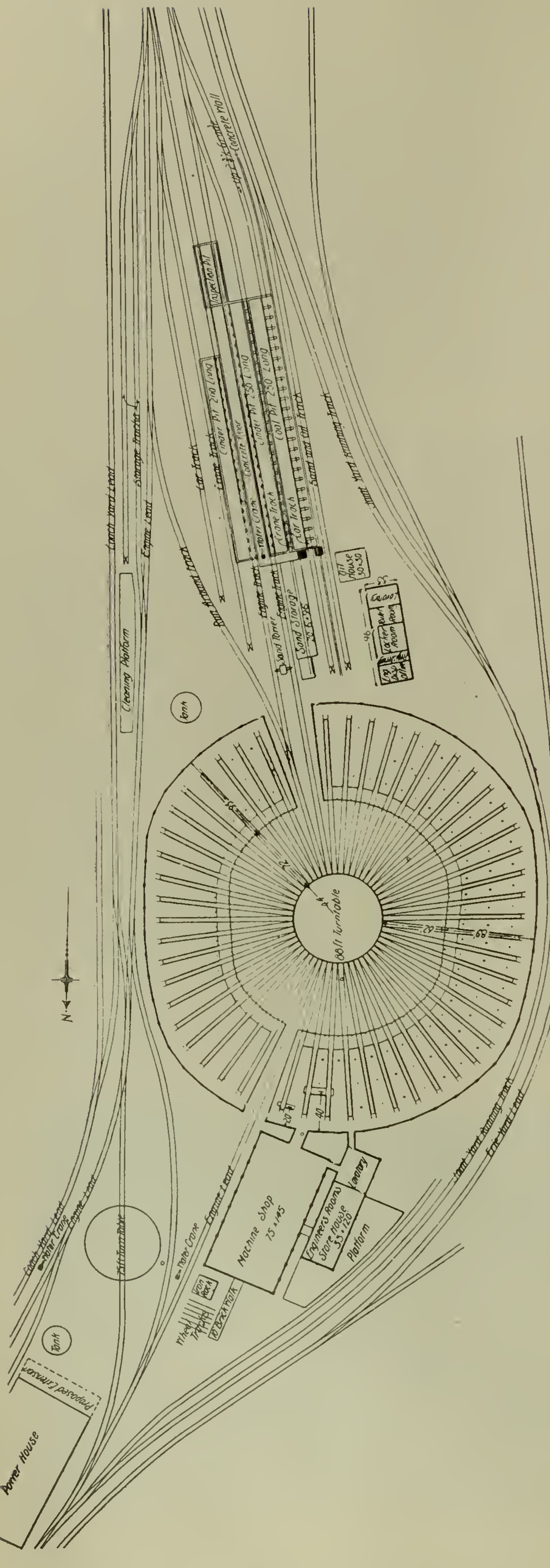
The roundhouse has 51 stalls and is served by a turntable 88 feet long, operated by a J. L. Pilling air motor. The short stalls at the sides have a span of 89 feet, and the long stalls at the north and south ends have a span of 95 feet between walls. The cross section of the roundhouse is of simple construction with sloping roof 23 feet high at the outer wall and 31 feet 1 inch at the inner wall. Concrete has been used in the construction wherever possible, walls, engine pits, foundations, conduits, cinder pits, etc., are all of this material. Brick has been used for floors.

The noteworthy features of the roundhouse which bear particularly on the movement of locomotives are in

VIEW SHOWING INTERIOR CIRCLE OF ROUNDHOUSE. STALL DOOR CONSTRUCTION AND DOUBLE ROW OF WINDOWS ABOVE ARE SHOWN —LOCOMOTIVE TERMINAL AT CHICAGO, C. & W. I. R. R.



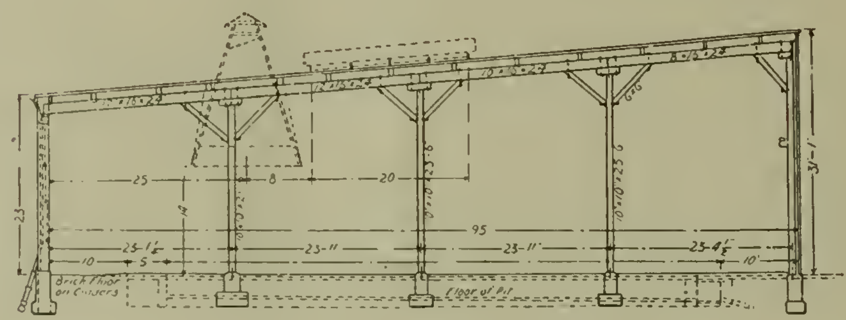
INTERIOR OF ROUNDHOUSE SHOWING ARRANGEMENT OF SMOKE JACKS AND THE LARGE WINDOWS IN OUTER WALL FOR NATURAL LIGHTING—LOCOMOTIVE TERMINAL AT CHICAGO, C. & W. I. R. R.



GENERAL LAYOUT OF LOCOMOTIVE TERMINAL AT CHICAGO—CHICAGO AND WESTERN INDIANA RAILROAD.

evidence immediately on entering the house. The unusual amount of light, the freedom from smoke and the ample space between repair pits are the first impressions received. All of these items are factors of importance in the rapid repair and turning of locomotives. An abundance of natural light has been secured by large windows 19 feet 9 inches wide and 15 feet 6 inches high in the outside walls and a double row of continuous windows over the stall doors in the inner circle. A coat of whitewash over the interior distributes the light uniformly so there are no dark corners. Light and plenty of it is needed in a roundhouse where locomotives must be repaired quickly.

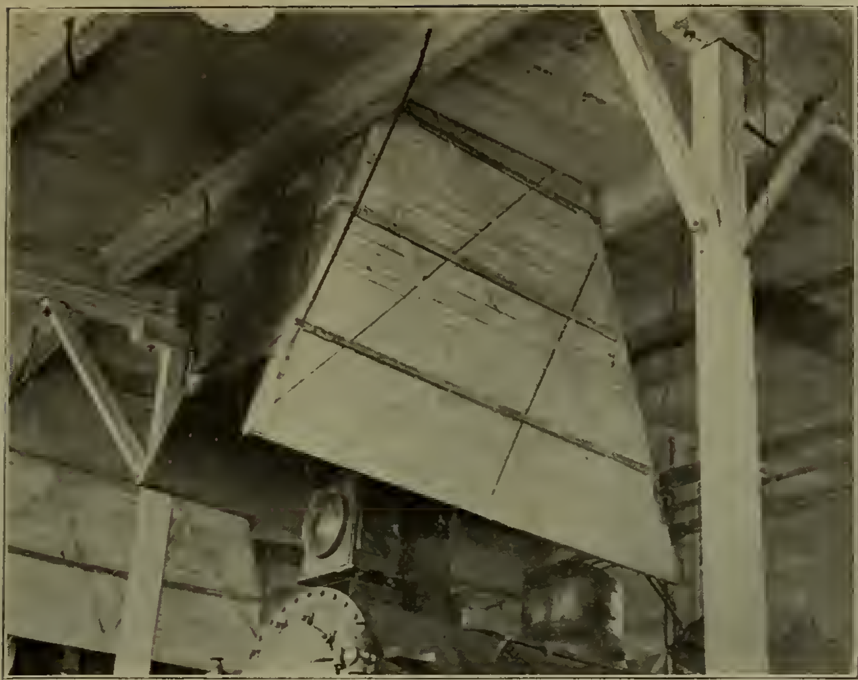
The freedom of the roundhouse from smoke and steam is perhaps the most noticeable feature. This is due to the efficient smoke jacks and ventilators pro-



CROSS-SECTION OF ROUNDHOUSE SHOWING CONSTRUCTION, ALSO ARRANGEMENT OF SMOKE JACKS AND VENTILATORS—LOCOMOTIVE TERMINAL AT CHICAGO, C. & W. I. R. R.

vided. The accompanying illustrations show the original design of these smoke jacks and the atmosphere of the house and the clean white washed walls bear visible testimony of their efficiency. The smoke jack is 15 feet 8 inches long and 4 feet 2 inches wide at the bottom and tapers up to a section of 2½ feet square at the top, surmounted with a large hood. A damper operated by a cord is provided to close the opening made when the jack is not in use. The jack is lined with a composition of asbestos fibre, lime and sawdust so that it is not inflammable nor subject to the action of gases. A slat ventilator 20 feet long is placed about 4 feet back of the smoke jack. These ventilators are over the steam domes of locomotives as they stand on the pits and carry away excess steam from the pop valves, etc. It is readily appreciated that this arrangement is an efficient one in keeping the house clear of smoke and steam. The condition of the atmosphere of a roundhouse bears a direct influence on the movement of locomotives. When the air is charged with gas and smoke the roundhouse force will not do the usual amount of work. The physical discomfort of breathing gas offers an excuse for loafing that is perhaps justified to some extent. A good smoke jack such as installed in this roundhouse is an important factor in economical roundhouse operation.

Those familiar with the crowded condition of old roundhouses will appreciate the space between pits and the ample room provided for making repairs and hand-



SMOKE JACK WITH LOCOMOTIVE STANDING BENEATH JACK—LOCOMOTIVE TERMINAL AT CHICAGO, C. & W. I. R. R.

ling material. There is no interference or difficulty experienced when repairing engines on adjacent pits.

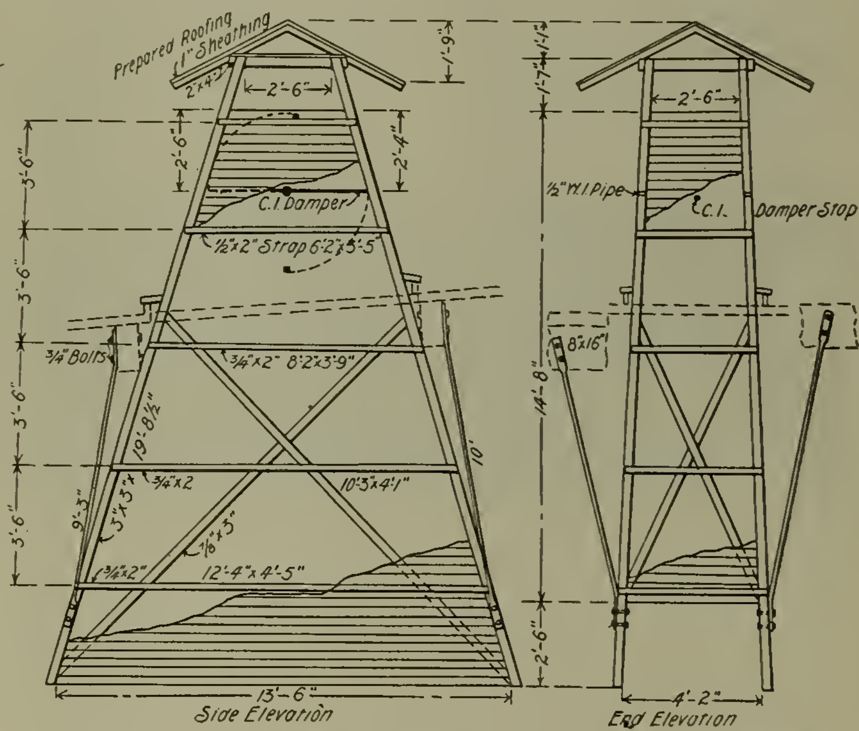
Drop pits are arranged on three tracks convenient to the machine shop, one pit for truck wheels and two for driving wheels. These last are connected by one pit served by an air jack for handling driving wheels without delay. As will be observed from the general layout, the drop pits are located opposite the main door of the machine shop so the wheels removed can be taken directly to the machines with little effort and loss of time. This arrangement has been carefully planned and is another of the excellent features of this roundhouse. The Miller hot water system of washing and filling boilers is installed with connections at all pits, making it possible to wash out boilers in from two to four hours.

The store house and machine shop are conveniently located to the roundhouse and are connected by covered passageways. A lavatory for employes' use is also arranged in the store house building. All of the buildings have been designed with the same care as the roundhouse. Large provision for natural lighting, ample floor space and convenient arrangement are features of the buildings.

UPPER END OF SMOKE JACKS AND VENTILATORS ON THE ROOF OF ROUNDHOUSE—LOCOMOTIVE TERMINAL AT CHICAGO, C. & W. I. R. R.

Owing to the necessity of separating the supplies of the various roads using the terminal, the storehouse is arranged in a somewhat different manner than usual. Each stock of material is kept in a certain rack and properly marked. Through the center of the room a large rack extends which holds the common supplies and the roads are charged with whatever is used in repairs to their engines.

In the arrangement of tracks for receiving and dispatching locomotives the same care has been used as manifested in the construction of the roundhouse. By referring to the general plan it will be observed that two incoming tracks and one outgoing track are provided. Both incoming tracks lead over the inspection pit, and cinder pits and facilities for coal, water and sand are arranged in order. A run around track leading from the yards to the turntable provides a means for turning engines without delay when the cinder pits are blocked and also makes it possible to put an engine arriving last in the house ahead of those already on the cinder pits.



SIDE AND END ELEVATIONS OF SMOKE JACK—LOCOMOTIVE TERMINAL AT CHICAGO, C. & W. I. R. R.

The outcoming track is connected to the engine lead track by two tracks, one of which passes over a 75-foot turntable. This turntable was put in for turning passenger coaches but it can be used in cases of necessity for turning engines. In rush times this auxiliary turntable can be used to relieve the conjestion of the main turntable and thus prevent delay to engines entering the terminal. A water crane serves the outgoing tracks. It is readily observed that this arrangement of tracks has been planned to handle a large number of engines with a minimum amount of delay.

The provisions made for coaling and clinkering engines are somewhat unusual. The illustrations show clearly the difference from the customary arrangement of coal shed and cinder pits. For coaling purposes two locomotive cranes with 2-ton clam shell buckets are used. The crane serving the west track takes coal from the coal pit. This pit is 12 feet 6 inches wide, 11 feet 3 inches deep and 250 feet long and holds 250 tons of

INSPECTION PIT—LOCOMOTIVE TERMINAL AT CHICAGO, C. & W. I. R. R.

LOADING CINDERS WITH CRANE. THE CINDER PIT FULL OF WATER IS SHOWN. COAL STORAGE BINS ON RIGHT—LOCOMOTIVE TERMINAL AT CHICAGO, C. & W. I. R. R.

VIEW SHOWS THE TWO CINDER PITS. IN THE BACKGROUND ARE THE TWO LOCOMOTIVE CRANES. ON THE LEFT COAL STORAGE BINS, ON THE RIGHT COAL CARS FOR LOADING DIRECT TO THE LOCOMOTIVE TENDERS—LOCOMOTIVE TERMINAL AT CHICAGO, C. & W. I. R. R.

INTERIOR OF MACHINE SHOP SHOWING LARGE AMOUNT OF FLOOR SPACE PROVIDED AND AMPLE FACILITIES FOR NATURAL LIGHTING—LOCOMOTIVE TERMINAL AT CHICAGO, C. & W. I. R. R.

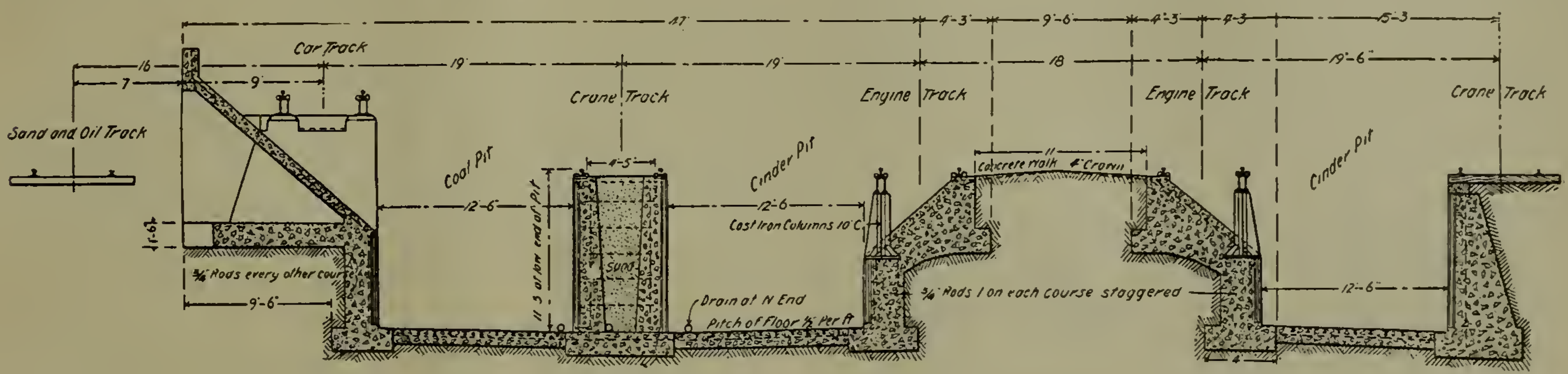
THE OUT GOING TRACK WITH LOCOMOTIVE TAKING WATER—MACHINE SHOP ON LEFT. ROUNDHOUSE, FOREMAN'S AND ENGINE DISPATCHER'S OFFICE IN ADDITION ON RIGHT—LOCOMOTIVE TERMINAL AT CHICAGO, C. & W. I. R. R.

TURNTABLE DRIVEN BY J. L. PILLING AIR MOTOR. OPERATING LEVER IS SHOWN. ANOTHER LEVER IS PLACED AT THE OTHER END OF THE TABLE SO TABLE CAN BE OPERATED FROM EITHER END—LOCOMOTIVE TERMINAL AT CHICAGO, C. & W. I. R. R.

coal. Coal is dumped direct from cars to the pit from an elevated track on the outer side of the pit supported on piers and steel beams. Engines on the east track are served direct from the cars by a crane in the same manner as those on the opposite side. These cranes will coal an engine in from 3 to 5 minutes and at a cost of about 8 cents per ton including all charges, such as repairs to the cranes, etc. This method of coaling is generally satisfactory, except that it is somewhat slow at times, due to the condition of the coal. With large sized coal the buckets will not always pick up the full sized load, consequently it will take longer to put a certain amount on the engine tank.

cinder pits is largely of concrete, properly reinforced and protected. The efficiency of this arrangement for coaling and clinkering engines has been demonstrated during the past year.

A locomotive inspection pit is located south of the cinder pits so that inspection can be made on both incoming tracks before hostlering is commenced. This pit is 60 feet long and 2 feet 6 inches deep from the top of the rail. The inner rails of both tracks are supported on cast iron piers and the outer rails rest on the walls of the pit. Thus inspection from below is afforded from the inside only. The walls, foundations and floor of the pit are of concrete. The floor is inclined for drain-

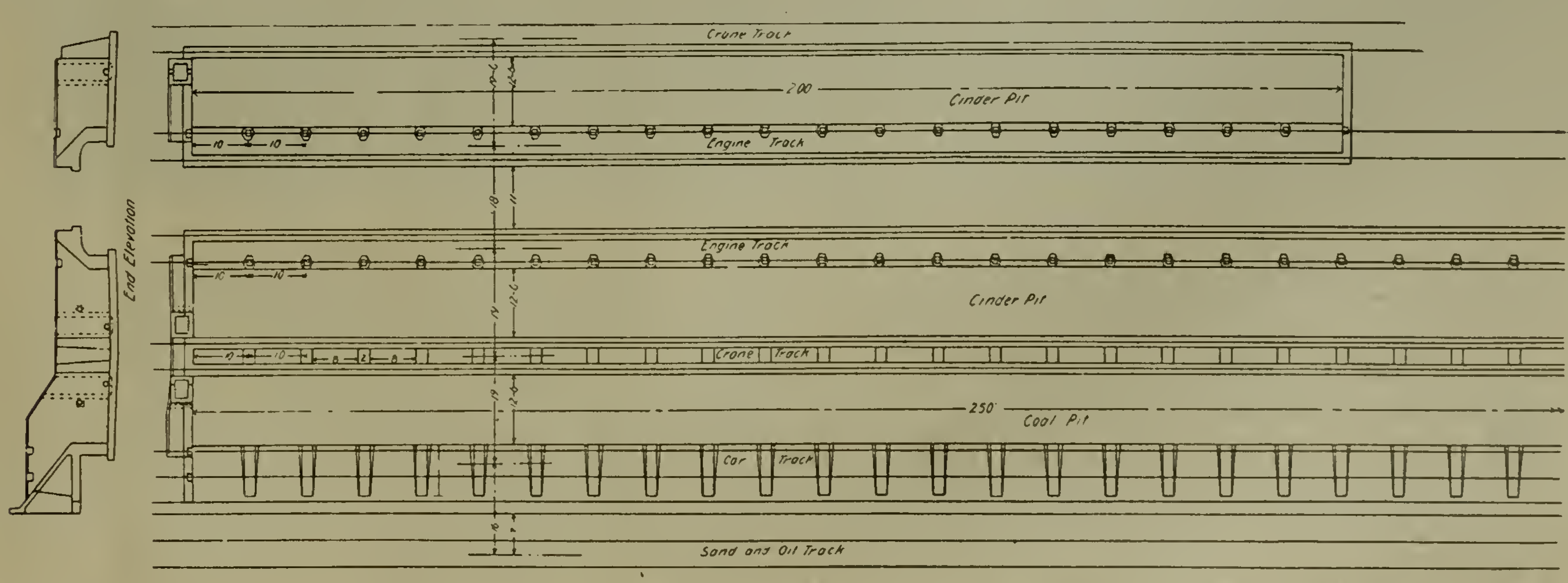


CROSS-SECTION OF COAL STORAGE BINS, CRANE TRACKS, CINDER PIT AND TRACKS—LOCOMOTIVE TERMINAL AT CHICAGO, CHICAGO & WESTERN INDIANA RAILROAD.

