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BOSTON

REPORTS

OF THE

PRESIDENT AND TREASURER

PRESENTED AT THE DECEMBER MEETING OF THE CORPORATION

JANUARY, 1910

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Report of the President.

To the Members of the Corporation:

I have the honor to present to you today a report upon the work of the Institute during the preceding year and upon some of the larger problems that must be dealt with in the the future.

CHANGES IN THE CORPORATION AND WITHIN THE INSTITUTE.

The Corporation has suffered the loss of two of its life members through the resignation of Mr. Francis Blake and Mr. David R. Whitney. These gentlemen have unfortunately found it necessary to resign after long and valued service, and after displaying their keen interest in the welfare of the Institute in many practical ways. In accordance with the by-law limiting the number of life members to thirty-five as soon as the number shall have been reduced below that limit, the resignation of these two members left only one vacancy. This has been most happily filled by the election of Mr. Francis R. Hart, an alumnus of the Institute, who has already rendered signal service to his Alma Mater in the difficult and important post of Treasurer. The Institute has been peculiarly fortunate in a succession of able and devoted treasurers, but none could have worked more loyally and enthusiastically in its interests than Mr. Hart. Unfortunately the increasing load of work and responsibility imposed by the Corporation that has the first claim on his energies makes it impossible for him to continue to give to the treasurership the time and thought that in

his judgment the difficulties of the position demand. He has therefore deemed it necessary to tender his resignation. To fill the vacancy thus caused the Executive Committee has been fortunate in securing the services of Mr. William B. Thurber, another distinguished alumnus of the Institute, who will bring to the task energy, enthusiasm, and the advantages of a wide business experience. His election is subject to your confirmation today.

The Corporation has welcomed to its membership three new term members, elected from the nominees of the Alumni Association—Messrs. Walter B. Snow, Theodore W. Robinson, and Charles R. Richards.

I should perhaps remind you that I was duly elected as President of the Institute towards the end of 1908, but that my obligations to Columbia University in the City of New York made it impossible to undertake the active duties of the position until the first of June, 1909. I was inaugurated with impressive ceremony on the 7th of June. The difficult period of the Institute's history since the resignation of Dr. Pritchett has been made memorable by a striking manifestation of the Technology spirit at its very best. Few men can realize what self-sacrifice is involved when a man of science of the front rank as an original investigator lays aside his chosen work and devotes all his time and thought and energy to administrative duties. You have already placed on record your appreciation of the services rendered by Dr. Noyes as Acting President; and I may add that his example cannot fail to be a lasting and impressive reminder to his successors in the presidential office of the high standards that they must endeavor to maintain. I feel that it is an unusual honor to follow such a man and an unusual privilege to have him working beside me, always ready to put at my disposal his unrivalled knowledge of the whole field of the Institute's activities and his trained judgment as to its best nterests.

During the year the changes within the Faculty have been

as follows: Professor George F. Swain, Professor Harry E. Clifford, Professor Fred Wheeler, Associate Professor George C. Shaad, and Associate Professor William E. Mott have resigned. The vacant professorships of Civil Engineering, Theoretical and Applied Electricity, and Military Science have been filled respectively by the appointments of Professors Charles M. Spofford, Harold Pender, and Captain Alpha T. Easton. Professor William E. Wickenden has been appointed Assistant Professor of Electrical Engineering. The following promotions have been made within the Faculty: Associate Professors Louis Derr, Augustus H. Gill, William H. Lawrence, and Arthur G. Robbins have been advanced to the grade of full professors; Assistant Professors Harry W. Gardner, Samuel W. Prescott, and Charles H. Warren to that of associate professors; and Instructor Clarence L. E. Moore to that of assistant professor.

In a number of cases these changes have involved the loss of instructors who were trained at the Institute and whose services to their Alma Mater have been very highly appreciated. Such losses are, however, inevitable in a great scientific school whose function it is, not only to educate engineers and architects, but to train men to impart to other schools the Institute's most effective methods and ideals.

WORK OF THE YEAR.