The arrangement of cinder pits is simple and effective. The two incoming tracks are placed on 18-foot centers with a concrete walk in between. Below each track is a sloping face of concrete arranged so that all cinders are delivered outward to the cinder pits located along the tracks. The pits are 12 feet 6 inches wide and 11 feet 3 inches deep, the west pit being 250 feet long and the east pit 200 feet long. The concrete walls are protected by steel rails laid flush with the face. The pits are filled with water for extinguishing the hot cinders so that all fire is effectually put out and there is no liability of burning wooden cars used in cinder service. The cinders are loaded in cars by the locomotive cranes. One crane will load a 36-foot gondola in about 18 minutes, which is a very economical method for handling cinders. An average of 3 cars of cinders are loaded per day. The practice of cleaning up each pit on alternate days is followed. The construction of the coal and

age. While this pit is not of elaborate design or expensive construction, it serves the purpose for which it was intended, and is a design which would increase the efficiency of other terminals not provided with inspection facilities.

An average of 73 engines is handled every 24 hours through the terminal. While this number is not excessive and there are terminals handling more engines over one turntable in the same time, the conditions are somewhat more difficult owing to the fact that five different roads are interested—generally in getting their own power turned as quickly as possible when occasion demands. As engines cannot be interchanged, it naturally follows that certain engines must be put in shape for certain runs unless in a wrecked or disabled condition. The usual prerogative of the roundhouse foreman in sending out the most available engine whenever the necessity arises does not hold in the operation of this

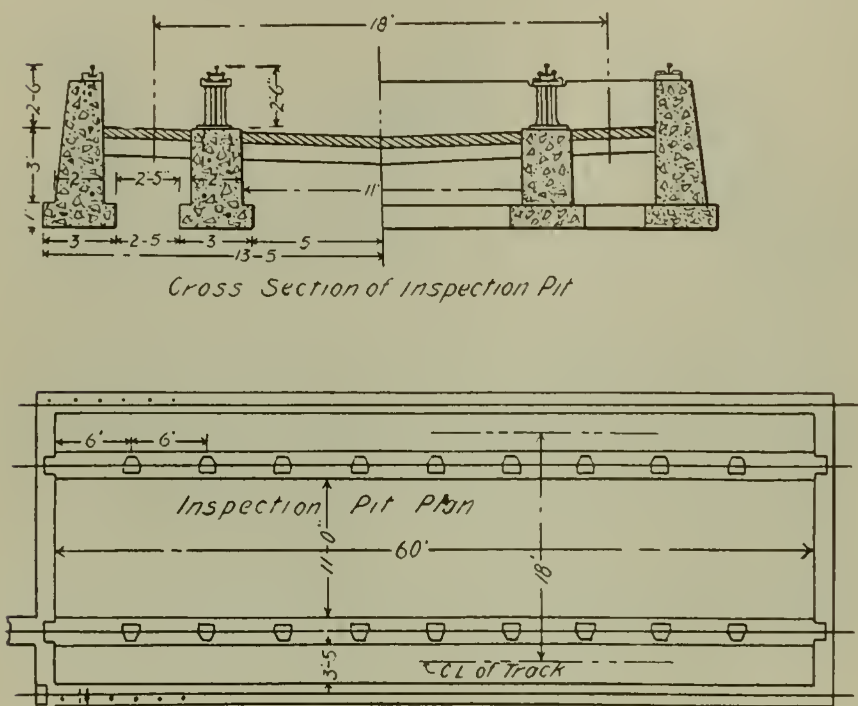


PLAN OF CINDER PITS, COAL STORAGE PITS, ETC.—LOCOMOTIVE TERMINAL AT CHICAGO, CHICAGO AND WESTERN INDIANA RAILROAD.

terminal. At times this may increase the difficulty considerably of furnishing motive power as fast as needed.

The organization consists of one general foreman, two roundhouse foremen, day and night shifts, one day boiler foreman, two engine dispatchers, day and night shifts. Three machinists are employed days and three nights, two boilermakers days and two nights, two air brake men, day and night shifts. In the machine shop one machinist is employed, also two blacksmiths and one carpenter. Outside two hostlers and helpers are used on both day and night shifts, also two crane men, two turntable operators. A certain number of laborers are employed both day and night.

One hostler and helper take all outgoing engines out of the house at the proper time. They also place all supplies, oil cans, etc., of the engine crew on the engine.



PLAN AND CROSS-SECTION OF INSPECTION PIT—LOCOMOTIVE TERMINAL AT CHICAGO, C. & W. I. R. R.

The other hostler and helper perform the usual duties of coaling, sanding, clinkering, etc. The engine dispatchers handle the Chicago and Western Indiana and Belt Railway engines only. Each road using the terminal dispatch their own engines and provide a call boy for their crews.

It will be observed that for the number of engines turned and the conditions which prevail on account of the number of roads using the terminal the organization is relatively small in number. The value of efficient organization and modern facilities is clearly shown in the operation of this terminal.

We are indebted to Mr. P. H. Peck, master mechanic, and Mr. N. B. Whitsel, general foreman, for courtesies extended in the preparation of this article.

Test of Roller Bearings on Cars

WHILE it is generally known that there is less friction in a roller bearing than the usual journal of brass lubricated with oil, but little definite information on the subject has heretofore been published. The report of the following tests with roller bearings in street car service as given in the Street Railway Journal show the saving in power where this type of bearing is used. While there is considerable difference in this service and that on steam railways the report shows the advantages of a bearing which could be adapted to service on steam railways.

The theoretical saving to be secured by the use of roller or ball bearings has long been fully understood, but the actual benefits derived in practice are not so well known. Many tests have been made showing their value on machinery, but it is only recently that their use has been fairly tried in electric railway service. Some interesting results are now available regarding tests made on a trolley car in Syracuse, N. Y., for over four and one-half years. This car is fitted with the Merrick roller bearing, furnished by the Standard Roller Bearing Company, of Philadelphia. The bearing consists of a sleeve of steel which is slipped over and upon the ordinary car axle journal, without changing it in any respect, and upon which the rollers run, this construction preventing any wear whatever upon the journal. The thrust is cared for in the usual way by a "horse-shoe" type of bronze thrust plate, so that no thrust is taken upon the rolls. It is simple in construction and has no parts that require especial attention or care. An oil reservoir is provided into which the rollers run as they revolve around the shaft, and as it uses very little oil, slight attention is required in this respect.

The great saving in power consumption is plainly indicated in the accompanying curves, covering the test run of two cars operated under practically the same conditions. The test was made on a three-mile run, which is nearly straight except for one short 90-degree curve. Car No. 70 was equipped with roller bearings, while car No. 87 used the ordinary plain bronze bearings. The amperes and volts applied were measured by calibrated Weston meters, and the power consumed included controller losses. Readings were taken every six seconds.

The time for runs and consumption of energy were as follows:

CAR NO. 70.

	Time in Minutes	Kw.-Hours
To Valley	18.1	1.94
Return	16.7	1.16
Total time	34.8	total energy 3.10

CAR NO. 87.

	Time in Minutes	Kw.-Hours
To Valley	19.1	4.42
Return	16.1	2.03
Total time	35.2	total energy 6.45

The saving secured may seem extraordinary, but is said to be confirmed by further tests in which it has been demonstrated that the net cash saving in coal consumption or its equivalent is $292 per car per annum, in addition to which there is a very considerable saving in the wear and tear occuring on ordinary brasses. The roller bearings at the end of four and one-half years, and after running 250,000 miles, are in such condition that they may be relied upon to run many years longer. The rolls show an average reduction in diameter or wear of .005 to .008 inches, and it is evident that with the rollers, axle sleeve and car box or housing, all properly hardened, as in this construction, very little wear will take place.

There are many advantages secured by the use of roller bearings in addition to the saving in power above noted. The consumption of oil is much less than with bronze bearings, and as the greatest saving by a roller bearing is in the starting of the load, the car starts much more gradually and therefore with greater comfort to the passengers.

One very considerable advantage that should be taken into account in the use of roller bearings may be the adoption of motors of smaller size and consequent lower cost than are required at present. This results not only in the first cost saving, but in reduced weight of the complete car, with a corresponding reduction in wear and tear of all parts, including the rails, etc.

In considering the saving in power shown in the tests mentioned, other tests of roller bearings are interesting as confirming the fact that a very large percentage of power may be saved by a properly constructed anti-friction bearing. One test made by the Federal Government some time ago of an army wagon fitted with and without roller bearing axles demonstrated a saving ranging from about 52 per cent up hill to as high as 75 per cent on an asphalt drive.

It has been shown that an electric cab will run on one charge from 25 to 35 per cent further with roller or ball bearings than when using plain bronze bearings. In using shafting hanger bearings a recent test showed that eighteen heavy grinding machines, using 49 horsepower with the plain babbitted bearing, required only 27 horsepower when roller bearing shafting hangers were employed.

All Steel Passenger Coach

Union Pacific Railroad

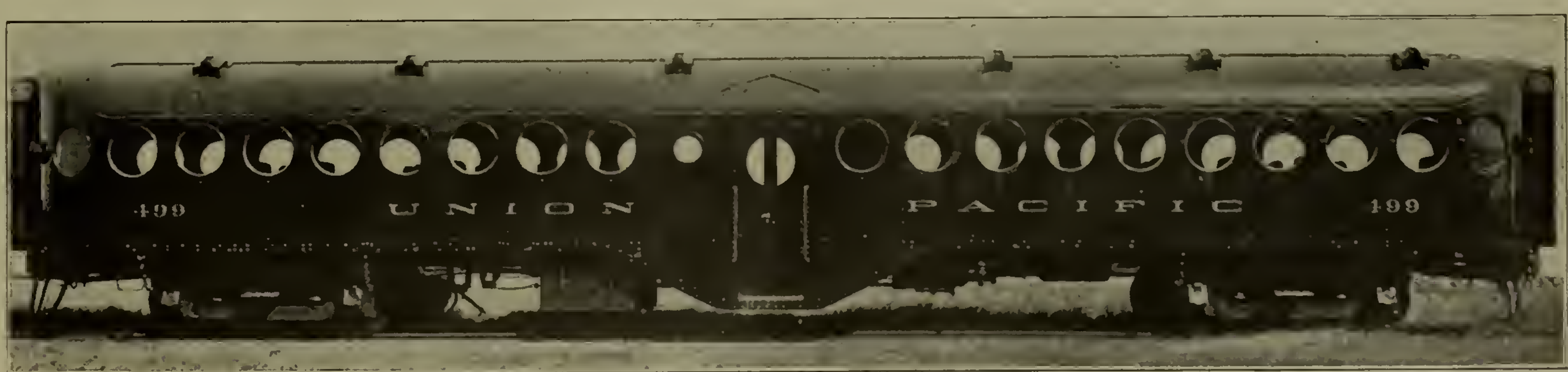
THE most recent introduction of steel into the construction of railway rolling stock by the Union Pacific railroad has been made in the building of an all-steel, fire-proof passenger coach which has been turned out at the Omaha shops and placed in service between Omaha and North Platte.

This coach bears very little semblance to the ordinary passenger coach, and has been constructed on entirely new lines. The upper deck and sashes have been substituted by a semi-circular roof, similar to that of Union Pacific gasoline motor cars. A reduction of twenty-four inches in the distance from rail to roof is thus accomplished. The ends of the coach are also round in order to lessen wind and air resistance.

A remarkable feature of this car is the thickness of the walls, which are only 2 inches from outside sheathing to finished surface or interior wall, a reduction of 3½ inches over the present wooden, or any fire-proof coach ever constructed. This affords an additional clearance of seven inches in the aisles and adds materially to the comfort of passengers.

The use of wood in the construction of this car has been practically eliminated, no wood being used, with the exception of about 200 pounds of wooden filling blocks. All mouldings, etc., are made of fire-proof material.

The lighting equipment consists of an electric generator placed on one of the trucks and belted to a pulley on truck axle. An auxiliary storage battery has been placed in steel boots below the car floor. At each seat is placed an eight candlepower lamp, with frosted globe, located slightly above a seated passenger's head, and at side of car.



ALL STEEL PASSENGER COACH—UNION PACIFIC RAILWAY.

The rectangular sash and gothic window sash are displaced by round metal sash 24 inches in diameter, which forms absolute dust and water proof windows.

The most noticeable departure from common practice in wooden car construction is the absence of steps and end vestibules, the steel coach being equipped with two side door entrances. The car also has a door at each end forming a passage-way to other cars.

Toilet rooms, two in number, are placed at diagonally opposite sides of the steps, at the center of car, and are provided with an excellent system of ventila-

INTERIOR OF ALL STEEL PASSENGER COACH—UNION PACIFIC RAILWAY.

tion and fresh air supply, in addition to the best of fixtures.

Vapor System of steam heat has been installed, furnished by the Chicago Car Heating Company. The system of ventilating this car is worthy of note. Cottier suction ventilators of an improved design are placed at intervals on the roof, along each side of center line of car. In the fresh air system, air is admitted at the circular ends of car, about eight feet from the rail, at each side of and train line doors, through intakes 12 inches in diameter, covered with a fine brass netting thence downward to an air-tight galvanized sheet iron box placed beneath car and containing two sets of removable dust collecting screens set vertically. These screens thoroughly clean the admitted air of any foreign substance.

After passing through these screens the purified air is admitted upward to the inside of car, and along the sides of same, through a galvanized sheet duct having perforations at each seat to allow admission of fresh air to interior of car. Along the outside of this fresh air duct are placed the steam heating pipes, which heat the incoming fresh air to the desired temperature. The amount of fresh air admitted to car is regulated by dampers in the intakes at ends of car.

Two 12 in. I-beam center sills, on 16-in. centers, and 6x3½-in. angle iron side sills, all securely fastened by cross ties, needle beams and diagonal bracing, comprise the underframing of this coach. The 12-in. center sills are intended chiefly for the buffing and pulling stresses, and in reality, do not carry any load, as they themselves are carried by the sides of the car, which are of girder formation, detailed description of which is given later. A single steel casting 11 ft. by 9 ft. 9 ins. includes double body bolsters, end sills, and end bracing of underframe, the weight of which is 3,700 lbs.

Sheet steel 1-16-in. thick is riveted over the underframing to prevent liability of fire, upon which is a layer of ¾-in. hair-felt. On this hair-felt is a flooring of fire-proof composition in pressed sheets 3 by 4 ft. ½-in. thick, laid on nailing strips ¾-in. by 2 in. embedded in the hair-felt. Stove bolts, with heads flush with top of floor, securely fasten floor construction.

The side posts and carlines are of one continuous piece of 3-in. channel iron, bent in the form of a letter "U," inverted, extending from side sill to side plate, thence forming a contour of the half-oval shaped roof and extending down to side sill on opposite side of car from whence it started.

To these channel iron posts, which are formed with flat side outward, is rivited the ⅛-in. steel side sheathing which, in turn with the posts, is rivited to the angle iron side sills. The steel sheathing extends from bottom of side sills to top of the 4-in. channel side plate, forming a deep substantial girder, which is additionally stif-

END VIEW OF ALL STEEL PASSENGER COACH—UNION PACIFIC RAILWAY.

fened by diagonal braces placed before windows and riveted to the sheathing. Holes 25-ins. in diameter are cut out of sheathing to accommodate the circular aluminum window frames.

The entire work of the designing and constructing this model all-steel passenger coach has been done at the Union Pacific railroad shops at Omaha, Neb., at the direction and under the supervision of superintendent of motive power & machinery W. R. McKeen, Jr.

Principal data of coach is as follows:

Actual weight	89,300 lbs.
Length over diaphragms	68 ft.
Height rail to floor	12 ft. 1¾ ins.
Height floor to ceiling	7 ft. 8¼ ins.
Width inside at wainscot	9 ft. 5⅝ ins.
Width of aisle between seats	3 ft. 5⅝ ins.
Width of car over side sills	9 ft. 5⅜ ins.
Roof sheets, galvanized iron	1/16 in. thick
Truck, 4-wheel cast steel.	
Seating capacity of coach	78

The Influence of Heat Value and Distribution on Railway Fuel Cost*

By J. G. Crawford

THE cost of locomotive fuel is about 12 per cent of the total operating expenses of a railroad, and consequently the subject of fuel economy is of the utmost importance.

It is not the purpose of this paper to discuss the economical use of coal on locomotives, but to deal with the economical purchase and supply of coal before it reaches the locomotives. In order that coal may be economically purchased and distributed the heat value and cost must be considered.

The heat value of coal may be determined by laboratory calorimeter tests or by evaporation tests made on locomotives. The latter method is preferable, as the coal is tested in actual service.

LOCOMOTIVE COAL TESTS.

The heat values of the coals found on or near the railroad system which are being or are likely to be used, should be determined by locomotive evaporation tests. The coals should be tested in groups, and in order that different groups may be compared, even though the tests are made 1,500 miles apart, each group of tests as well as the individual tests should be carried on under similar conditions.

The unit of comparison for coals is the number of pounds of equivalent water evaporated per pound of coal. It is evident that the following items will affect this ratio or unit of comparison: Kind of Coal; Class of Engine; Condition of Engine; Engine Crew, especially the fireman; Class of Service.

Since the object of coal tests is to determine the comparative value of various coals, all others of the above conditions should be kept as uniform as possible.

In a series of tests which have all been conducted under similar conditions, the heat value of each coal is proportional to the equivalent number of pounds of water evaporated from and at 212 degrees per pound of coal.

The results covering the A. B. C. Railroad will be expressed as follows:

Name of Coal.	Equivalent Evaporation per pound of Coal Actual.	Rank.	Price per Ton.
"A"	5.60	80.0%	$1.50
"B"	5.60	80.0	1.30
"C"	6.30	90.0	1.30
"D"	6.30	90.0	1.60
"E"	7.00	100.0	1.30
"F"	7.00	100.0	1.10
"G"	7.70	110.0	1.40
"H"	7.70	110.0	1.20
"I"	8.40	120.0	2.10
"J"	8.40	120.0	2.50

The above coals do not necessarily represent individual companies or mines, but coals of equal heat value and price from the same point of distribution are included under one name.

For convenience the coals have been assumed to be poorer and better than the standard coal by multiples of

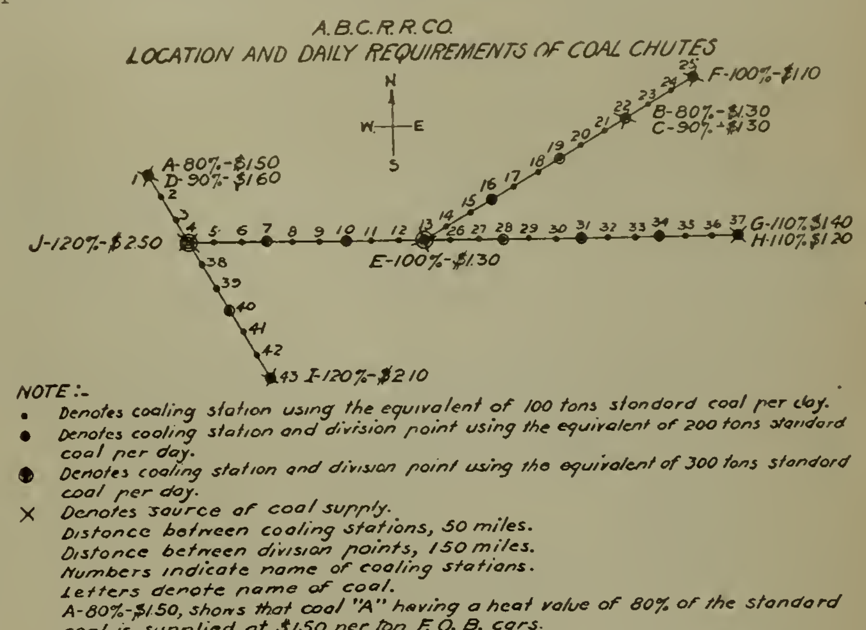


FIG. 3.

10 per cent. The prices selected in most cases bear little or no relation to the heat value which is true under actual conditions.

COAL DISTRIBUTION, A. B. C. RAILROAD.

For convenience, the A. B. C. Railroad System, as shown in Fig. 3, has been assumed as having the following requirements and conditions:

(1) Coaling stations require respectively the equivalent of 100, 200 and 300 tons of standard (100%) coal per day.

(2) That the railroad can get as much coal as it desires from all the sources of supply.

(3) That all these coals will mix with each other without additional trouble from clinkering, etc.

(4) Cost of handling at chutes, ten cents per ton.

(5) Cost of haulage from source of supply to chute, two mills per ton mile. (Under the accounting system put in force by the Interstate Commerce Commission on July 1st no charge is made against the fuel account for the haulage of coal on a company's own line. This has been the practice, at least on the more important lines, for a number of years past; although about 1901 at least two of the important systems charged their fuel account with the haulage of company coal at the rate of three and five mills per ton mile, respectively. Whether or not the haulage of company coal on a company's own line is, or is not, charged to the fuel account, is a matter of no importance, as the cost remains the same in either case, but in order to work out the best coal distribution it is a matter of the utmost importance to know accurately this cost of haulage. The above rate of two mills per ton mile is probably too low in most cases, but is selected at this figure to simplify the computations to follow.)

COMPETITIVE POINTS.

The prices and heat values of the coals have been so selected that they illustrate a number of combinations

*Abstract of a paper by Mr. J. G. Crawford, fuel engineer, C., B. & Q. R. R., before the November meeting of the Western Ry. Club.

that arise in practice which will be taken up under the following headings:

EQUAL HEAT VALUE, UNEQUAL PRICE AND SAME SOURCE OF SUPPLY.

Coals "G" and "H" having the same heat value, and being supplied from the same point, should cost the same. As $1.40 per ton is asked for "G" and $1.20 for "H," "G" should not be used, and thus is eliminated from consideration.

EQUAL HEAT VALUES, UNEQUAL PRICE AND DIFFERENT SOURCES OF SUPPLY.

Coals "J" and "I," Fig. 4, have the same heat value, and "J" is supplied at $2.50 per ton from station No. 4, 300 miles from station No. 43, where "I" is supplied at $2.10 per ton.

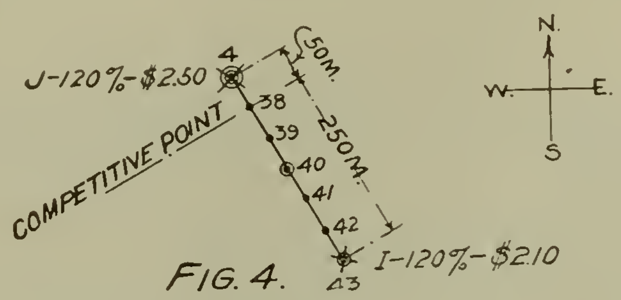


FIG. 4.

The dividing line between coals "J" and "I," which is called the competitive point, is found from the following equation in which "X" is the distance from station No. 4 to the competitive point.

$$\frac{\$2.50 + \$\ .10 + x\ (\$\ .002)}{120\%} = \frac{\$2.10 + \$\ .10 + (300 - x)\ \$\ .002}{120\%}$$

$$x = 50 \text{ miles}$$

This shows that at all points north of station No. 38 "J" coal should be used; south of station No. 38 "I" coal should be used, and at station No. 38 either "I" or "J" coal can be used, as both will cost $2.70 on the engine at that point, made up as follows:

	Coal "J"	Coal "I"
F. O. B. Station	No. 4	No. 43.
First cost	$2.50	$2.10
Haulage	.10	.50
Handling at chute	.10	.10
Cost on engine, per ton	$2.70	$2.70
Cost on engine of amount equivalent to one ton of standard coal	$2.25	$2.25

Coals "E" and "F," Fig. 5, have also the same heat

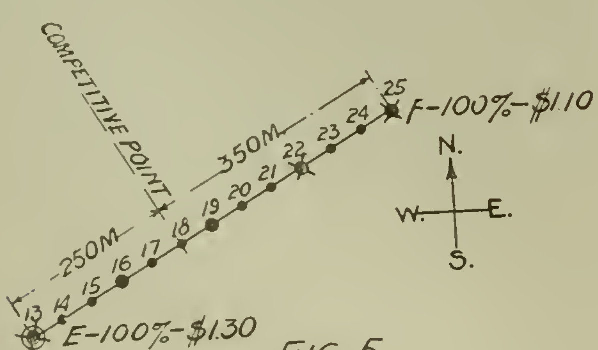


FIG. 5.

value and are from different sources of supply:

The equation for finding the competitive point of these coals is as follows:

$$\frac{\$1.30 + \$\ .10 + x\ (\$\ .002)}{100\%} = \frac{\$1.10 + \$\ .10 + (600 - x)\ \$\ .002}{100\%}$$

$$x = 250 \text{ miles}$$

This shows that at station No. 18 both coals cost the same, made up as follows:

	Coal "E"	Coal "F"
F. O. B. station	No. 13	No. 25
First cost	$1.30	$1.10
Haulage	.50	.70
Handling	.10	.10
Cost on engine	$1.90	$1.90

UNEQUAL HEAT VALUES, EQUAL PRICE, SAME SOURCE OF SUPPLY.

Coals "B" and "C," costing the same, are supplied from the same source, but "B" is an 80 per cent and "C" a 90 per cent coal. As "C" is 12½ per cent better than "B," "C" should be used and "B" excluded.

UNEQUAL HEAT VALUES, UNEQUAL PRICES, SAME SOURCE OF SUPPLY.

Coals "A" and "D" are supplied from the same source, but are different in both heat value and price, "A" being an 80 per cent coal costing $1.50 per ton, and "D" being a 90 per cent coal costing $1.60 per ton. "D" being 12½ per cent better than "A," and costing only 6 2/3 per cent more, should be used to the exclusion of "A."

UNEQUAL HEAT VALUES, UNEQUAL PRICES AND DIFFERENT SOURCES OF SUPPLY.

Coals "D" and "J," Fig. 6, are unequal in heat value

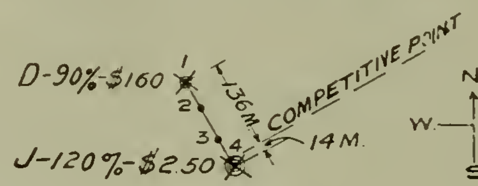


FIG. 6.

and price and are supplied from different points. Their competitive point would be found as follows:

$$\frac{2.50 + \$\ .10 + x\ (\$\ .002)}{120\%} = \frac{\$1.60 + \$\ .10 + (150 - x)\ \$\ .002}{90\%}$$

$$x = 14.3 \text{ miles}$$

The competitive point of coals "D" and "J" is fourteen miles north of "J," therefore chutes at stations No. 1, No. 2, and No. 3 should be supplied with "D," and station No. 4 with "J." At the competitive point coal on the engine would cost as follows:

	Coal "D"	Coal "J"
F. O. B. station	No. 1	No. 4
First cost	$1.60	$2.50
Haulage	.27	.03
Handling	.10	.10
Cost on engine, per ton	$1.97	$2.63
Cost on engine of amount equivalent to one ton standard coal	$2.19	$2.19

The competitive point of coals "J" and "E," Fig. 7, is found from the following equations:

$$\frac{\$2.50 + \$\ .10 + x\ (\$\ .002)}{120\%} = \frac{\$1.30 + \$\ .10 + (450 - x)\ \$\ .002)}{100\%}$$

$$x = 36.4 \text{ miles}$$

This shows that "J" coal cannot be used east of station

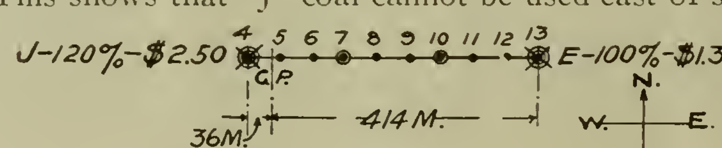


FIG. 7.

No. 4 and that "E" coal should be used at stations No. 5 to No. 13 inclusive. At the competive point coal on the engine would cost as follows:

	Coal "J"	Coal "E"
F. O. B. station..................	No. 4	No. 13
First cost	$2.50	$1.30
Haulage	.07	.83
Handling	.10	.10
Cost on engine, per ton............	$2.67	$2.23
Cost on engine of amount equivalent to one ton standard coal........	$2.23	$2.23

The competitive point of coals "E" and "H" is determined by the following equation, as shown in Fig. 8.

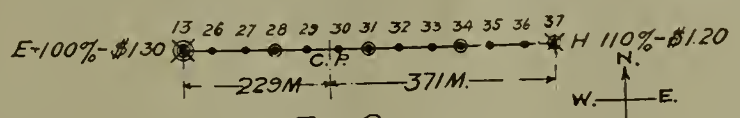


FIG. 8

$$\frac{\$1.30 + \$.10 + x\,(\$.002)}{100\%} = \frac{\$1.20 + \$.10 + (600 - x)\,\$.002}{110\%}$$

$$x = 229 \text{ miles}$$

"E" coal is thus limited to station No. 29 and west thereof and "H" coal from stations No. 30 to No. 37 inclusive. At the competitive point the following would be the cost of coal on the engine:

	Coal "E"	Coal "H"
F. O. B. station..................	No. 13	No. 37
First cost	$1.30	$1.20
Haulage	.46	.74
Handling	.10	.10
Cost on engine per ton............	$1.86	$2.04
Cost on engine of amount equivalent to one ton standard coal.........	$1.86	$1.86

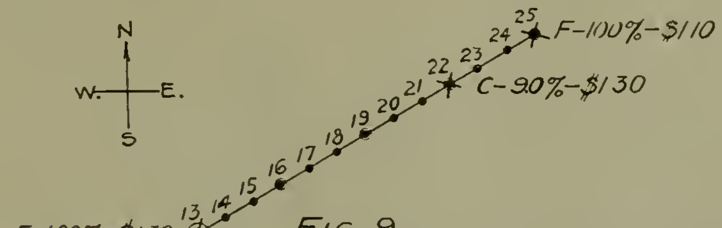


FIG. 9.

The competitive point of coals "C" and "F," Fig. 9, is found from the following equation:

$$\frac{\$1.30 + \$.10 + x\,(\$.002)}{90\%} = \frac{\$1.10 + \$.10 + (150 - x)\,\$.002}{100\%}$$

$$x = -13.2$$

Note that "X" is a negative quantity which shows that "F" can be hauled 26.4 miles more than the above 150 miles and then cost the same on the engine at station No. 22, the point of distribution of "C," as the amount of "C" coal equivalent to one ton of standard coal. This is proven by the following table:

	Coal "C"	Coal "F"
F. O. B. station..................	No. 22	No. 25
First cost	$1.30	$1.10
Haulage	.00	.30
Handling	.10	.10
Cost on engine	$1.40	$1.50
Cost on engine of amount equivalent to one ton standard coal.........	$1.55	$1.50

The present coal distribution on the A. B. C. Railroad

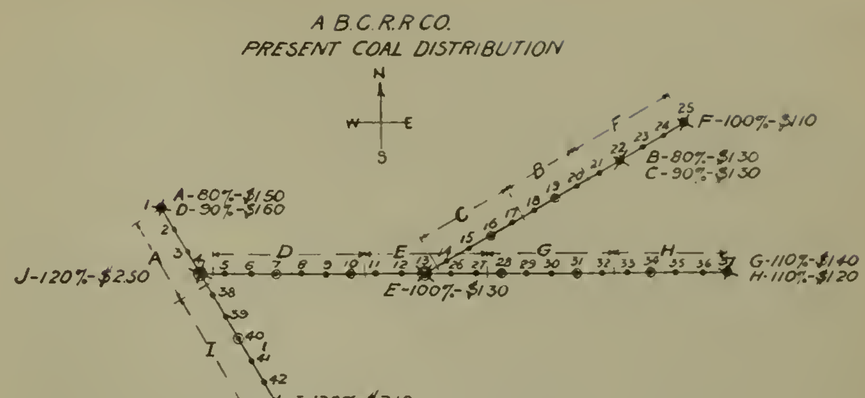


FIG. 10

PRESENT VS. PROPOSED COAL DISTRIBUTION A. B. C. R. R.

is shown by Fig. No. 10 and the proposed distribution by Fig. No. 11.

Some objection may be offered to the distribution shown in Fig. No. 10, but when it is considered that the relative heat values are not known before tests have been made the distribution is not an improbable one.

The cost of fuel per day under the present system of

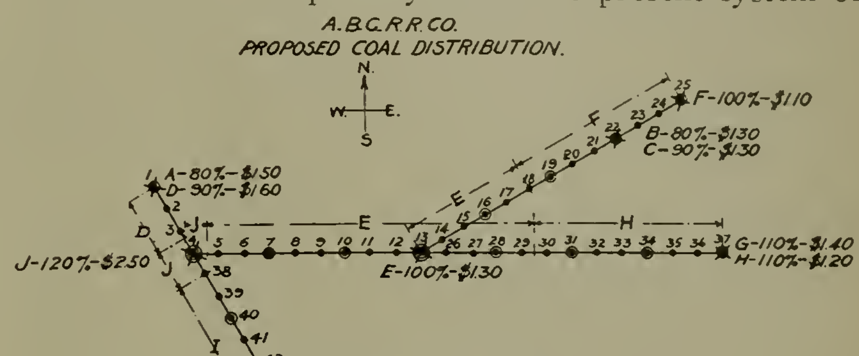


FIG. 11.

coal distribution is shown in Table No. 1 and that of the proposed distribution by Table No. 2.

The following totals, Table No. 3, made up from Tables No. 1 and No. 2, show the amount of each kind of coal used under the present and proposed distributions:

Kind of Coal.	Present Distribution: Tons Used.	Present Distribution: Equivalent to Following Tons of Standard Coal.	Proposed Distributio: Tons Used.	Proposed Distributio: Equivalent to Following Tons of Standard Coal.
"A"	875.0	700	.0	6
"B"	500.0	400	.0	0
"C"	555.5	500	.0	0
"D"	888.8	800	444.4	400
"E"	700.0	700	2300.0	2300
"F"	700.0	700	1100.0	1100
"G"	636.3	700	.0	0
"H"	636.3	700	999.9	1100
"I"	666.4	800	583.1	700
"J"	.0	0	333.3	400
Total	6158.3	6000	5760.7	6000

Table No. 3.

The following Table, No. 4, shows the averages and totals of Tables Nos. 1 and 2, and shows the savings to be made by adopting the proposed distribution:

Coal Distribut'n	Tons	Average Haulage	Ton Miles	Cost of Coal: First Cost	Cost of Coal: Haulage	Cost of Coal: Handling	Cost of Coal: Total
Present	6158.3	176	1,084,035	$8840.55	$2168.07	$615.83	$11,624.45
Proposed	5760.7	136	783,140	8058.68	1566.28	576.07	10,201.03
Difference	397.6	40	300,895	$ 781.87	$ 601.79	$ 39.76	$ 1,423.42

Table No. 4.

The proposed coal distribution would effect a daily saving of $1,423.42 on a daily expenditure of $11,624.45, or a saving of 12.2 per cent; $782 of the saving is due to the decreased amount paid mine companies; $602 due to saving in haulage, and $40 is saved by having less tons of coal to handle, there being only 5,761 tons of coal used daily under the proposed distribution as against 6,158 tons under the present distribution. The table also shows the decrease in the average length of haul and the decrease in total ton miles.

It is not expected that every railroad company in working out a coal distribution would find that there could be a saving of over 12 per cent made by distributing the coal according to the methods herein outlined, but there is no doubt but what considerable saving is to be effected on most systems.

The relative importance of fuel and oil economy has often been mentioned, but by way of comparison it may be said that a saving of less than two per cent in the fuel bill would pay for the entire amount of oil and waste used for locomotive lubrication, and many railroads can save several times the amount of the lubrication bill by perfecting their system of coal purchase and distribution.

During the last fiscal year the average cost of fuel for locomotives and lubrication for locomotives on several leading western roads was as follows:

Fuel for locomotives.............	$6,042,266	13.2%
Lubrication for locomotives.......	148,160	.3%
Total operating expenses.........	45,604,820	100%

This shows that the cost of lubrication of locomotives amounts to only 2.5% of the cost of fuel for locomotives and that at least forty times the energy that is now spent in reducing the cost of lubrication should be expended on the fuel item.

It is not expected that any railroad can at all times distribute coal according to some predetermined plan, but the cost of fuel will be considerably less, when purchased and distributed according to its heat value and cost, than though purchased and distributed in a semi hap-hazard manner.

The greatest saving can probably be effected when the commercial demand is not at a maximum, which will prove beneficial to purchase and distribution by allowing more economical coals to be used and correspondingly less amounts of the less economical coals.

DISCUSSION.

The discussion of the paper was general and while the opinion generally prevailed that the proposed plan could be worked out to advantage under favorable conditions, there was some doubt expressed in regard to the practicability of the plan under general operating conditions. The effect of grades, direction of volume of business, etc., on the proposed distribution were questions raised by various members. In answer, the author of the paper explained that these conditions could be taken care of by assigning the proper haulage rate to each individual case about which there was any doubt. This would show the most economical distribution under the conditions and definitely locate the proper competitive point. Regarding the haulage rate the author continued as follows: The haulage rate should be accurately determined for you will note from Table No. 2 that the cost of haulage amounts to nearly 20% of the first cost of the coal, and this on a basis of 2 mills per ton mile. The most accurate determination of this cost would include separate rates from each mine or point of supply to each coal chute and in many cases this would involve the use of different east and west bound rates over the same division. In some cases these refinements might be warranted.

In any event the rate should be figured about as follows:

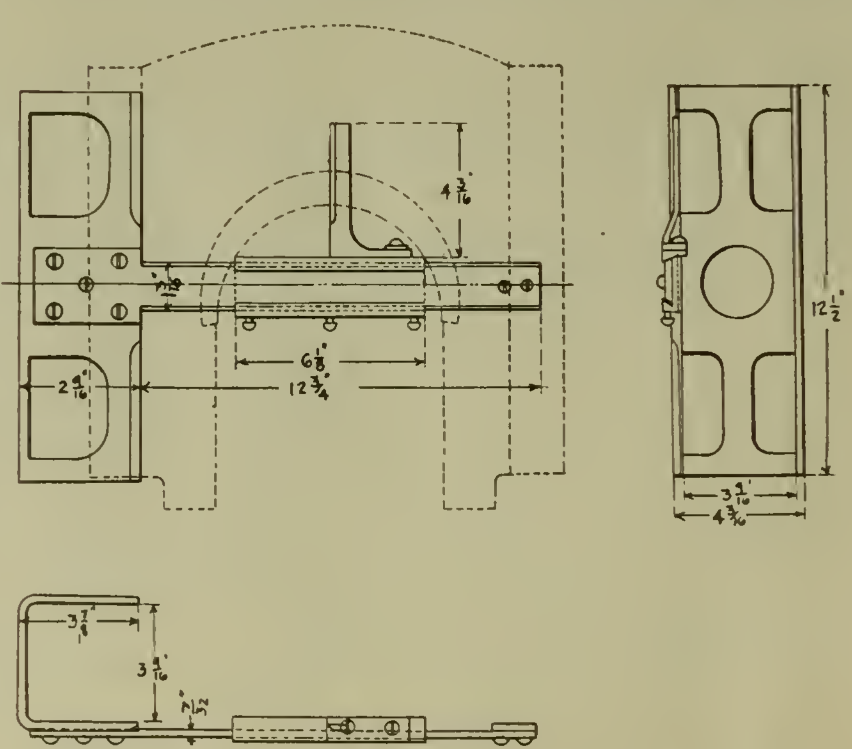
A railroad is hauling 10,000,000 ton miles per day of which 1,000,000 ton miles are company coal and conditions change so that 1,200,000 ton miles company coal are hauled or a total for all freight of 10,200,000 ton miles. The rate per ton mile for hauling company coal should then be figured as the difference in operating expenses for 10,200,000 ton miles and the operating expenses for 10,000,000 ton miles divided by 200,000 ton miles. This method will avoid charging the haulage of coal with operating expenses which would not be affected by an increase or decrease of ton-mileage of company coal.