The work within the Institute during the year is clearly indicated by the heads of departments and other administrative officers in the reports that are appended. It will be seen from these that the year has been one of steady progress, not marked by any striking modification of the conditions or the methods of the previous year. The total number of students has risen slightly—from fourteen hundred and sixty-two to fourteen hundred and seventy-nine, the entering class being—with the exception of that of last year —the largest in the history of the Institute for more than ten

years. The number of students coming from a great distance gives some measure of the reputation of a school, and is specially significant for this Institute whose fees are relatively very high. The number from beyond the borders of Massachusetts is at present six hundred and twenty-seven. Of these, seventy-nine come from thirty different foreign countries, China and Mexico being the largest contributors. The remaining five hundred and forty-eight are from forty-two states and two territories of the Union, the District of Columbia, Philippine Islands, Porto Rico, and the Canal Zone. The number of graduate students is two hundred, and they represent eighty-four colleges and universities. It is evident from this that our students live in a community whose members have been brought up in widely different conditions. They thus have the opportunity of a liberal education by the simple process of mixing with their fellows. Unfortunately, the conditions under which they live do not make it possible to take advantage of such opportunities to the full.

An important step in the development of the social life of the students was taken last year and referred to in the report of the Acting President. This was the opening of the new Technology Union, designed to serve the purpose of a students' club house. It has continued throughout this year to be the center of social life among the students and has contributed largely to the marked increase of social activities that is referred to by the Dean in his report. The successful management of the dining-room at the Union has proved a problem of considerable difficulty and one that has not yet been solved in a thoroughly satisfactory manner. The health of the students as a whole continues excellent, and it is particularly gratifying to find that their health seems to improve steadily as they stay longer at the Institute. Interesting statistics on this matter are given by the Dean and Medical Adviser; and from these it appears that the very hard work that the Institute demands from its

students is a good thing for them physically as well as mentally.

The most important change in the carrying on of our work during the year has been the establishment of a separate Course in Electrochemistry. The purpose and leading features of this Course are lucidly set forth in the report of Professor Cross.

Besides doing the regular work of instruction, several of the departments have devoted a considerable share of their resources and energies to the conduct of scientific research. This has for some time been a marked feature of the Institute, and it is of the first importance that it should be maintained. Doubtless in various schools many educational sins have been committed in the name of research, but there can be no question that the spirit of research is the very breath of life to a scientific school. The Institute has been peculiarly fortunate in having on its faculty men who recognize this thoroughly; and it is not a little remarkable that many of the most important contributions to *pure* science that have been made within recent years in America have been made by graduates of the Institute of Technology, which on its scientific side is popularly, although of course quite erroneously, supposed to be almost exclusively a school of applied science. It is interesting, too, to note that a number of the gifts recorded in the Treasurer's report are for the prosecution of research. Amongst these is the gift from an anonymous friend for sanitary research work; from a member of the Corporation for research in applied chemistry; from several contributors to the fund of seismological research; from Dr. Charles Weld for research in naval architecture; and from Dr. Noyes for research in the department of physical chemistry. One of the most gratifying of the gifts is that from Mrs. William Barton Rogers, whose interest in and enthusiasm for the Institute could not have been greater when it was founded by her husband nearly half a century ago. The largest item on the Treasurer's list of

gifts is that of over $40,000 from the Alumni Fund. This, of course, has been contributed, not by one individual, but by a large number of the alumni.

RELATION WITH THE ALUMNI.

There have been many proofs during the year of the continued and increasing interest of the alumni in the welfare of their Alma Mater. The contribution towards the alumni fund, to which reference has just been made, was a practical demonstration of allegiance which has greatly helped the Institute at a critical stage of its development. Indeed, but for such support it would have been impossible to carry on the work without a very serious diminution of efficiency. The great Reunion of the alumni in June surpassed anything of its kind in the history of the Institute, both in the magnitude of the gathering and the intensity of loyalty and enthusiasm displayed by those who came. As the success of the Institute must depend in large measure on the attitude of the alumni, any movement that tends to bring about a closer relationship between the alumni and your Corporation must be of interest to this body. During the last year an important change has been made in the constitution of the governing body of the Alumni Association, which has become more truly representative in character. By the new constitution an Alumni Council has been established, to which the Corporation might appropriately refer any question with reference to which an authoritative expression of opinion on the part of the alumni might be desired. This Council may also render great assistance to the administration by considering various problems of interest to the Institute and reporting the views of the alumni as to the best method of dealing with them. At the first meeting of the Council, committees were set up at the suggestion of Dr. Noyes, then Acting President of the Institute, to consider the following questions: the establishment of a camp for the summer school

of civil engineering; the equipment and instruction in refrigerating, gas engineering, and aëronautics; the foundation of scholarships to connect the Institute with the more important high schools in this section of the country; the development of a research laboratory of engineering; the establishment of a committee on Student Welfare.