The discussion also brought out the fact that supply agents were not always allowed to buy the coal best adapted to locomotive service and from mines favorably located in regard to economical distribution. In commenting on this Mr. Crawford very aptly said: If for any reason a certain coal company or group of coal companies must be favored it is advisable for both the traffic and operating departments to know what it costs to favor those companies. If it costs $50,000 per year to favor the Blue Circle Coal Company and the railroad company does not get $50,000 benefit from that favoritism, then the favoritism should be cut to a paying basis.

Driving Box Centering Device

Great Northern Railway.

THE practice in the Dale Street, St. Paul, shops of Great Northern Railway is to bore brasses in driving boxes regardless of the absolute center between shoe



DRIVING BOX CENTERING DEVICE—GREAT NORTHERN RAILWAY.

and wedge faces and adjust the thickness of shoe and wedge to correspond to the distance between center of brass and face of box.

To transfer the lines indicating the shoe and wedge faces to the side face of the box and to determine the center of the brass quickly and accurately an ingenious tool has been devised by Mr. James C. Heron, general foreman. This tool is illustrated by the accompanying line drawing. It consists of a "T" square having a "U" shaped head and with an adjustable slide on the straight edge. The legs of the "U" forming the head are of the same length so that when one edge is placed against the shoe or wedge face, a line scribed on the side face indicates accurately the position of the shoe or wedge face. The slide on the straight edge of the tool carries a small square so adjusted that the vertical edge is centrally located between the two ends of the slide. Then, with the edge of the "T" square head against the shoe or wedge face and with the upper corners of the slide against the curved face of the brass, a line scribed on the edge of the brass or on the face of the box, will indicate the true center of the brass. From these lines, the distances from the center of the brass to the shoe and wedge faces may be readily measured and the required thickness of the shoe and wedge determined accordingly.

The practice of the Great Northern Railway is to perform all driving work box by an auxiliary gang operating on the machine floor so that when the boxes are delivered to the erecting floor they are ready to go on the journals. Brasses are fitted to mandrels which correspond in size to the journals on which the boxes will go into service.

Pacific Type Locomotive

Chicago, Rock Island and Pacific Ry.

THE American Locomotive Company have recently built 30 consolidation locomotives for the Chicago, Rock Island & Pacific Railway. The design of these locomotives is especially interesting as it illustrates the trend in modern locomotive boiler construction more clearly than most of the recent designs. The engines have a total weight in working order of 204,500 pounds, 183,000 pounds of which is carried on the driving-wheels. The cylinders are 23 in. in diameter by 30 in. stroke, and with a working pressure of 185 pounds these engines have a maximum tractive force of 39,610 pounds. They are intended for heavy freight service, and, although, except for the application of the Allfree Hubbell design of valves and cylinders to ten of the order, they represent no special features of design, they are an excellent example of an engine for heavy freight service.

The distinctive features of the Allfree-Hubbell valves and cylinders has already been thoroughly illustrated and described in the February issue of the Railway Master Mechanic so that it will not be necessary to go into details in this article, but reference can be had to the issue indicated describing this design.

The valves, as will be seen from the engraving of the side elevation of the engines, are actuated by the Walschaert valve gear. In this instance the link bracket is attached directly to the back of the guide yoke, and the reverse shaft bearing is integral with the link bracket. The reach rod which is made of 2 in. heavy iron pipe is connected to a downward extending arm of the reverse shaft, and the radius bar is connected by means of a lifting link to a backward extending arm of the shaft. It will be noticed from the halftone engraving of the engine that grease cups have been applied to the front and back bearings of the eccentric rod, which in our opinion is a very good idea and will considerably lessen the wear of these parts.

PACIFIC TYPE LOCOMOTIVE WITH ALLFREE-HUBBELL VALVES AND CYLINDERS—ROCK ISLAND SYSTEM.

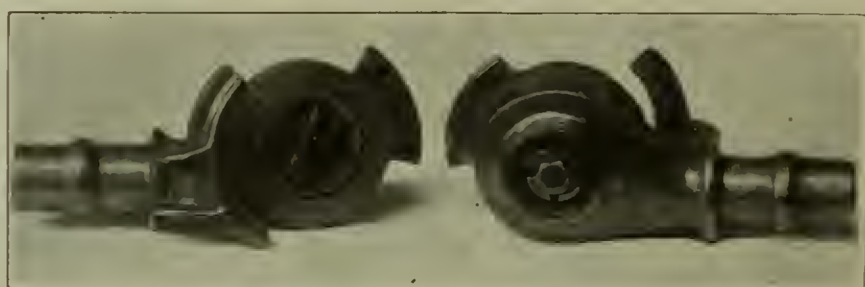
Although by no means the heaviest consolidation engines built, these are the largest locomotives of this type ever built by this company for the Rock Island road. Compared with other engines of this type nearest in weight and capacity now in service on that road, of which there were 100 built by the same builders, the engines here illustrated have cylinders 1 in. larger in diameter, 2 in. larger boiler, Walschaert valve gear, and the last 10, as before mentioned, Alfree-Hubbell valves and cylinders. In spite of the 2 in. larger boiler these engines have 340 2-in. tubes 15 ft. 6 in. long instead of 383 tubes of the same length and diameter as in the other engines of this type nearest in design now on that road. This reduction in the number of tubes gives a spacing of 1 in. between the tubes in this design, which would seem a very favorable feature. The increase in the diameter of the cylinders also permits of a reduction of boiler pressure from 200 pounds to 185 pounds in these latter engines, which would seem to indicate an increasing tendency towards lower boiler pressure in American locomotive practice. The increase in the diameter of the cylinders, however, in the design here illustrated more than makes up for the decrease in working pressure and gives these engines a maximum tractive force of 39,610 pounds, making them to the best of our knowledge the most powerful engines of this type now on the Chicago, Rock Island & Pacific Railroad. The frames which are of cast steel with double front rails double bolted and keyed to the main frames are 5 in. wide.

The general dimensions and specifications are as follows:

Type of engine	Consolidation
Service	Freight
Fuel	Bit. coal
Tractive force	39,610 lbs.
Gauge	4 ft. 8½ ins.
Cylinders	23 in. x 30 in.
Valve gear, type	Walschaert
Valves, size and kind	Richardson slide
Valves	Steam lap 1 in. Exhaust lap .0 in.
Valve travel, in full gear	5¾ ins.
RATIOS.	
Weight on drivers ÷ tractive force	4.6
Tractive force × diam. drivers ÷ heating surface	850.
Total heating surface ÷ grate area	57.
Firebox heating surface ÷ tube heating surface	.061
Weight on drivers ÷ total heating surface	6.2
Volume of cylinders cu. ft.	14.4
Total heating surface ÷ volume of cylinders	202.
Grate area ÷ Volume of cylinders	3.5
BOILER.	
Type	Extended wagon top
Working pressure	185 lbs.
Diameter first ring	74 ins.
Staying	Radial
FIRE BOX.	
Material	Steel
Length	107 ins.
Width	67¼ ins.
Thickness of sheet	Sides ⅜ ins. Back ⅜ ins.
Thickness of sheets	Crown ⅜ ins. Tube ⅝ ins.
Water space	Front 5 ins. Sides 5 ins. Back 5 ins.
TUBES.	
Material	Iron
Wire gauge	No. 11.
Number	340
Diameter	2 ins.
Length	15 ft. 6 ins.
HEATING SURFACE.	
Fire box	167.8 sq. ft.
Tubes	2,743 sq. ft.
Total	2,910.8 sq ft.
Grate area	51 sq. ft.
DRIVING WHEELS.	
Diameter, over tires	63 ins.
Diameter, wheel centers	56 ins.
Journals, main, diameter and length	10 in. x 12 in.
Journals, others, diameter and length	9 in x 12 in.
Material centers	Cast steel
ENGINE TRUCK WHEELS.	
Diameter, engine truck	36 ins.
Journals, engine truck, diameter and length	6 in. x 12 in.
WHEEL BASE.	
Driving	17 ft. 0 in.
Total engine	26 ft. 0 in.
Total engine and tender	58 ft. 0 in.
WEIGHT.	
On driving wheels	18,300 lbs.
On engine truck	21,500 lbs.
Total engine	204,500 lbs.
Total engine and tender	357,300 lbs.
TENDER.	
Style	Water bottom
Wheels, diameter	33 ins.
Journals, diameter and length	5½ in. x 10 in.
Water, capacity	7,000 gals.
Coal, capacity	15 tons

Automatic Steam and Air Coupling

THERE are frequent accidents to freight trains on account of train line angle cocks becoming accidentally closed or through the failure of trainmen to open them throughout the length of the train. In either event the braking power of the train is reduced below the safe limit and the movement of the train is not within the control of the engineer. While the ordinary coupling



AUTOMATIC AIR HOSE COUPLING, UNCOUPLED.

and angle cock are efficient when properly handled, there are a number of objections to the arrangement which sometimes are of a very serious nature.

The illustration shows a coupling which has been designed to overcome the objections to the ordinary

AUTOMATIC AIR HOSE COUPLING, COUPLED.

angle cock. This coupling is a consolidation of the ordinary and standard coupling and the train line angle valve. The valve for closing the train line is placed within the body of the coupling and is automatically opened or closed as the hose are coupled and uncoupled. Externally the coupling has not been changed from the standard so that it is interchangeable with the couplings now in use.

The construction of the coupling is very simple. The air enters the coupling from the hose the same as at present, and passing around the hollow shell passes through four openings of the valve through corresponding openings of the next coupling. The flow of air is not restricted beyond the limits of present practice. The valve is rotated from an open to closed position as the hose are uncoupled so that each coupling is closed until coupled up again. Likewise the valves are automatically opened when the hose are coupled. This prevents any mistakes being made and as the valve is inclosed it cannot be tampered with. When the coupling is in use with the standard coupling, the valve is opened with a small wrench giving direct connection.

There are a number of good features of this coupling which has been patented by Mr. A. H. Skillings, Ashburnham, Mass. Tests have shown that it is a practical coupling for air and steam pipes under any allowable pressure.

A Modern Foundry Building

UNTIL recent years the foundry was rare as a component part of a railway shop plant. Foundry work is entirely of a manufacturing nature and with the recent development of the large railway shop plant, the tendency toward the general introduction of the foundry as a principal department has become pronounced. Several railway general shops completed since 1902 include grey iron foundries as essential features and a number of shops now in the course of construction include elaborate plans for foundry work. The tendency is to concentrate the foundry work for the entire system at the general shops, so that the foundry has not entered into the consideration of plans for minor and division shops.

As most of the railroad foundry buildings are of comparatively recent construction it is observed that the good features of other modern shop buildings have been included in the design of the foundry. Thus large provisions for natural lighting, facilities for ventilation, etc., are noticed in a number of foundry buildings. While most of the foundry constructions can be commended for their modern arrangement, it is believed that the foundry recently built by the Michigan Stove Co., Detroit, Mich., offers a number of improvements in design that can be adapted to railroad foundry construction with advantage.

As shown by the illustrations the building is of steel construction with the side and end walls largely composed of glass windows. The building is 128 ft. square with a height from floor to roof of 40 ft. The side walls are 30 ft. high to the eaves and the extreme height to the top of the monitors is 50 ft. The foundations are of concrete, the walls are 12 in. thick and 6 ft. high, composed of brick. The frame work of the building is steel. The floor is of brick laid in cement.

A MODERN FOUNDRY BUILDING WHICH EMBODIES A NUMBER OF NEW AND ORIGINAL IDEAS IN FOUNDRY CONSTRUCTION.

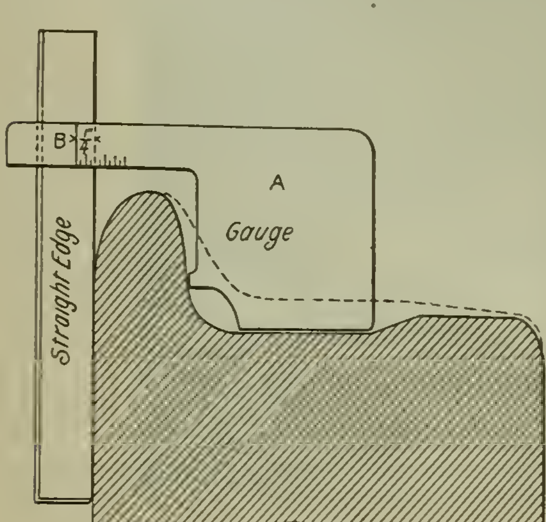
INTERIOR OF A MODERN FOUNDRY SHOWING THE STEEL CONSTRUCTION OF THE BUILDING AND THE LARGE AMOUNT OF WINDOW AREA FOR NATURAL LIGHTING.

The roof construction is unusual. Three monitors are placed crosswise of the central section of the roof, instead of lengthwise. The walls of the monitors are built up largely of windows and every other window is movable to provide for ventilation. The windows in the side walls of the roof are 10 ft. high. The pitch of the roof is low, permitting the use of the ordinary gravel roof covering. The girders and roof trusses are on 18 ft. centers, and for economy in construction a row of columns is placed through the center of the shop to support the roof instead of providing stiffer roof trusses of the full length of span.

The large amount of window area in the walls of the building is shown by the illustrations. There are three rows of windows in each wall, the two upper rows being stationary while the lower row can be opened. A balcony or deck will be erected at some future time on the line of the top of the first row of windows. The present plan is to begin the balcony 10 ft. from the window face making it wide enough to accommodate one row of moulders, with a gangway on the inner side.

The building is almost entirely fire proof so that sprinklers were not installed. Wood was used in the roof, around the window frames and in the charging platform. When the wood is perfectly dry and beyond the danger of dry rot, the upper surface will be covered with sheet metal and the inner side with fireproofing.

The ventilation of the building is excellent. Although surrounded by high buildings the temperature is comfortable on the hottest days and does not rise much during pouring. In about 15 minutes after the heat is off the air is clear of gas and at normal temperature. As before stated, good circulation of air is obtained by opening the lower row of windows and those in the monitors. The building is heated by a forced circulation of hot water at 157 degrees through coils of 1½ in. pipe, giving a radiating surface of 4,300 sq. ft. The temperature at zero weather will average 45 degrees. It is believed that a careful study of this foundry will show the desirability of adopting some of its modern features to railroad building construction.



A Flange Worn	B Depth of Cut	C Reducing Tire in Diam.
1/32 in	1/16 in	1/8 in
1/16 "	1/8 "	1/4 "
3/32 "	3/16 "	3/8 "
1/8 "	1/4 "	1/2 "
5/32 "	5/16 "	5/8 "
3/16 "	11/32 "	11/16 "
7/32 "	3/8 "	3/4 "
1/4 "	7/16 "	7/8 "
9/32 "	1/2 "	1 "
5/16 "	17/32 "	1 1/16 "
11/32 "	9/16 "	1 1/8 "
3/8 "	5/8 "	1 1/4 "
13/32 "	21/32 "	1 5/16 "
7/16 "	11/16 "	1 3/8 "
15/32 "	3/4 "	1 1/2 "
1/2 "	25/32 "	1 9/16 "

GAUGE FOR MEASURING UP DRIVING WHEEL TIRES BEFORE TURNING.

COMMUNICATION

Turning Driving Wheel Tires

Editor Modern Machinery:

It seems to me that the question of turning driving wheel tires is not looked into as it should be in the majority of the locomotive repair shops. Driving wheel tires are very expensive and with improper turning will not last very long. When an engine comes in for repairs with badly worn flanges, the wheels are put in the wheel lathe and the tires are turned down at random till a good flange is obtained. In some cases where the flange is worn badly and the shop management has no rule to go by, the wheel lathe man will take off a good big cut, thinking he will get a good flange, and, when he comes to finish it up, he finds that it will not true up, making it necessary to take another cut which takes time. Then again, he will take a deep cut and get it too deep, thereby wasting the tire.

Herewith is presented a sketch and table which I have gotten up and put in service in the shop at this place with excellent success. Take the smallest wheel in the set and the one with the thinnest flange; make gauge, A, from number 16 or 18 boiler iron; put a line at B for the standard thickness of your flange, graduating it back about ½ inch; put a straight edge across the inside of tire, and whatever you find flange to be worn you refer to table (column B). Opposite the amount worn (for instance ¼ inch) you find the depth of cut 7-16 inch, and ⅞ inch reduction in diameter as per column, C. After finding out how much your flange is worn, you caliper the smallest diameter of the tire with the worn flange, then close up your calipers ⅞ inch and you are ready for turning on a mechanical system with no guess work. This table can be printed on good paper with a typewriter and put into a small frame and hung up at the wheel lathe so it can be referred to at any time. Master mechanics will find the life of steel tires much longer with this system of tire turning. This table applies to all steel tired wheels.

Yours truly,

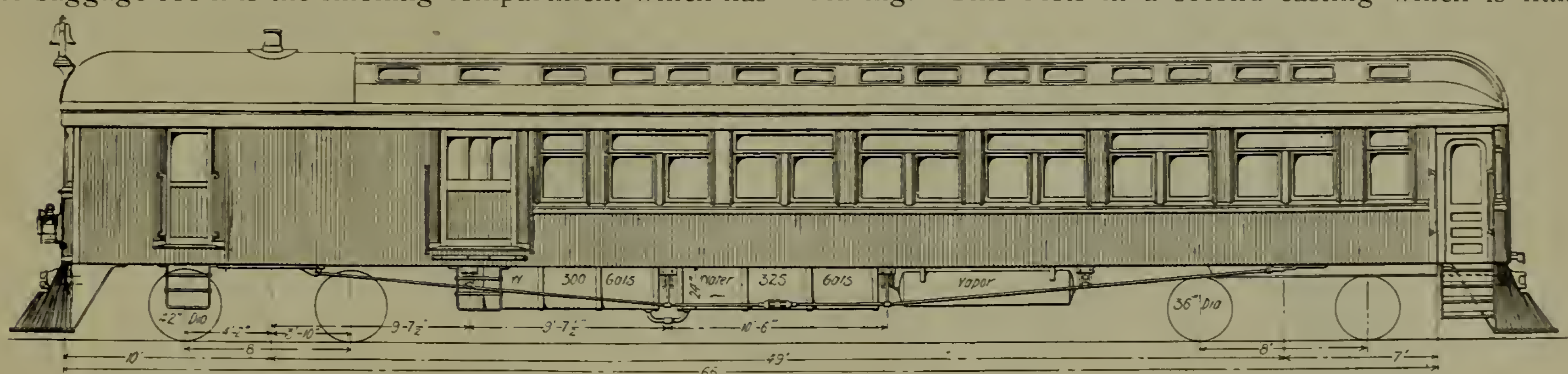
Stroudsburg, Pa. W. H. S.

Steam Motor Car

Intercolonial Railway

A STEAM motor car of original design has been recently completed by the Intercolonial Railway at their Moncton shops. By referring to the accompanying illustrations it will be seen that the car is similar in design to the first class standard coaches of the road. At the motor end, the roof is of wrought iron and curved from plate to plate to which it is bolted, thus permitting it to be moved when it is desired to take out the boiler. As it is intended to run these cars in either direction with or without a trailer, both ends of the car are equipped with pilots and M. C. B. couplers.

The car is 66 ft. long over end sills, 9 ft. 10 in. wide over side sills and is divided into four compartments. The boiler room is 13 ft. 6 in. long and contains the boiler, throttle lever, pump, coal bunkers, etc. The next compartment is the baggage room, 8 ft. 4½ in. long, fitted with large sliding doors at each side. Adjoining the baggage room is the smoking compartment which has



STEAM MOTOR COACH BUILT BY THE INTERCOLONIAL RAILWAY AT THEIR MONCTON SHOPS.

a seating capacity of 12 persons. The passenger compartment is 30 ft. 3 in. long and has a seating capacity of 40 persons. The interior finish and design is similar to the standard coaches. Lavatories are placed at the end of the car.

The vestibule on the end of the car opposite the boiler room is made 7 in. longer than the Pullman standard in order to give more room for the necessary apparatus used when the car is operated from that end. The car is heated by the Safety Car Heating and Lighting Company's steam heat system and lighted by the new incandescent gas mantle lamps of the same company.

The cars are fitted with steel platforms at each end. Water tanks having a total capacity of about 1,000 Imperial gallons and the vapor and gas tanks with the necessary pipes and fittings are slung from the underframing with wrought iron straps. The cars are equipped with the Westinghouse air brake apparatus of the latest and most approved design for cars of this class. The passenger end of the car is carried on a standard four-wheel passenger car truck.

The method of carrying the motor end of the car is unique, having been designed first for these cars. On account of the boiler passing through the center of the car it was not possible to put a center bearing immediately under the car sills and over the center of the engine truck. This had to be carried below the ash pan and was done in the following manner: A large cast steel body bolster weighing about 4,430 lbs. was made to fit the underframing of the car body, having an opening in the center through which the boiler passes. This casting is securely bolted to the sills of the car. Four heavy steel struts carry the weight of the car body to a cast steel bolster below the engine frame having a male center bearing. This rests in a second casting which is hung from the engine frame by means of four wrought iron hangers fitted with equalizing springs. The springs rest in cup shaped caps and seats which allow the car body and engines to take the different positions necessary when rounding curves. The opening in the casting under the car body is made large enough to allow plenty of side, backward and forward motion of the boiler. Buffing springs are arranged in this casting to prevent any jarring when the car is in motion.

The general dimensions of the care are as follows:

Gauge of track	4 ft. 8½ in.
Seating capacity	52 persons
Length over end sills	66 ft. 0 in.
Width over side sills	9 ft. 10 in.
Heights, inside, top of floor to under side of lower deck rail	7 ft. 7¾ in.

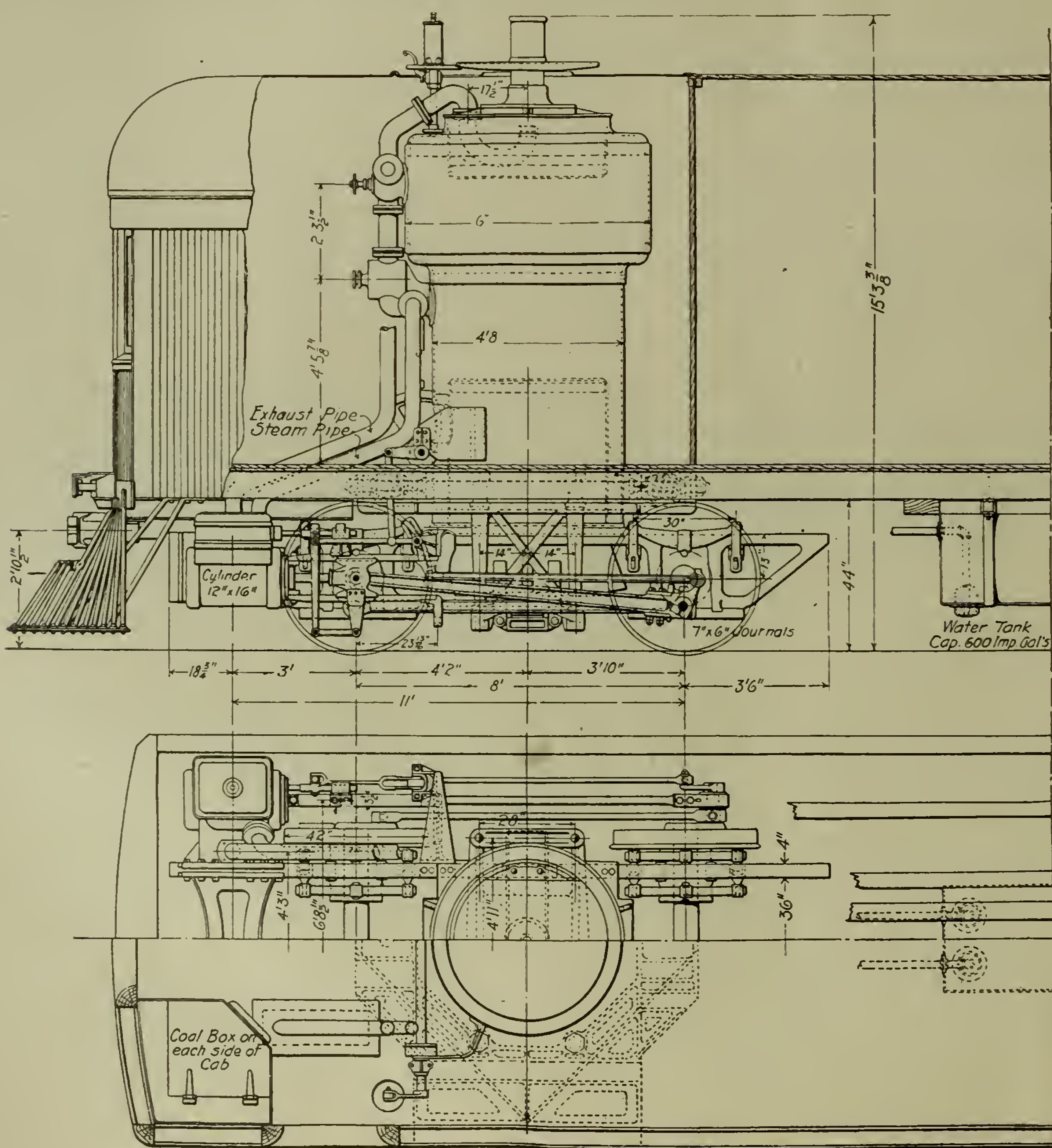
Outside of end sill to center of body bolster at motor end	10 ft. 0 in.
Center to center of body bolsters	49 ft. 0 in.
Wheel base of truck	8 ft. 0 ins.
Side door openings in baggage compartment	3 ft. 8 in.
Side door openings in boiler room	2 ft. 3 in.
Total wheel base	57 ft. 2 in.

BOILER AND MOTOR.

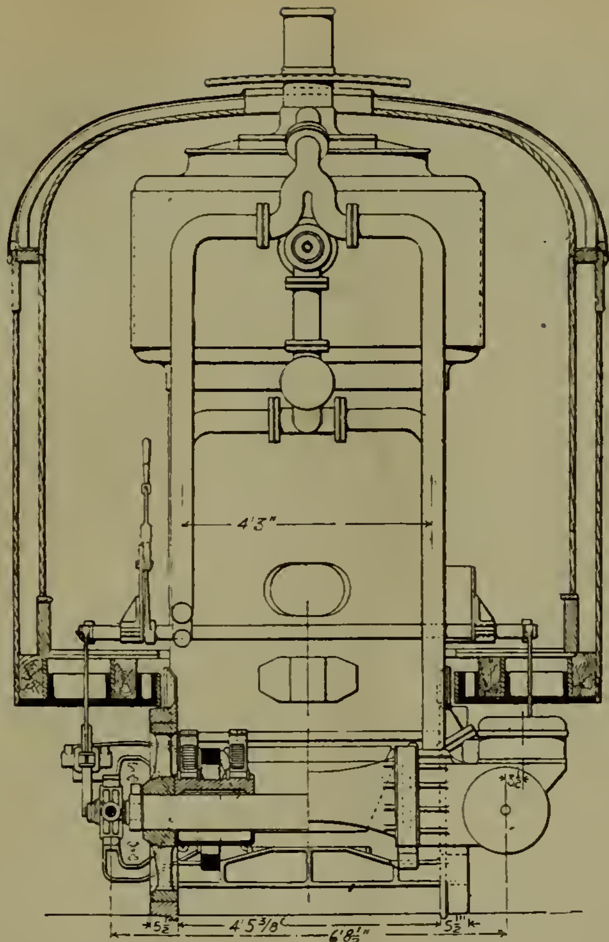
The car body supported on a cast steel body bolster is attached to the equalizing spring gear of the locomotive with four steel struts which are carried on the locomotive frame by means of cross bars and coil springs. The boiler is carried on a cast steel saddle, properly braced and is attached in such a manner that it can be readily removed and replaced. All exposed steam surfaces are lagged with asbestos. The boiler is the vertical type and carries a pressure of 180 lbs. per square inch. The locomotive has outside cylinders, with balanced slide valve operated by the Walschaert valve gear. The cylinders are 12 in. diameter by 16 in. stroke. The capacity of the engine is about 200 horsepower. The journal bearings are 7 in. by 16 in. long.

The principal dimensions and specifications of the boiler and engines are as follows:

Cylinders	12 in. x 16 in.
Driving wheels, dia	42 in.
Wheel base of engine	8 ft. 0 in.
Boiler, type	Circular, upright with steam drum
Heating surface in tubes	684.672 sq. ft.
Heating surface in firebox	44.04
Total heating surface	728,712 sq. ft.
Grate area	11.54 sq. ft.
Working pressure	180 lbs.
Test	250 lbs.
Water tank capacity	About 1000 gals.
Two coal bunkers (½ ton each)	1 ton
Weight of motor (without car)	51,000 lbs.
Weight of motor (with car)	92,000 lbs.
Total weight of motor and car loaded, about	142,000 lbs.
Tractive force	8500 lbs.



PLAN AND SIDE ELEVATION OF FRONT END OF STEAM MOTOR COACH SHOWING DESIGN AND CONSTRUCTION OF BOILER AND ENGINES—INTERCOLONIAL RY.



FRONT ELEVATION AND SECTION OF STEAM MOTOR COACH—INTERCOLONIAL RY.

Horsepower of engine, about	200
Speed on 1 per cent grade	25 miles
Drivers	Coupled
Motor to haul a trailer of	40 tons

The entire motor car was designed in the mechanical drawing office of the Intercolonial Railway, Moncton, under the supervision of the superintendent of motive power, Mr. G. R. Joughins, to whom we are indebted for the illustrations and information regarding this car. The locomotive was built in the Intercolonial shops, and the car body was built at Rhodes Curry & Co.'s Amherst. The work of assembling of the two parts and the trial tests were made in the Intercolonial Works, Moncton.

The first one of the three cars built for the Intercolonial Railway has gone into service, running between St. John & Hampton, and its performance will be watched with more than usual interest.

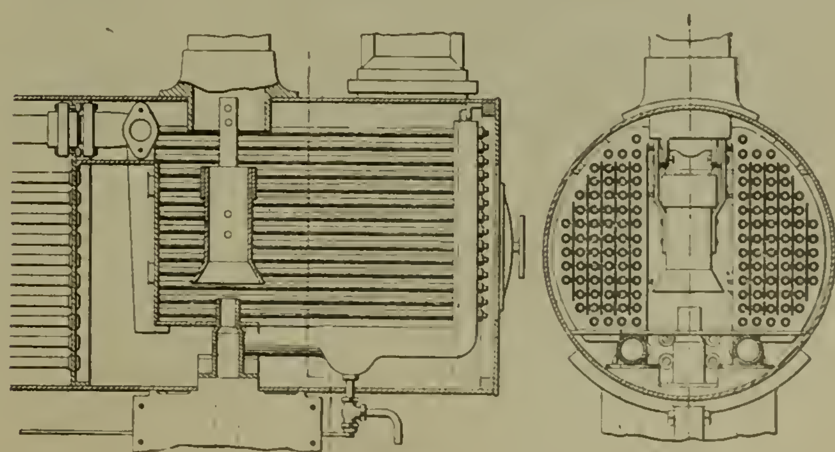
The Munson Locomotive Superheater

THE value of superheated steam in locomotive practice has not been fully realized in this country until recently. In Europe the superheater has been used on locomotives for a number of years with satisfactory results, but the complication of the apparatus kept back its development on American railroads. The Canadian Pacific Railroad has lead in the development of the superheater and it is largely through results obtained by it that this important detail in locomotive construction has been more widely adopted.

There are a number of superheaters in use which differ materially in design and principle. They may be divided roughly into two classes, viz., the fire tube and the smoke box. The former are in more general use and represent the original type of superheater applied to locomotives. The smoke box type is of more recent development and is a design common only to American railroads. The best known superheater of this type is known as the Baldwin and is a product of the Baldwin Locomotive Works. This superheater was thoroughly illustrated and described in the March and May issues of the RAILWAY MASTER MECHANIC. As this superheater has given satisfactory service on a number of roads and is a type that can be applied to locomotives with little change in construction, further development of this design should naturally follow.

One of the first modifications of the Baldwin design of superheater has been devised and patented by Mr. Sweney Munson of Fowler, Colorado. As shown by the illustration this superheater is composed of two groups of horizontal tubes arranged between headers. Each group of tubes is interposed between the dry pipe and valve chamber so that steam will pass through these tubes on the way from the boiler to the cylinders. The hot gases in the front end will circulate around the tubes and give up a certain percentage of their heat to the steam. While in this type of superheater a high degree of superheat cannot be obtained, tests have shown that a superior cylinder steam performance is obtained from locomotives equipped with a similar device. In bad water districts the superheater is especially valuable as it dries the steam and prevents water from being carried over into the cylinders. In the Munson superheater a drainage chamber has been cast on the lower side of the steam pipes and a large pipe screwed into it and extended down through the smoke arch. A plug valve is attached to the end of the pipe and by means of a rod leading from the cab to the handle of the valve, the engineer can drain the superheater at times when the water in the boiler is priming or foaming. This will save the lubrication of the valves and cylinders and perhaps a cylinder head. This drainage pipe can also be opened when the engine is drifting, giving the valves release through the steam pipes. This does away with the use of relief and by pass valves.

The superheating pipes are screwed into the back header and rolled in the front one and a plug opposite each flue is placed in the outer wall of the front heater so that flues can be removed and replaced. In order to obviate the use of stays in the flat faces of the headers, parallel webs are cast between the headers. The flues are arranged between these webs. The construction of the superheater is shown by the illustration.



THE MUNSON LOCOMOTIVE SUPERHEATER.

The rear header is set far enough ahead of the flue sheet to allow work being done on the flues at any time by removing the petticoat pipe and back draft plate between the back headers.

On Being Loyal to the Company

THERE is a lot of tommy-rot said and printed about loyalty. Men in all kinds of service are entreated to be loyal to their employers, to further their interests in every possible way, to always speak well of them, etc. In being loyal to their employers they are told that they are loyal to themselves and to their own best interests. Very true, and we would be among the last to encourage any other spirit, but is it not true that men of every race and in any occupation, whether it be that of the soldier, sailor, artisan, or what not, are loyal only to that which commands their admiration and respect? We are loyal to our country, for we believe it to be the biggest, grandest, freest nation on earth, and so it is with a company. If a company is honest, progressive, fair and liberal in its treatment of employes and customers; in short, is an embodiment of what a manly man would be, it will have no need to cry for loyalty. On the other hand, if its policy is to gain every possible advantage, cut wages, discharge employes on specious pretexts, or because of failing health or advancing years after having served faithfully for long terms, to seize valuable inventions of employes without giving adequate return other than ordinary wages, to put sons of officers or directors in places of authority when they have not earned these places and are incapable of filling the positions without the help of unrecognized assistants, then we believe that loyalty is not to be expected, and men would be indeed poor creatures who would give heart service to such thankless masters.—Machinery.

All Steel Passenger Coach

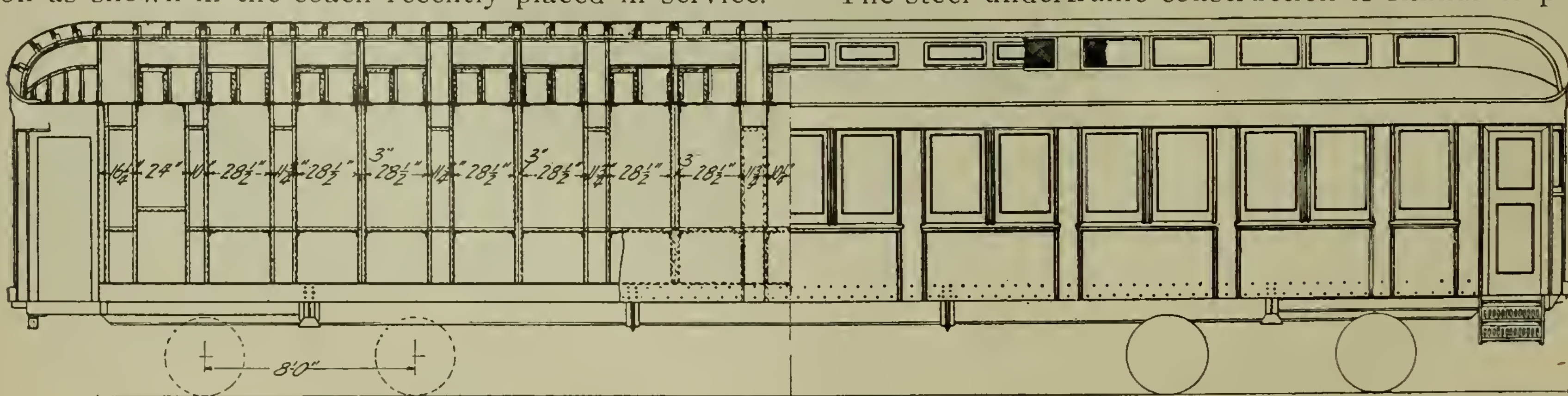
Erie Railroad

THE Erie Railroad has recently added to their equipment a steel passenger coach in which wood and inflammable matter has been almost entirely excluded. The use of steel in passenger car construction is not new on the Erie as they have had a number of steel mail and baggage cars in service for several years. The results obtained from this equipment has led to the further application of steel to car construction as shown in the coach recently placed in service.

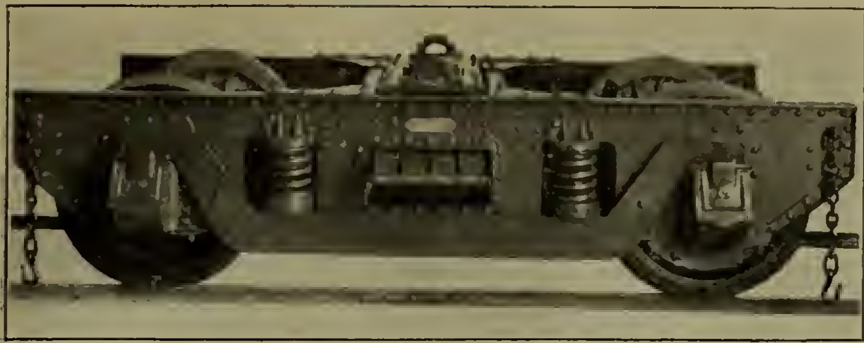
STEEL PASSENGER COACH—ERIE RAILROAD.

The steel coach under discussion both outside and inside, looks much the same as the standard wooden coach. Owing to the use of steel, the construction and dimensions of the experimental coach vary considerably from the standard equipment. The steel car is 52 ft. 8 ins. long over end sills, 9 ft. 9¼ ins. wide over side sills and has an extreme width of 10 ft. ½ in. The car seats 61 people and weighs 96,000 lbs.

The steel underframe construction is similar to pre-



SIDE ELEVATION AND SECTIONS—STEEL PASSENGER COACH, ERIE RAILROAD.