SOCIETY OF ARTS.

With regard to the Society of Arts, I am pleased to be able to report that there has been a gratifying revival of interest in its proceedings. This Society has played a conspicuous part in the educational development of Boston; but like other similar societies elsewhere it has suffered in its popularity by the change of conditions since its foundation. The interest in science has not diminished; on the contrary, it is intenser and more wide-spread; but science has become much more specialized. This has led to the establishment of numerous technical societies dealing with special branches of science, and the proceedings of these societies attract the attention and monopolize the time of a large number of those who are most seriously interested in science and its applications. Apart from this, there has been a marked falling off of the "lecture habit" in most communities in which, a generation ago, lectures by competent men attracted a great deal of attention. If the recent revival of popular interest in the proceedings of the Society be maintained, it will, of course, be an encouragement to continue the work on the lines that have been followed so long. Unless, however, this be the case, the Society will doubtless divert its energies into some different channel. The next few years will therefore be critical ones in its history.

POLICY FOR THE FUTURE.

As to the future policy of the Institute as a whole, there seems no call for radical change as regards its educational

methods or its aims and ideals. It has had the great advantage of having been started on a broad gauge and kept thereon by a long succession of broad-minded instructors and administrators. For some time its combination of liberal and professional studies and its emphasis on science as a means of culture were regarded as experiments in the world of education. The experimental stage, however, has long since been passed; and the type of education initiated here has conclusively proved its usefulness. As far then as internal management is concerned our problem presents no peculiar difficulties. We have merely to continue along the natural lines of development and do all we can to secure the best type of instructors and maintain the highest possible standard of scholarship and technical skill. If we do this, we will continue to render a great service to the state and to the country as a whole.

Amongst the features of the Institute that are specially encouraging in the outlook on the future may be mentioned the peculiar devotion of the Faculty and of the alumni. In the short time that I have occupied the office of President I have had several opportunities of observing the readiness with which members of the Faculty sacrifice their financial interests through their belief in, and loyalty to, the Institute. Moreover, the number of the students is very encouraging, especially when we consider the relatively high fees that we are forced to impose in order to maintain our standards of efficiency. Here we have no problem of staying the decline of an institution that is running down, for the number of our students is as large as we can accommodate. What is still more important is that the quality of the students is excellent; for, after all, in an educational mill the great thing is to get good grain. The students that come to us are nearly all young men of character and grit, just of the type for whom careers of usefulness and success can be most confidently predicted. I may add that one of the chief assets of the Institute is the tradition of seriousness of purpose

and hard work on the part of the students. It is certainly a tribute to Rogers' wisdom that the school that he founded has succeeded so easily, one might almost say inevitably, in avoiding the more serious problems of discipline, the abuse of athletics, and the various other difficulties that have long been pressing so hard on many of the colleges throughout the land and of late have been causing so much disquietude both within and without these colleges. It is scarcely necessary to say that the prestige of the Institute must prove invaluable to it in facing the difficulties of the future. It is known and respected throughout the world as one of the pioneers in the field of education that it occupies, and as one of the most successful today in maintaining the highest standards in the training of engineers and of architects. Its graduates are eagerly sought for to fill important positions all over the world, and now, as formerly, every head of a department reports that far more graduates are applied for than can possibly be supplied. Then, although it has not as yet the financial resources that are needed for its development, the Institute is fortunate in having large assets and in being entirely free from debt.

THE NEED OF FURTHER ENDOWMENT.

I mention these encouraging features because I think it well that we should all realize that the one thing needful is further endowment to enable the Institute to take up new work and to improve the conditions of the old. This claim for new endowment is unfortunately a commonplace of presidential reports, but it is none the less pressing because of its commonplace character. It will be seen from the Treasurer's report that we have this year a real deficit,—a real excess of expenditure over income. This is the case in spite of the greatest care in keeping expenses as low as is consistent with the high standards that we endeavor to maintain. Besides this, it has been recognized for long that we

have not sufficient means to develop naturally, and that the quality of the instructors that we can employ must inevitably deteriorate if we cannot meet the increased cost of living by the payment of better salaries. In many respects the salaries that we pay compare very favorably with what is the best practice in this matter in the country. Our peculiar weakness is in our treatment of the middle men, on whom a large share of the burden of teaching falls. These men are eagerly sought for to fill higher positions in similar institutions elsewhere; and, although we should always welcome their promotion, we should be able to get the best of them back if we need their services later; or if we cannot get them, we should be able to get men of equal grade. To make this possible further endowment is indispensable. It is to be hoped that this will come from public-spirited citizens; but it is also, I think, to be hoped that an effort will be made to secure more support in this direction from the state. No one who has looked into the matter can fail to recognize the great service that this Institute has already rendered to the State, and still more the greater service that it can render in the future if not allowed to languish by insufficient support. At present it receives an annual grant of $25,000 from the State of Massachusetts, which is not a twentieth part of its annual expenditure. Such a grant to such an institution seems absurdly inadequate, especially in view of what other states are doing. We have only to look to the western states of this Union to see how differently matters are being dealt with elsewhere; and the zeal for technological education on the part of the state is certainly not confined to this Union. A recent visit to Europe has made it evident to me that many of the states of the old world that have been slow to recognize the needs of the age are rapidly making up for lost ground. It would be peculiarly unfortunate if Massachusetts, which was a pioneer in the matter of state support for this type of education, should be left behind in the race.

THE PROBLEM OF A NEW LOCATION.

The problem of securing increased endowment is not the only serious one that confronts us. We must find a new location for the Institute. The need for such a change was urged in his annual reports by Dr. Pritchett for years, and Dr. Noyes last year summed up the matter thus: "There has grown up not only amongst your own members, but amongst all the other groups of men connected with the Institute,—Faculty, Alumni, and Undergraduates,—a sentiment so strong that it will be satisfied with nothing less than the creation of a new Institute on a new site." The situation must therefore be familiar to every member of your Corporation, and it cannot be necessary for me to do more than briefly recapitulate the grounds for the desired change.

First.—The present site, although conveniently situated, is noisy, dirty, and subject to mechanical and electrical disturbances which interfere with its efficiency as an educational machine. It is cut up into a number of sections at a considerable distance from one another, separated by busy streets; and no land is available in the immediate neighborhood of any of these sections except at a prohibitive price.

Second.—The present buildings are overcrowded, the need for more room being a constant source of complaint from heads of departments in their reports. Devices of all sorts have been adopted to economize space, with results that are far from satisfactory and seriously hamper the proper development of the Institute.

Third.—The buildings are scattered in such a way as to necessitate a separation of departments, which for convenience of teaching should be closely associated.

Fourth.—This overcrowding and scattering of buildings not only limits the efficiency of the Institute, but robs it of the outward dignity of a great educational institution. It should be part of the education of an engineer or an architect to be brought up under conditions that impress him

with the dignity of his profession; the lack of such conditions, not only acts unfavorably on the student, but reacts on the public. It fails to attract their attention to the importance of the Institute and the claim that it has on their support.

Fifth.—The older buildings have reached a stage when repairs of all sorts are necessary and great expense is incurred in their maintenance. In many respects they have grown out of date; for example, they are not ventilated by modern methods.

Sixth.—The newer buildings are mostly temporary in their structure, and are beginning to reach the limit of age for which they were designed.

Seventh.—It is difficult, if not impossible, under the present surroundings to provide properly for the physical and social development of the students.

Eighth.—The unfavorable conditions that exist today will be so aggravated within the next ten years that removal will then be inevitable and the Institute will be forced to a suburban location far removed from the center of the city, —a result which is almost universally admitted to be undesirable.

Ninth.—The expense of making proper provision upon the present site for the development immediately demanded is very large; and although it is less than that of removing to a site, yet the difference is probably more than compensated by the greater ease of securing funds for the execution of a well-considered, consistent plan for rebuilding the Institute upon an attractive location.

Tenth.—In order that the prestige of the Institute may not suffer through the prevalence of the idea that it is resting upon its laurels, and in order to meet the competition arising from the development of similar schools throughout the country, it is important that some decisive and impressive step be taken as speedily as possible. The Institute needs a new site and new equipment, in order to maintain

its position as a scientific school of the front rank and as the leading representative in the world of a characteristic form of combined liberal and professional education.