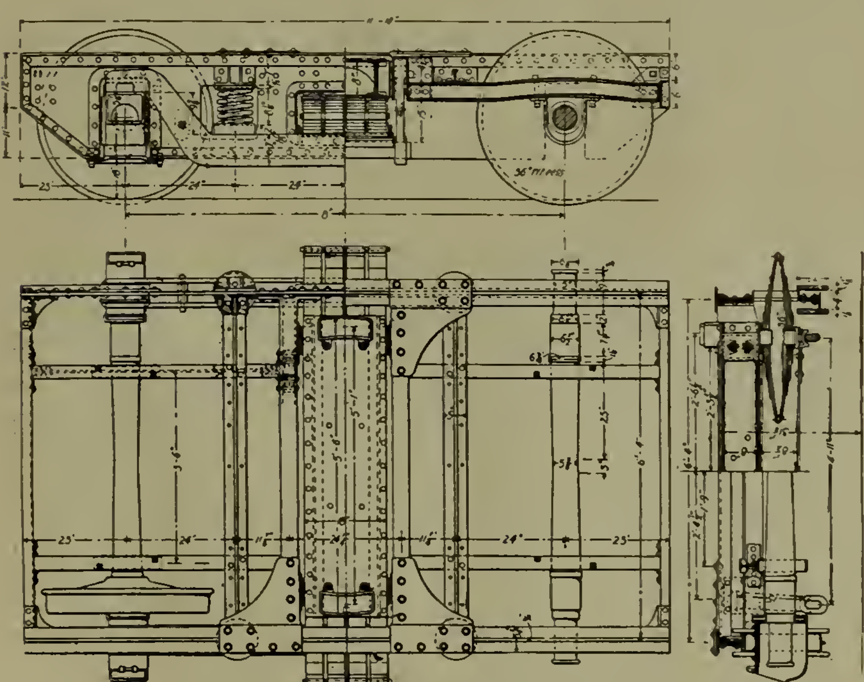


FOUR-WHEEL TRUCK—STEEL PASSENGER COACH, ERIE R. R.

vious designs. The center sills are continuous 15 in. channels. In addition to the center sills, the car is carried by side sills of 8 in. channels and four intermediate sills of 4½ in. I beams. Cross bearers of 4½ in. I beams are spaced on 6 ft. centers. Over the underframe a ⅛ in. steel sheet is laid and on top of this a layer of plastic composite flooring ½ in. thick.

The cross-section of the car is similar in shape and dimensions to the standard wooden coach. The main and upper decks are of treated wood with mouldings of metal. The siding is ⅜ in. steel riveted to the side and end posts which are 3 in. channels. All rivet heads on the outside are countersunk and faced even with the sheet. The vestibules are of the Pullman type. In addition to the small amount of wood used in the decks and other places the end doors are made of this material. The seats are covered with plush but it has been treated with the same preparation as applied to the wood used in the car, which should render it impervious to fire. The total amount of material used in the car that is ordinarily inflammable will not exceed 300 lbs.

The accompanying illustrations show the original design of the truck used under the car. The truck is of the four wheel type and is built up of riveted steel



PLAN, SIDE AND END ELEVATIONS AND SECTIONS OF FOUR WHEEL TRUCK—STEEL PASSENGER COACH, ERIE R. R.

plates. The web plate is ¾ in. steel, reinforced with 2½ in. angles riveted along the edges. The equalizers are made of 1⅛ by 7 in. iron in the usual design. The truck bolster is of the box girder type built up of two 8 in. I. beams held in position by ½ in. cover plates. Wheels are of steel, 36 in. in diameter; journals, 5 by 9 inches. The truck is well proportioned and is of strong rigid construction.

Meeting of Advisory Committee, Master Painters' Association

The annual meeting of the Advisory Committee of the Master Car & Locomotive Painters' Association of the United States and Canada will be held at the Hotel Astor, Times square, New York City, on Saturday, February 22, at 10 o'clock in the morning.

The committee asks the hearty co-operation of all members of the association and will be thankful for suggestions as to subjects for discussion at our next convention. Let us endeavor to have as strong a program as possible.

D. L. PAULUS,
Chairman.

Car Interchange and Inspection

By C. C. Hill, C. & O. Ry.

IN taking up the question of car interchange and car inspection, to produce any new features would be a rather difficult problem. In its ordinary state it is a subject of deep interest to all of us. All the fine points have been absorbed and discussed by men high in authority in car departments; and what has been handed to us should be made the subject of study.

All the officials, from the highest to the lowest, have interested themselves in the problem, and have endeavored to make vital points clear to the ones who hew the wood and carry the water—that is, the car inspector, car repairer, and car foreman. These are the ones that keep cars moving, or have the repair tracks and terminals congested, if not blocked. Not all of them do their best, and many, who are able, lose much of their natural force from contrariness, carelessness, listlessness, egotism and many from lack of judgment.

My experience in the line of car inspectors and repairers has led me to feel that I should rather have a good plug that will do his best than to have a "Cracker Jack" that won't try. Of course, in either case, much depends on the attention given to the work by the foreman. A good foreman makes good men. He will break some in, and more will come to him.

The interchange inspector is usually familiar with the current rules and regulations governing the inspection of cars: defects that come in under the Interstate Commerce law and those chargeable to car owners, those requiring M. C. B. defect card, those that must be repaired in order to make car safe, and those that may be accepted and run on record.

Our inspection at Cincinnati has in a measure become uniform, barring a little kick that is sometimes registered against us by some remote inspection point; (and we

* Paper presented at November meeting of the Cincinnati Car Foremen's Association.

all get an occasional one of these) but these are not so many, and not always wrong.

Inspectors should be conferred with and instructed beyond what is contained in M. C. B. rules. This book has much in little, and when the foreman has placed a book of rules in the hands of the inspector, he has by no means done all that he should do. The meaning is not always clear, and is not construed alike even by those whose business it is to make and promulgate rules. Get together with the men and get their ideas, as well as give them the benefit of yours. In writing on a matter of this kind, ideas are advanced that are familiar to car inspectors generally, and the inspector is flattered by the fact that he was just as familiar with the matter as the writer or the one speaking on the subject; but it has brushed the cobwebs away, and has done him good.

What vastly different views men interested take in the M. C. B. rules is plainly shown by the discussions in M. C. B. conventions, and in the Car Foremen's Associations, and much more so by the number of cases taken to the Arbitration Committee for decisions. If the rules were so very plain, men whose undoubted knowledge has placed them in high positions would not wrangle and go to this Court of Equity for a decision.

Then to go to the car inspector and repairer with the best you have in mind, and give it to him as plain as you can. Give it to him with the understanding that cars are built to run, to carry freight to keep business moving, and to pay (the parties who own and control them) some income from their investment, and to pay you and me for our work, and retarding the movement of cars is just so much against our own interests as well as that of our employers.

The management expects this of us, and any falling short of this detracts from our value as employes. There are not so many vital points to a car. Many of the defects are a reality in fact, are purely imaginary so far as the safety of car and lading is concerned.

Retaliation is the bane of some interchange points: A offers B a car that has some slight defects and an important load. B is in bad humor and very exacting and refuses to accept car only on his own conditions. Car is left laying for a decision from the joint car inspector and is delayed 24 hours, and in all probability the joint car inspector runs the car. All in good time B has a car to offer to A under similar conditions, and here is his opportunity to get even. Following out the same line of argument in the opposite direction, it does not occur to these men that they are retarding the movement of important business.

The management has built these cars to run, and the men who are to see that all possible despatch is used, consistent with safety, are the desirable men. While the inspector, repairer and foreman often assume much, there is in reality very little individuality belonging to them, nor should there be much.

The hustlers get the business, and the management expects it of the inspector to keep things moving, not to retard them.

The Master Car Builders' rules contain much in little, and to the casual reader it seems easy; we find it different from that when making it a study. It has been worked on and revised from time to time by the master minds in the business, and the man who was familiar with its teaching 25 years ago would find it a stranger, or nearly so, at the present. As before stated, the case submitted to the Arbitration Committee are great helpers. Men who are selected from the many on account of their long experience; and taking their decisions as a whole it is a matter on which all are to be congratulated that so very little is found that deserves criticism.

Broad minded, fair minded inspectors and foremen find little difficulty in the interchange of cars. The inspector who seeks trouble will find it. How often has each of us found inspectors or foremen acting on the principle that anything is good enough to be delivered to my neighbor, but nothing he has is good enough for me.

Under the present rules of interchange, car owners are largely responsible for defects; and the builders of this rule built well and understood well the object of the building. The object was to facilitate the movement of traffic. Prompt movement, therefore, largely depends on the inspector, who, at interchange points especially, should be thoroughly acquainted with the vital parts of a car, should know what is practically safe to run, and what should be repaired. Defects that are considered by the Interstate Commerce Commission are many, but they are not of a class that are difficult to overcome, and in almost all cases a remedy can be applied in a few minutes.

The management is on to this fact, and it is up to the inspector, who desires to hold his job, to give the fitness of a car to go his careful consideration, and save unnecessary delays to valuable and hurried shipments.

The car inspector at terminals is one of the important factors. He must be consistent. Be sure you are right, state facts, make yourself familiar with defects that may result in consequential damage, and with defects that look big on paper but are of no consequence as to safety, bearing in mind at all times that you are not inspecting to see how many cars can be set out and laid up for repairs, but how many can be run with safety. Of course it should be understood that I have reference to loaded cars in transit. Empty cars should be overhauled, and all defects repaired whenever practical.

The men who keep cars moving with the least friction or casualty are to the front.

Criticism of one set of inspectors at a given point against those at some point in opposition rarely leads to good results, and I should advise each to adopt the code which kept Babylon the cleanest city in the universe for hundreds of years: "Each man keep his own door yard clean."

Personal Mention

Mr. J. J. Reid has been appointed master mechanic of the Missouri Pacific at Ft. Scott, Kan., succeeding Mr. R. G. Long, resigned.

Mr. C. F. Ludington has been appointed chief fuel superintendent of the Atchison, Topeka & Santa Fe, with headquarters at Topeka, Kan., and Mr. H. E. Wescott has been appointed fuel supervisor of the coast lines, with office at San Bernardino, Cal.

Mr. E. A. Wescott has been appointed superintendent of the car department of the Erie, with headquarters at Meadville, Pa. Mr. E. I. Dodds and Mr. T. Tracy have been appointed assistant superintendents of the car department, both with headquarters at Meadville. The positions of assistant mechanical superintendent, assistant to mechanical superintendent and assistant master car builder have been abolished. Effective on October 15.

Mr. R. W. Evans, master mechanic of the Alabama Great Southern, has been appointed superintendent, with headquarters at Birmingham, Ala., succeeding Mr. R. E. Boswell, resigned.

W. D. McDermott has been appointed master mechanic of the St. Louis Southwestern of Texas, with office at Texarkana, Tex., succeeding Frank Cain. See Houston & Texas Central.

Frank Cain, master mechanic of the St. Louis Southwestern of Texas at Texarkana, Tex., has been appointed assistant general master mechanic of the Houston & Texas Central, with office at Houston, Tex.

J. J. Reid has been appointed master mechanic of the Missouri Pacific Ry. at Fort Scott, Kan., succeeding R. G. Long, resigned.

Mr. J. F. Graham, superintendent of motive power of the Oregon Railroad & Navigation Company, has had his jurisdiction extended over the Corvallis & Eastern, effective on November 5.

Mr. Axel Johnson has been appointed general foreman of the car department of the Lake Shore & Michigan Southern at Collinwood, O., succeeding Mr. J. W. Senger, who has been appointed supervisor of materials, with office at that point.

Mr. William Kennedy, heretofore master mechanic of the Grand Trunk at Toronto, Ont., has been appointed superintendent of motive power of the Central Vermont, with headquarters at St. Albans, Vt., succeeding Mr. A. Buchanan, Jr., resigned.

Mr. William H. Lungren, foreman of car shops of the Philadelphia, Baltimore & Washington at Wilmington, Del., has been retired under the pension rules of the Pennsylvania system, having completed 54 years of service with the latter company.

Mr. J. Markey has been appointed master mechanic of the middle division of the Grand Trunk at Toronto, Ont., to succeed Mr. W. Kennedy, resigned. Mr. J. R. Donnelly has been appointed master mechanic of the northern division at Allandale, Ont., in place of Mr. Markey. Mr. W. Gell succeeds Mr. Donnelly as master mechanic of the Ottawa division at Ottawa, Ont.

Mr. M. M. Dooley has been appointed master mechanic of the Alabama Great Southern at Birmingham, Ala., succeeding Mr. J. W. Evans, promoted.

Mr. C. C. Barclay has resigned as district superintendent of the Pullman Company at St. Paul, Minn., to become connected with the mechanical department of the Northern Pacific at Livingston, Mont.

The headquarters of Mr. R. C. Evans, superintendent motive power and car departments of the Western Maryland, have been removed from Union Bridge, Md., to Hagerstown, Md.; effective on November 4.

Mr. W. I. Rowland, general foreman of the Baltimore & Ohio at Grafton, W. Va., has been appointed master mechanic at that point, succeeding Mr. O. J. Kelly, resigned. Mr. John J. Foley has been appointed general foreman of the locomotive department at Fairmont, Va., in place of Mr. M. V. Prendergast, resigned.

J. E. Cameron, superintendent of motive power of the Atlanta, Birmingham & Atlantic, has resigned and the office has been abolished. R. L. Doolittle, assistant master mechanic of the Central of Georgia at Macon, Ga., has been appointed master mechanic of the Atlanta, Birmingham & Atlantic, with office at Fitzgerald, Ga.

James Carr has been appointed master mechanic of the Midland Valley with office at Muskogee, Ind. T., succeeding C. H. Welch.

Mr. Alfred Lovell, who recently resigned as superintendent of motive power of the Santa Fe, has opened an office as consulting engineer at 819 Harrison Bldg., Philadelphia, Pa. Mr. Lovell will make railroad investigations a specialty and his long and varied experience in railroad work makes him especially competent to engage in work of this kind.

Mr. L. Bartlett, heretofore general foreman of the C., B. & Q. Ry at Danver, Colo., has been appointed master mechanic at Alliance, Nebr., vice Mr. A. C. Adams, resigned.

Mr. W. G. Rose, formerly general foreman of the Wabash at St. Louis, has been appointed master mechanic of the C. H. & D. Ry. at Cincinnati, Ohio.

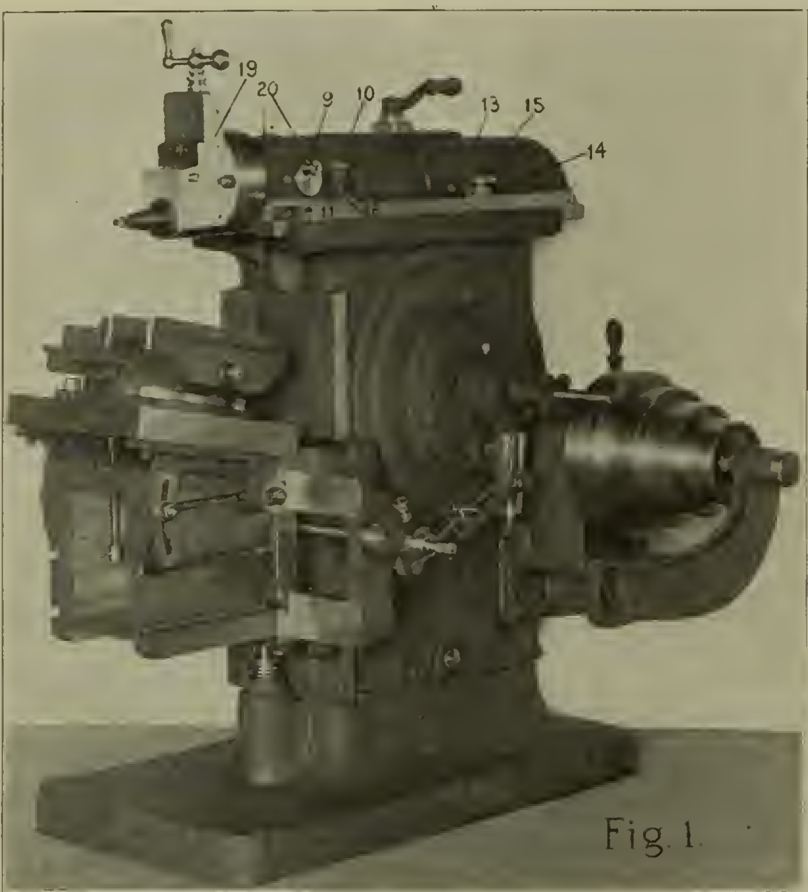
Down Feed Attachment for Shapers

A PATENT was granted August 27, 1907, on the down feed attachment as hereinafter illustrated and described. This attachment is applied to all Stockbridge shapers made by the Stockbridge Machine Co., Worcester, Mass., and is an improved method of imparting a downward feed to the cutting tool. As its operation is automatic the possibilities and economy in the operation of shaper over hand feeding is not only in the saving of operator's time—he can be doing something else—but the feed being absolutely uniform, is up to the full capacity of tool with each stroke, which is impossible with hand feeding.

The downward feeding motion is imparted to the tool carrying sliding head 19 during the operation of the machine by an intermittent rotation of screw 4 which is actuated by means of miter gears 5, intermediate shaft 6 and gear 7 from a short shaft 8 a plate 9 which receives an intermittent motion through mechanism supported by a plate 9 which is removably attached to the side of the ram, said plate and mechanism being shown in Fig. 2

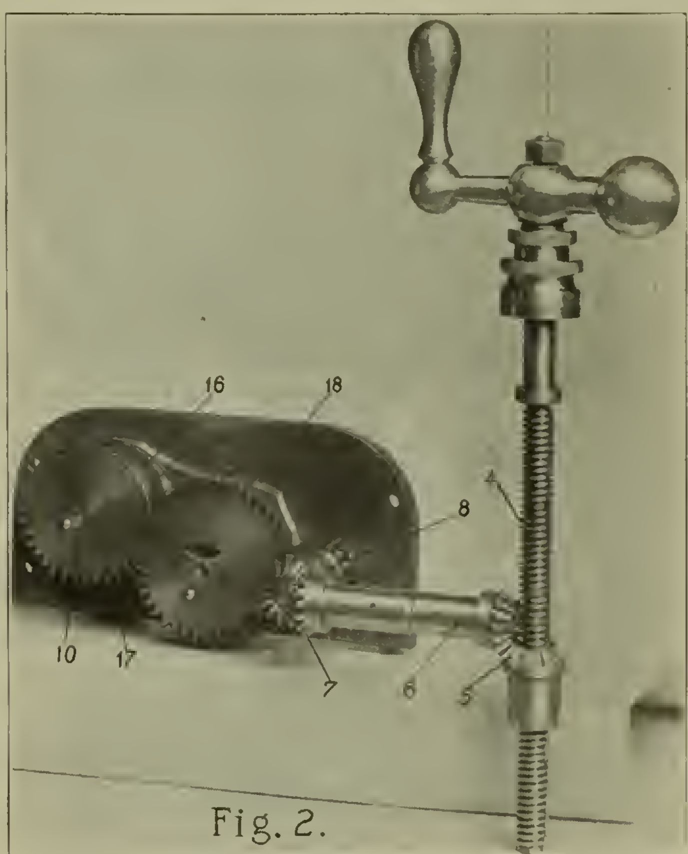
Journaled to the plate 9 is an ossilating shaft 10 carrying on its outer end an arm 11 having its free end 12 arranged to be brought into contact with the dog 13 supported on a plate 14 which is adjustably attached by a bolt to the fixed framework of the machine, whereby the rocking motion is given to the shaft 10.

The boss 16 is tubular and incloses a coiled flat spring hav-



SHAPER WITH DOWN FEED ATTACHMENT.

ing one end attached to the shaft 10 and its opposite end to the tubular boss 16, so that the tension of the coiled spring will be applied to resist the swinging movement of the arm 11 as it is brought into contact with the dog 13 on the backward move-



CONSTRUCTION OF DOWN FEED ATTACHMENT FOR SHAPER.

ment of the ram, and serves to return the arm 11 to its normal position as the ram moves forward.

The gear 17 through the chain of gears, communicates the motion given to it by the rocking of shaft 10 to the screw 4 which feeds head slide 19. The feed is on the return stroke and is made positive by pawl acting on the annular gear 18 provided with internal ratchet teeth adapted to be engaged by the pawl when the ram is on the return stroke, but slips on the forward stroke to allow rocker arm 11 to be brought back to the normal position by the coiled spring.

The dog 13 is pivoted in slide 14 and has a coiled spring attached to it on the back side which holds it in the position shown. But should this slide be pushed too far forward causing swinging arm 11, on the return stroke of ram, to pass over dog 13, then on the sweeping arm coming in contact with the dog on the forward stroke of ram the dog swings forward allowing arm to pass by.