As to the requirements of a new site, it is obvious that the site should be of sufficient area to make provision for the probable advancement in the next generation. It is difficult to see even so far into the future as to say definitely what this area should be. Having regard, however, to what is deemed necessary elsewhere, it would seem that twenty-five acres is a minimum. Then the location should be worthy of the dignity of a great educational institution, whose work should be recognized as of the very highest importance to the welfare of the state. The site should be such that students' houses or dormitories could be erected near at hand. Especially at an institution like this, which draws such a large number of its students from a great distance, there must always be a great many who cannot live at home. Whatever may be the difficulties in the successful management of students' houses, there can, I think, be no doubt that they are infinitely to be preferred to the cheap lodging houses to which the circumstances of so many of our students force them to resort. Living in such houses is not only bad for the health, but it deprives the student of the social advantages which he ought to reap by being a member of a community so cosmopolitan in its character as is the Institute of Technology. Another requirement of the new site is that it should be as accessible as possible from the various railroad stations in Boston, so as to enable those who want to live at home to do so. There are already a large number of these coming to the Institute from all directions around Boston. It would, I think, be extremely unwise to completely change the character of the Institute by forcing all its students into dormitories. Lastly, the site should be as near as possible to the center of Boston, so that close contact might still be maintained with the various professional, industrial, and business activities of the city.

A special committee has been engaged during the year in considering the relative advantages and disadvantages of a large number of sites. Many of these are eliminated by consideration of the requirements that have been indicated above. But there are three or four left that would satisfy most of our needs. The problem of final selection will doubtless be affected largely by the consideration of the cost. The financial burden of a change is a heavy one; for the total sum required to rebuild, re-equip, and make growth possible by increased endowment involves millions. The Institute is national in its scope and in its services, and so may reasonably look for help in many quarters. But its chief reliance must probably be on Massachusetts; and the citizens of Massachusetts who are interested in education have many calls on their generosity. It may be said that it is to their alumni that most American institutions look for their chief support; but the alumni of the Institute do not, as yet, form a large or a wealthy body. Most of them are men who have had to make their own way in the world, and this is a process in which time is a very important factor. It is a striking proof of the rapid development of the Institute within recent years that half of its graduates have received their degrees within the last ten years. These men are enthusiastically loyal, and will doubtless help us largely in the time to come; but we cannot reasonably expect very much from them as yet.

I mention all these discouraging features of our situation, not from any feeling of pessimism as to the future; indeed, nothing could be further from the fact. I realize that most of the Institute's difficulties are due to its success and not to its failure, and I believe that a splendid future is assured to it, if, at this critical stage of its history, it does not falter through lack of courage. It seems to me that when the opportunity arises it should sell that part of its property which is unrestricted,—that is, all except the Boylston Street property,—and with the proceeds secure a new site. It should

then throw upon the public the burden of completing the purchase money of this site, if any complement be required, and of putting up new buildings and improved equipment. The Boylston Street property could be retained for carrying on that part of the work that can with the least inconvenience be separated from the rest until the time comes when restrictions upon its use can be removed at a reasonable cost. Such a policy involves some risks; but these are almost as inevitable to a progressive educational institution as to a progressive business. The question whether the risk is one that can reasonably be taken is, of course, a question for the individual judgment. My own opinion is that the risk is not great, provided only we have the active co-operation of all those interested in the Institute. It is scarcely necessary to add that the question of the future location of the Institute is one that should be settled as promptly as possible. It has been before your Corporation for many years. If it were settled, the Institute could devote all its energy to the really great work of developing its educational resources; for, of course, its primary and fundamental problems are, and must always remain, educational.

CO-OPERATION WITH NEIGHBORING INSTITUTIONS.

Of the larger questions of future policy not already touched upon in this report, probably the most important is the question, how far can we profitably co-operate with other educational institutions in our neighborhood? Waste of effort is regrettable anywhere; in educational institutions it is more than regrettable,—it is a deliberate sin against the light. Every educated man must know that the record of progress is largely the history of the elimination of waste; and every institution of learning has the duty imposed upon it of avoiding waste wherever possible. In our own field of technological education it does not require any remarkable powers of prevision to foresee that the burden of keeping

up to the growing needs of the day will become heavier in each department. Then as science advances more and more and gradually invades new territories, as inevitably it must, the field of activity of a school of applied science will be greatly extended. Thus an institute of technology will have to cultivate a wider area and cultivate it more intensely than in the past. All this will make the task of conserving all its powers as much as possible, a still more imperative duty. The practical questions are, have we now reached the stage when coöperation is expedient, and, if so, how can this coöperation be most effectively undertaken? After a preliminary survey, the only question in my mind is as to the best means of coöperation. This is a problem of some difficulty and delicacy and one that cannot be solved satisfactorily without care and patience. At present I can only say that I shall give it my earnest attention in the immediate future.