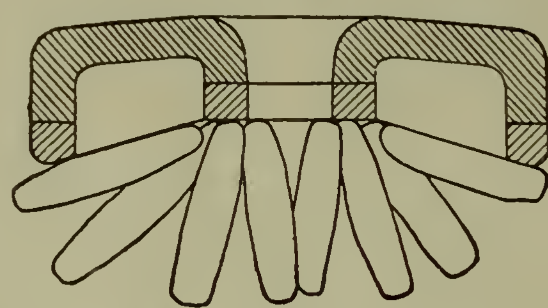
The feed may be thrown out entirely by knob 20.

The down feed is positive in its action, simple and compact in construction and makes a valuable adjunct to the shaper.

Lifting Magnets

Effective methods of transporting material about a shop plant bear directly upon the efficient operation of the plant and influence the output obtained. Traveling cranes have produced excellent results in transporting and distributing material. With the development of crane service, the necessity has arisen for providing methods of attaching material to the crane lifts in minimum time and for distributing the material quickly at the point of delivery. By reducing the time necessary for these processes the delivery capacity of cranes is materially increased. This is especially applicable to loading and unloading material, where the time consumed in picking up and dropping the pieces is particularly effective.

This class of work has opened an unusually broad field for the application of electro-magnets and during the past ten years electro-magnets for lifting and handling materials have been developed to a high degree of efficiency. Of course their field is confined to material having magnetic qualities and they are useful only in lifting and handling the various kinds of iron



THE CONCAVE FACED MAGNET, ESPECIALLY ADAPTED TO HANDLING PIG IRON.

and steel. Still these allow a broad scope and lifting magnets are being widely introduced. Their principal feature of advantage is that while capable of lifting heavy loads they eliminate the time necessary in adjusting hoisting tackle to the objects to be raised. An impressive feature about the plate magnet used for lifting and transporting metal in sheets is that the same magnet will pick up the plates one, two or three at a time, or will seize on an entire pile and will distribute the plates about the shop singly or in twos and threes as required. This is accomplished by regulating the amount of current taken by the magnet so as to increase or diminish its tractive force.

These magnets are useful not only for lifting and distributing metal plates, but also for handling pig iron, scrap iron and steel rails, car wheels, castings and forgings of various kinds, car sills, etc., and much other material used about an industrial or railway plant.

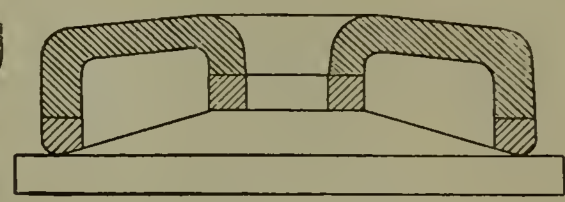
Lifting magnets differ in size and form. From a structural standpoint a lifting magnet consists of a copper coil embedded in an outer casing of cast iron or steel. Magnets used for handling pig iron, scrap metal and similar material are usually circular in form and range from 35 to 50 inches in diameter. Those used for handling metal in sheets or bars are usually smaller and are generally rectangular in shape, though for certain classes of work, the circular form answers as well.

LIFTING MAGNET RAISING A TON OF PIG IRON.

The body of the magnet is usually a circular casting of iron or steel, hollowed on the inside to receive the magnetized coil, and corrugated on the outside in order to secure the greatest possible surface area for heat radiation. The downward extensions of the body form the magnet poles, the inner pole being the portion of the magnet body which lies within the magnetizing coil and the outer pole, that portion which lies without. Above the coil the body and poles form one piece, but viewed from below the poles are seen to be separated by the annular depression in which the coil is placed. After the coil has been inserted this gap is bridged by a brass ring which constitutes a coil shield.

The coil is invariably of copper and upon its design and construction the efficiency of the magnet depends to a greater extent than on any other single feature. The object is to obtain the greatest possible amount of magnetization with a given amount of copper.

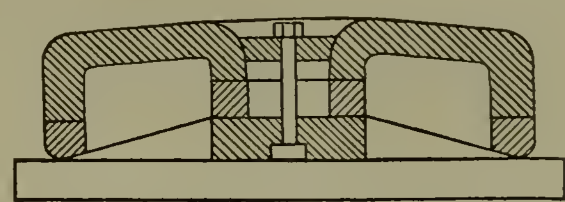
In the design of the magnet illustrated by the accompanying engravings, the magnetic attraction of the inner pole has been purposely made stronger than that of the outer pole. The practical effect of this is that in handling pig iron or similar material the bulk of the pieces constituting the lift are drawn towards the center of the magnet thus enabling the crane operator to drop the load within a much smaller area than is possible with magnets in which the flux is so distributed that the pieces of metal lifted tend to cling to the outer edge of the magnet frame.



THE CONCAVE FACED MAGNET IS NOT ADAPTED TO LIFTING OBJECTS WITH PLANE SURFACES.

Lifting magnets of large size, designed for use with pig iron, scrap, etc., are made concave on the under side, because this form is best for handling large numbers of irregularly shaped pieces of metal at a single lift. When, however, the load consists of ingots or other large objects with plane surfaces, this concavity becomes objectionable, since an air gap intervenes between the inner pole and the object to be lifted.

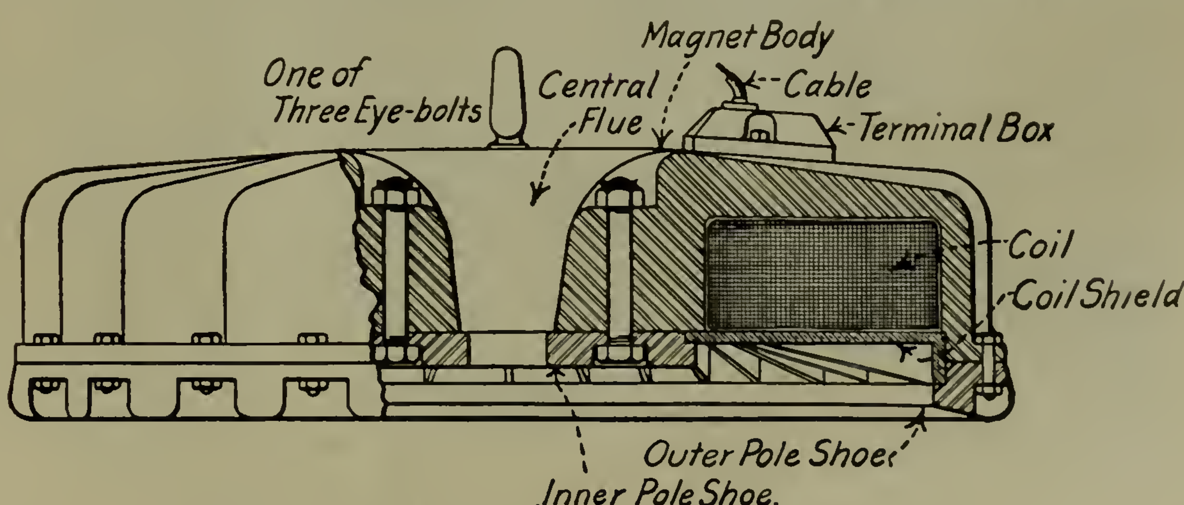
The central aperture in magnets of this design makes it possible to convert them in a few moments from concave faced magnets into magnets adapted to handling large masses of metal with plane surfaces. This is accomplished by inserting in the central aperture an auxiliary pole piece so proportioned as to extend the inner pole downward to the level of the outer pole, thus eliminating the air gap and insuring intimate contact of both poles with the object to be lifted.



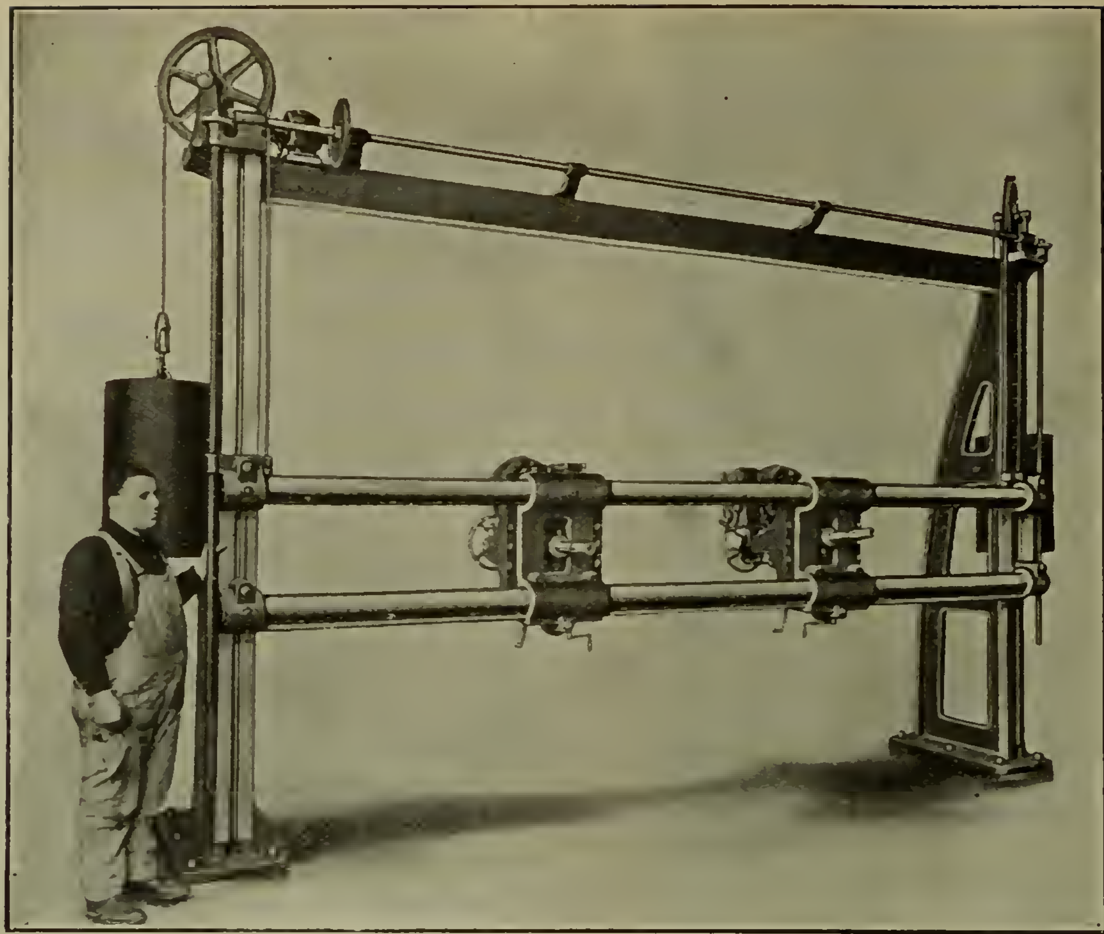
THE CONCAVE FACED MAGNET WITH AUXILIARY POLE-PIECE FOR LIFTING OBJECTS WITH FLAT SURFACES.

One other structural feature deserving of mention is the removable pole shoe bolted to the under side. The pole shoe of a lifting magnet may be likened to the sole of a shoe—it is the part subjected to the greatest wear and tear and the advantage of having it readily renewable is obvious.

The magnets illustrated by the engravings accompanying this text are manufactured and marketed by the Cutler-Hammer Clutch Company, Milwaukee, Wis.



CROSS-SECTION OF MAGNET BODY OF LIFTING MAGNET.



DALLETT'S MOTOR DRIVEN BOILER SHELL DRILL.

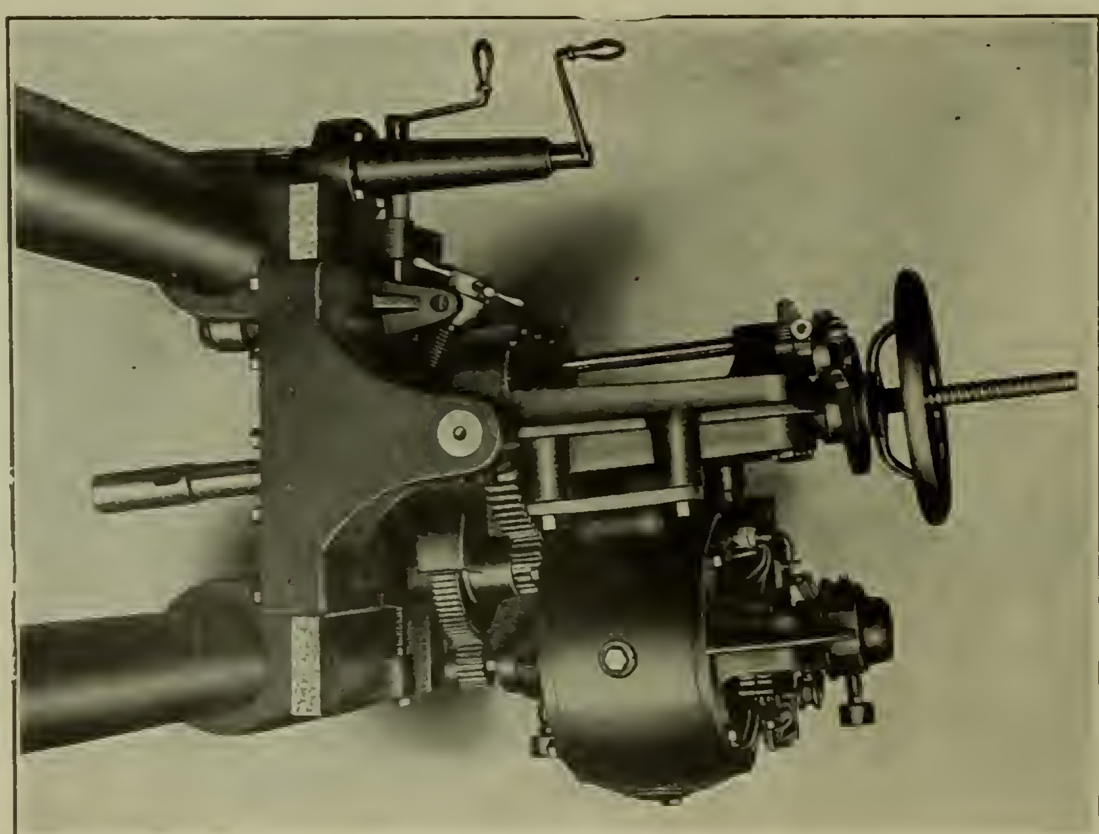
The Dallett Motor-Driven Boiler Shell Drill

We illustrate herewith a new boiler shell drill built by the Thos. H. Dallett Co., of Philadelphia, Pa. This machine is motor-driven throughout and has been designed for the special purpose of taking advantage of high speed steel, and as shown in the accompanying illustration represents the latest development in machines of this character.

As will be noted, there are two end housings, on the front face of which, carried by brackets, are two 5-inch bars on which are mounted two independent motor-driven drill-heads balanced by the two counter-weights, having a vertical range of 6 feet and raised and lowered by means of screws actuated by a motor on the top rail of the machine, this motor being handled by a reversible regulator on the inside of the housing which does not appear in the cut.

An especially noteworthy feature of this machine is the central position of the spindles, not only between the bearings of the drill-head on the bars, but also between the bars, so that the pressure of the drill against the work has no tendency to set up torsional or sidewise strains in the drill-head or bearings, causing excessive friction of the drill in the hole, rapid deterioration of the drill and undue consumption of power, owing to the spindle being thrown out of alignment, as must be the case where a drill spindle is not central of its support.

The machine is entirely self-contained, all adjustments being effected by means of crank handles and hand-wheels, no wrenches whatever being required, and the operator has all the



ONE OF THE DRILL HEADS, MOTOR DRIVEN—DALLET'S BOILER SHELL DRILL.

adjustments of the drill-head at his command from either side of said drill-head without moving from his position.

At the lowest position of the carriage, the center of spindles are 21 inches from the floor, and in its highest position, 7 feet 6 inches. The distance between the housings is 14 feet, and the distance between spindle centers when the drill heads are in their outmost position is 12 feet.

The length of the standard machine over all is 17 feet 8 inches, the height 11 feet 6 inches and the total weight 12,000 pounds.

The small cut shows one of the drill heads with its individual motor and illustrates the method of mounting the gear frame on trunnions. As this cut shows, each drill head has a vertical adjustment in itself of 6 inches, operated by a crank handle at the bottom, and is moved along the bars by means of a pinion and rack on the under side of the lower bar.

The motors shown on these drill heads are Northern 2 horsepower variable speed motors, the regulating box and switch being mounted on the opposite side of the motor.

There are no bevel gears used in the transmission from the motor shaft to the spindle, making a very durable and efficient gear reduction.

The spindle speeds range from 80 r. p. m. to 160 r. p. m. and the whole mechanism of the drill head is especially designed and built for the purpose of using high speed steel drills if desired.

The spindle is 1-13/16 inches in diameter, is bored for a No. 4 Morse taper, has a traverse of 18 inches and a perpendicular range through an arc of 15 deg. to permit drilling rivet holes radially to the center of the boiler which is set on rollers in front of the machine. The last movement is controlled by the hand-wheel which appears immediately beneath the gear reduction. The large cut shows one drill head with the spindle in a horizontal position and the other with it inclined upward.

The feeding mechanism consists of a feed shaft, crank head, rocker pawl plate, pawl, ratchet wheel, feed nut and feed screw, the thrust of the latter being directly upon the back end of the spindle. The connecting rod between the crank and rocker plate is fitted with a spring which can be set for any pressure of feed, so that it is impossible for this pressure to be exceeded, as the spring is compressed when the limit is reached and the feed ceases to operate until the pressure is reduced, thus making an automatic relief. Change of feed is effected by shifting the thumb latch around the crank head and a range of feeds from .005 inch per revolution of spindle to 1-16 inch can be obtained. This range of feeds covers the entire requirements of drilling in boiler work.

Increasing Use of Graphite Paint

Even the most casual observer cannot have failed to notice that within the past decade there has been a very radical change in the color of the coatings applied to railroad bridges, viaducts and other steel structures for the purpose of protecting them from corrosion and the elements.

The change has been from reddish brown to grayish black. The reason for this is that the most exhaustive research, theoretically and practically, has disclosed the fact that the natural form of carbon—graphite—is now known and recognized throughout the world as the pigment best meeting all of the many and varied requirements essential to the production of paint that will effectually protect under all conditions the surface which it covers.

Graphite is an inert substance absolutely unaffected by extreme heat, frost, steam, water, sulphur fumes, acids, alkali, brine or, in fact, by any climatic or chemical condition and these properties together with its natural affinity for oil, its ability to withstand extremes of temperature, its density, the ease attending its application and the resulting saving of labor, its remarkable covering power and the consequent reduction in first cost and last but not least its long life which eliminates the annoyance and expense of frequent re-painting—saves, in fact, the cost of several applications—renders it the ideal paint for either the primer or weather coats.

But to give this service in the greatest degree it must be pure, finely pulverized and thoroughly ground in the best of linseed oil.

Graphite paint, then, is desirable in exact proportion with its purity and to be of unquestionable quality its pigment should analyze not less than 85 per cent graphitic carbon of the amorphous variety—preferably Mexican graphite—the remaining 15 per cent to consist principally of such silica as is naturally carried by the ore from which it is ground.

This at least seems to be the consensus of opinion among authorities in railroad painting and as the railroad world is always alert to take advantage of new ideas which can be shown to save time and money and give best results, any radical departure from the beaten path is always first noticeable in railroad equipment to be ultimately copied as the standard of excellence by the smaller consumer—hence the gradual change from reddish brown to grayish black above referred to in the color of railroad bridges is now apparent everywhere in our manufacturing districts.

There are today on the market many so-called graphite paints but neither the brand of the paint nor the reputation of the maker should be taken as prima facie evidence of quality. The careful buyer will insist upon the manufacturer's guaranteed analysis and the shrewd buyer will get as close as possible to the source of supply—the miner of the raw material—thereby minimizing his chances of getting paint loaded with worthless and harmful adulterants.

The United States Graphite Company, Saginaw, Mich., miners of graphite and manufacturers of graphite paint have printed a very interesting booklet "About Graphite Paint" which upon request will be sent to those interested in this subject.

The Cleveland Twist Drill Co. Buys the Three Rivers Tool Co.

The Cleveland Twist Drill Co. has purchased the business, stock, raw material, patents, good will of the Three Rivers Tool Co., Three Rivers, Mich.

The machinery will be moved to and immediately installed at the works of the Cleveland Twist Drill Co., Cleveland, and the manufacturing resumed with as little interruption as possible. While there will naturally be some delay in getting things in running order, still with the assistance of Mr. J. G. Matthews, former manager of the Three Rivers plant, who will have charge of the "Peerless" department, the Cleveland Twist Drill Co. hopes to begin finishing up old orders very soon, and be prepared for new work.

Hereafter the reamer will be known as the "Peerless," and with their exceptional facilities and long experience in manufacturing small tools, the Cleveland Twist Drill Co. should be able to serve their clients well.

It will be interesting to our readers who have not examined these reamers to know what they are. The blades are of high speed steel brazed into a body of tough steel, with the result that the parts are united into one solid piece.

The body of the reamers is of low carbon steel, especially selected for elasticity and shock-resisting qualities. Many engineers and men of science who have given the subject special attention say the combination of high speed blades and an elastic body makes the ideal tool; adding longer life and increased efficiency.

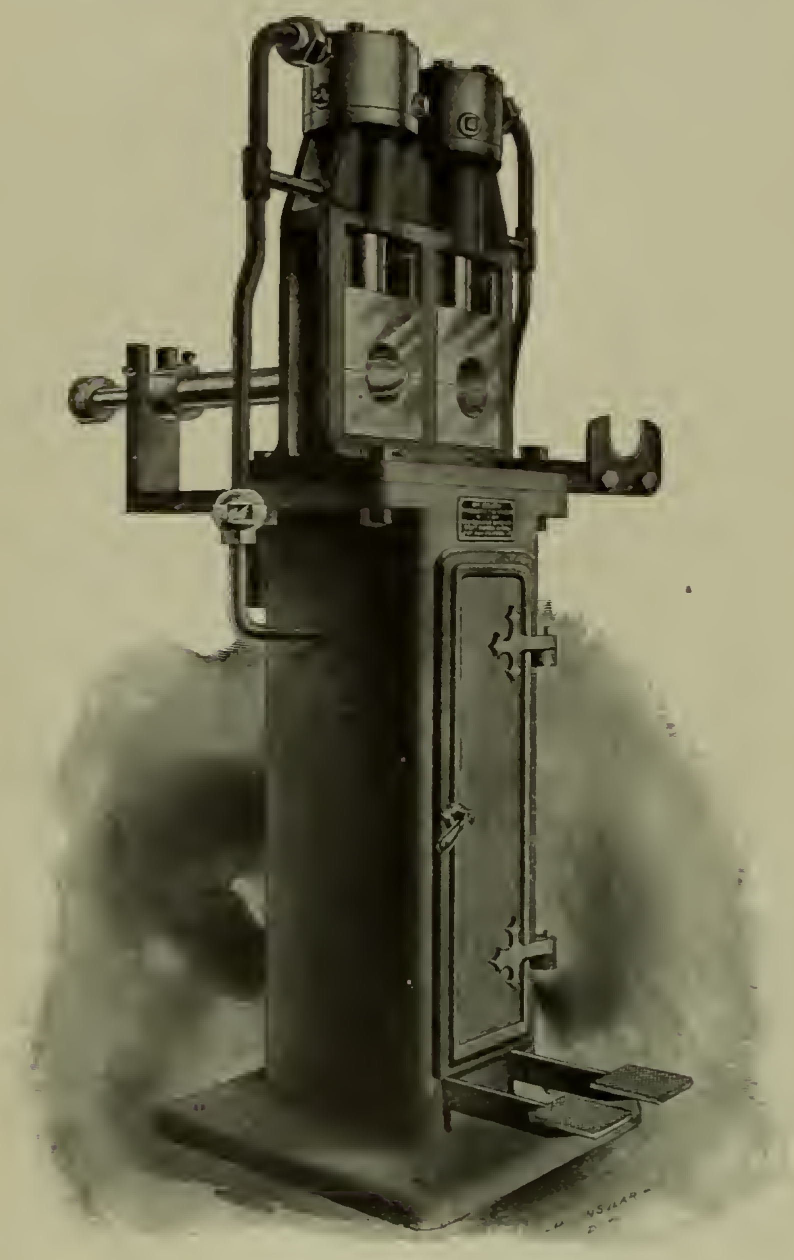
Two distinct types of "Peerless" reamers will be made—both intended for hand and machine work; the one is ordinarily termed solid, and the other expansion. The process for brazing the blades is the same in each. The expansion type is expanded by means of a plug threaded at the point with a taper seat near the top. The increase of diameter takes place at the extreme point; or in other words the part where the cutting is done. The advantage of this feature will be readily appreciated by all mechanics.

All business communications should hereafter be directed to The Cleveland Twist Drill Co., Cleveland, Ohio.

Pneumatic Flue Welder and Swedger

THE use of compressed air for welding and swedging flues is being gradually extended as the superiority of the compressed air machines over the former existing types is more fully realized. The principal advantages of the pneumatic flue welders lie in the ease of operation, rapidity of output and high standard of work. With the increasing use of compressed air in all railroad shops it is expected that in time the pneumatic flue welder will be the recognized machine for this class of work.

Among the number of pneumatic flue welders on the market, the McGrath, manufactured by the Draper Manufacturing Company, Port Huron, Mich., is a well known design that has been giving good satisfaction. The accompanying illustration



THE MCGRATH PNEUMATIC FLUE WELDER.

shows the design and construction of the double machine, fitted with dies and mandrel for welding and swedging flues. The machines are also made in single sizes with one cylinder and all types can be supplied with a large number of dies for doing light forging work in addition to flue welding, etc.

The McGrath flue welding machine will handle all sizes of flues up to 4½ inches in diameter. They take up less than 2 square feet of floor space and are built in a substantial manner for standing hard usage. As will be seen from the illustration the principle of the machine is very simple. Air cylinders mounted at the upper end of the machine operate the dies by direct connected pistons. The operator has positive control of the machine through foot valves located near the base.

In action the pneumatic flue welder is much more rapid than the old machines for this purpose. A 2-in. flue can be welded and swedged in about 5 seconds, with one heat. The record for the McGrath machine made at the American Railway Appliances Exposition in Washington was 104, two inch flues welded and swedged in sixty minutes. One railroad reports welding and swedging 26,000 flues per month on one machine. Another railroad which formerly used three machines of another style and handled 10,000 flues a month, now handles 13,000 with one McGrath welder at about one half the former cost.

All machines are interchangeable for either welding, swedging or scarfing dies. With 80 to 100 lbs. of air the machines will strike 2,000 or more blows per minute. This shows clearly why the pneumatic welders are the most rapid and economical machines for this class of work.

Notes of the Month

Mr. Geo. A. Gallinger, heretofore traveling from the Chicog office of the Independent Pneumatic Tool Company, has been appointed manager of this company's Pittsburg, Pa., office, at 1210 Farmers Bank Building.

A recent application of Voltax Compound, a non-corrosive paint manufactured by the Electric Cable Company, 17 Battery Place, New York City, was the painting with it of the steel hull of the municipal ferry boat "Richmond," of the city of New York. The use of Voltax for similar work is rapidly increasing, due to the successful results secured through its use.

The directors of the American Locomotive Company met recently for organization and re-elected the retiring officers to serve for the ensuing year. Mr. S. T. Callaway was elected secretary to succeed in that capacity Leigh Best, who has been secretary of the company since its organization. Mr. Best continues to hold the office of vice-president.

The Baldwin Locomotive Works have been awarded a diploma of a gold medal for most admirable, effective and artistic installation of exhibit at the Jamestown Exposition.

On and after Wednesday, November 6, 1907, the reference libraries of The American Institute of Electrical Engineers, The American Society of Mechanical Engineers, and The American Institute of Mining Engineers, 29 West 39th street, New York, will be open evenings until nine o'clock on all week days except public holidays.

These libraries, constituting practically one library of engineering, situated near the New York library, in the new headquarters of the engineering societies, are available to members of the above societies, engineers, and the public generally, subject to proper regulations. Strangers are requested to bring letters of introduction from members or to secure cards from the secretaries of the respective societies.

The Sherwin-Williams Company, paint and varnish makers, held their twenty-seventh annual convention at their Chicago plant at Pullman Station the week of October 28 to November 2. Two hundred and fifty representatives and managers from all parts of the United States and Canada were present.

The entire week was spent in reviewing the work of the past year and in planning the further extension of the business. Special sessions were devoted to discussions on the company's products, on salesmanship and on advertising.

The fifth floor of the main office building of the Chicago plant was transformed into a convention hall where the daily sessions were held. A banquet and smoker were given the latter part of the week at the Chicago Beach Hotel.

The Pittsburgh Automatic Vise & Tool Company, general offices, Pittsburgh, Pa., have recently equipped the shops of New

York Central Ry., the Pennsylvania Railroad, Louisville & Nashville, Atlantic Sea Coast, Seaboard Air Line, Norfolk & Western, Grand Trunk and the St. Louis & Southwestern, besides many others. Their high speed type vises appear to appeal especially to the hard service found in railroad shops.

Among the notable orders for Allen riveting machines recently reported by John F. Allen, 370-372 Gerard avenue, New York City, is one for a Stack riveter that will reach 84 inches into a stack 8 inches in diameter and drive 1 inch hot rivets or ½ inch cold rivets. This riveter, which is of unusual size and capacity, is going to the Hawley Down Draft Company, Chicago, Ill.

Bulletin 4002, recently issued is devoted to the Bowser System of Oil Storage as especially adapted to the needs of railway storehouses, terminals, signal towers, etc. It describes in detail the construction of the different styles of tanks, pumps and accessories manufactured by the Bowser Company, and is profusely illustrated with half-tones of some of the larger railroad installations made by this company, together with several suggestions for oil storage systems.

This bulletin emphasizes the safety, economy, convenience and cleanliness of the Bowser system and lays especial stress upon its flexibility since it is adapted to both the largest and smallest requirements and can meet any local condition which might arise. Upon application to S. F. Bowser & Co., Inc., Fort Wayne, Ind., copies of this bulletin will be sent to any address.

The Warner & Swasey Company, Cleveland, O., have just opened a Chicago office in the Commercial National Bank Bldg., Adams and Clark streets, under the management of Mr. E. B. Boye. This office is in position to furnish any information regarding their machine tools.

Mr. R. D. Hurley, manager of the Pittsburgh office of the Independent Pneumatic Tool Company, Chicago, died on Nov. 5, 1907. Mr. Hurley was well known in the railway and supply field, and his death is generally regretted.

H. B. Ayers has assumed his new duties as general manager of H. K. Porter Company, locomotive manufacturer at Pittsburg, Pa. Mr. Ayers comes well qualified to take up his new labors. For the last two years he has been in charge of the Canadian Locomotive Works at Montreal, and previously held the position of general manager of the Pittsburg Locomotive Works.

At a special meeting of the board of directors of the Gould Coupler Company, Mr. F. P. Huntley was elected vice-president and general manager, and Mr. George G. Milne secretary.

The American Locomotive Company has recently issued the ninth of their series of pamphlets covering the standard types of locomotives. As the title indicates, this number of the series is devoted to six-wheel switching locomotives and contains half-tone illustrations and the principal dimensions of 26 different designs of this type.

The designs illustrated range in weights from 102,000 to 176,500 pounds, and are adapted to a variety of service conditions.

An attractive booklet describing the gasoline motor cars developed by the Union Pacific Railroad has been received. General descriptions and illustrations of the first car built and those following up to the last, or No. 12, are presented. The successful performance of these cars is a matter of record and this has been clearly shown by giving the records made both in regard to running time and economy of operation.

The Baldwin Locomotive Works have recently issued Record of Recent Construction No. 63, which is devoted to the latest interesting design of locomotives built.

An excellently arranged and printed catalogue describing the Pond Rigid Turret Lathe has been issued by the Niles-Bement-Pond Company, New York. A large number of half-tone illustrations show the various types of lathe, this from all sides, and a portion of the catalogue is devoted to line drawings showing the kinds of work that can be done to advantage on the turret lathe.

The Watson-Stillman Company, New York, have issued catalogues Nos. 71 and 72. The first is devoted to the line of hydraulic pumps manufactured by the company. A large number of half-tone illustrations and line drawings fully illustrate this type of pumps, and their various parts. Catalogue No. 72 is descriptive of the Twinvolute Turbine Pump. This improved pump is illustrated and described in the same complete and attractive manner as the hydraulic pumps in the other catalogue mentioned. A number of tables regarding hydraulic is contained therein.

The seventh edition of the Blue Book of the National Paint Works, New York, entitled "Technical Review of Paints for Metal," is a very interesting and instructive manual in regard to the subject of metal painting. There is a lot of good information about painting included that should be known by every railroad painter.

The American Locomotive Company has recently received an order of 101 four-wheel motor trucks for the Brooklyn Rapid Transit Company. These will be built entirely to designs prepared by the builder and will follow closely the M. C. B. standards, and embody as far as possible the practices of locomotive construction, thereby insuring strength combined with easy riding qualities, the two essential characteristics of the motor truck of the present day.

The Boston Gear Works, Norfolk Downs, Mass., have issued Catalogue E showing the standard gears manufactured by the company. The large number of gears, pinions, etc., in addition to the other specialties manufactured are listed in a plain and compact form.

The Republic Railway Appliance Company, Chicago, have issued a very artistic catalogue describing the Republic Friction Draft Gear. The illustrations are of the very best and show the gear and its various parts in a plain and convincing manner.

A. B. C. Corporation, American National Bank building, Richmond, Va., announces its recent acquisition from the Atlantic Brass Company of New York all of the patent rights and licenses of the A. B. C. journal bearing and wedge. Walter D. Thomas is president of the new company.

Tweedy, Hood & Finlen, Inc., announces that it has succeeded to the business of the Tweedy-Randolph Company, dealer in railway, mill and mine supplies, Chicago. The business will be conducted under the same policy as heretofore, and the offices of the company will remain in the Fisher building. The new firm is composed of O. S. Tweedy, P. W. Hood and James T. Finlen.

Paxton-Mitchell Company, manufacturer of Mitchell metallic packing, 1116 Jackson street, Omaha, Neb., advises that it has received the order for metallic packing for the 125 locomotives recently ordered by the Harriman lines. The company will also furnish the metallic packing for 23 locomotives ordered by the San Pedro, Los Angeles and Salt Lake, and for 15 locomotives being built for the Southern.

Helwig Manufacturing Company, St. Paul, Minn., manufacturer of pneumatic tools, has removed its offices from the German-American bank building to the Scandinavian-American bank building.

Central Inspection Bureau, 17 State street, New York City, has received an order to inspect a large number of trucks for the Newburgh & South Shore, which are to be built by the Middletown Car Works.

American Creosoting Company, 600 Ellsworth building, Chicago, which has eight new creosoting plants under construction, expects to have its Springfield, Mo., plant in operation by December 1.

South Baltimore Steel Car & Foundry Company, Baltimore, Md., on October 30 was placed in the hands of James Ford and Arthur G. Wellington, as receivers. The liabilities are placed at $1,000,000, and it is stated that the company has sufficient assets to meet these claims, but on account of the present financial conditions, is unable to realize on its resources.

Allis-Chalmers Company, Milwaukee, held its annual meeting at Jersey City, N. J., on October 24. Walter H. Whiteside of Milwaukee was re-elected president and Elbert H. Gary was elected chairman of the executive board. All the old directors were re-elected and Herman W. Falk, president of the Falk Manufacturing Company, was added to the board.

The Norton Company, Worcester, Mass., are sending out an interesting pamphlet on Alundum, its invention and use. The process of manufacture is described and illustrated.

Carborundum Company, Niagara Falls, N. Y., is making extensive additions to its plant, in order to properly handle increasing business.

T. J. Jackson, manager of the railroad department of the Republic Rubber Company, died last week at Tucson, Ariz. Mr. Jackson was formerly connected with the Chicago & Northwestern railway as storekeeper at Belle Plaine, Ia., and later at Winona, Minn. He was traveling inspector of material and labor for a time on the same road. About 1902 he left the railway business to become connected with the Midvale Steel Company and thereby entered the supply field.

Norton Car & Foundry Company, Norton, Va., has been incorporated with a capital stock of $10,000 to $25,000. The officers of the company are: Rudolph Swank, president; J. R. McNutt, secretary and treasurer; and C. J. Swank, all of Norton. The company intends to manufacture all types of cars for steam and electric railways.

Dominion Metal & Manufacturing Company, Madison, N. J., has been incorporated with a capital stock of $150,000 to manufacture metals, alloys, babbitt metals and bearings for locomotives, railways, etc. The incorporators are: Charles E. W. Smith and S. M. Smith of Madison, N. J., and Frank C. Burton, 115 Broadway, New York.

Michigan Lubricator Company, Detroit, Mich., is meeting with great success with its Michigan Bulls Eye locomotive lubricator and automatic drain valve. Among the more recent orders received are: Forty 4-feed Bulls Eye locomotive lubricators, with automatic drain valves, for the Great Northern, and a number for the Northern Pacific and the Philadelphia & Reading.

Non-Explosive Safety Naphtha Container Company, New York, manufacturer of the McNutt system of safety devices for handling gasoline, naphtha and all volatile liquids, has opened a branch office at 1256 Michigan avenue, Chicago, in charge of S. A. Felton as general manager. R. S. Moss is also connected with the Chicago office as expert. The New York office and headquarters of this company are at 509-515 West Fifty-sixth street, having removed recently from its offices at 1133 Broadway to its plant.

Commercial Acetylene Company, 80 Broadway, New York, announces that Col. W. P. Hix, who has been general manager of this company for the past few years, has resigned and will be succeeded by F. S. Hastings. O. F. Ostby has been appointed sales manager.

T. B. Arnold Supply Company, Missouri Trust building, St. Louis, representing the Union Spring & Manufacturing Company and the M. B. Suydam Company of Pittsburg, has recently opened an office at 1204 Fisher building, Chicago, where the same companies will be represented. Mr. Arnold will spend considerable time in Chicago and A. C. Woods and J. H. Rogers will look after the St. Louis interests.

Technical Publications

LAYING OUT FOR BOILER MAKERS. Size 10 by 13 inches. Pages 191. Illustrations 432. The Boiler Maker, New York, 1907. Cloth bound. Price, $4.00.

This book, which has been largely reprinted from the pages of The Boiler Maker, has been compiled for the purpose of giving the practical boiler maker all the information relating to laying out in detail different types of boilers, tanks, stacks and irregular sheet metal work.

The first part of the book is given over to a number of rather simple and elementary problems, which show the methods of laying out by orthographic projection and triangulation, as well as giving numerous practical points regarding the best methods of doing the work and the behavior of the material, which may be expected when it is shaped according to the lines laid down by the layer out. The succeeding chapters take up the layout with greatest detail of the ordinary plain tubular boiler, Scotch boiler, and the locomotive boiler. In addition to the description of the real work of laying out, the necessary calculations are given to enable the workman to figure out the strength of the boiler. A very suggestive chapter is given on the repairs to different types of boilers. While this is, of course, by no means a complete description of such work, yet it contains much practical information that is of importance. The final chapter consists of a series of miscellaneous problems collected from widely scattered sources and comprising much of the work, both usual and unusual, which a boiler maker will meet in the course of his experience.

TABLES OF QUANTITIES FOR PRELIMINARY ESTIMATES. By E. F. Haugh and P. D. Rice. Size 4 by 6½ inches. Pages 92. Published by John Wiley & Sons, New York. Cloth bound. Price, $1.25.

This book of tables has been prepared in a compact form for the use of the locating engineer in the field as well as in the office. The calculations are carefully made, using five and seven logarithms, making the tables correct to the nearest cubic yard. The tables of quantities for preliminary estimates include all quantities from 12 ft. roadbed with side slopes ¼ to 1 to 35 ft. roadbed with side slopes 1½ to 1. Several pages of tables relating to toe slopes from 1¼ to 1 to 1½ to 1 are included. Acreage tables, chains reduced to feet, feet reduced to decimals of a chain, cubic yards from sum of end areas are also tabulated in convenient form.