RICHARD C. MACLAURIN.

Reports of Administrative Officers.

REPORT OF THE SECRETARY OF THE FACULTY.

The reports from the various departments of the Institute will be found to contain information in regard to the following matters which have received Faculty attention and approval during the past school year: changes in the schedule of studies of Courses III. (Mining Engineering and Metallurgy) and IV. (Architecture), in each omitting foreign language study above the first year, also a revision of the schedule of studies in Course XI. (Sanitary Engineering); the forming of a distinct Course in Electrochemistry, numbered XIV., formerly option 3 of the Course in Physics; the withdrawal of the undergraduate Course in Landscape Architecture; and the authorization of student conferences relating to the subject of Physics in the second year.

The School of Engineering Research as a distinct feature of the Institute has been discontinued, and all matters relating to its courses of study and candidates for the degree of Doctor of Engineering are now referred to the Committee on Advanced Degrees and Fellowships.

The students' records have been, as usual, carefully considered, those of the first and second year students six times during the year, and those of the third and fourth years twice. Standing committees of the Faculty review the records of students of the second and third years and report to the Faculty. On recommendation of these committees those whose records are low are referred for advice to the Dean or to some other member of the Faculty. The policy of the past years has been continued, advising or requiring withdrawal in the case of those who remain in low standing,

and who seem to be unfitted to pursue courses of study at the Institute. In January, 1909, twenty-two students were advised, and thirty-three required to withdraw, and in June, 1909, thirty-eight were advised, and thirty-six required to withdraw.

There are attending the Institute thirty-nine students who have been admitted to graduate courses of study, nine of these being candidates for the degree of Doctor of Philosophy, two for that of Doctor of Engineering, and twenty-two for that of Master of Science. Two non-resident fellows and four resident fellows have been appointed for the year 1909–10.

One hundred and eighty-two students have been admitted to undergraduate courses of study on credentials from other colleges, one hundred and thirty-six having already received a degree from their former college.

In June, 1909, nineteen candidates were recommended for the degree of Master of Science and one hundred and thirty-two for the degree of Bachelor of Science.

Fellowships and graduate scholarships to the amount of $5,200 have been awarded to seventeen students. One hundred and ninety-nine undergraduate students have received scholarship assistance from Institute funds to the amount of $22,687.50.

ALLYNE L. MERRILL,
Secretary of the Faculty.

REPORT OF THE DEAN.

The past year has been one of marked changes on the social side of the life of the undergraduate. At the beginning of the year the new Union was opened, and its management placed largely in the hands of the undergraduates. Three committees were placed in charge: the House Committee, Dining-room Committee, and the Entertainment Committee.

The work of the Dining-room Committee was necessarily

the most difficult task, and although the total receipts of the dining-room did not cover the total expenses of the year, and although there were at times justifiable criticisms of the food and service, all praise should be given to the efforts of the members of the Dining-room Committee to do their work in a satisfactory manner. It was, perhaps, too much to expect that undergraduates should be able at once to meet the inherent difficulties connected with the management of a large restaurant. The attendance of students up to the end of the year was larger than it has ever been at any previous lunch room, and the special dinners furnished in the evening to student organizations were larger in number, and better attended, than in any former year.

At the beginning of the present school year, however, some changes were made in the management of the Union, which we trust will be of benefit in remedying the defects noted in the previous year. The responsibility of the management of the dining-room has been placed on the President's Assistant, Mr. Maurice R. Scharff. The student committees are continuing as heretofore, the Committee on the Dining-room giving assistance to Mr. Scharff in the furtherance of his plans. The Dean still retains the position of Chairman of a general Union Committee, made up of students from the three upper classes.

The work of the Entertainment Committee gave noticeable satisfaction to every one. On almost every Friday evening of the year some form of entertainment was furnished to all students who were interested to attend. Many interesting and distinguished speakers kindly offered their services to this Committee. There was an entertainment given on Christmas Eve which was largely attended, and after the intercollegiate track games in the spring (held at the athletic field), all visiting collegians were invited to attend an informal gathering at the Union.

The effect of the Union in promoting a more general acquaintance among the undergraduates is noticeable to any

one who is familiar with student life at the Institute. There is now a very strong desire on the part of the undergraduate body to bring about an improvement in all the conditions of social life at the Institute. A small body of students may, from time to time, commit acts that call for public criticism, but the general tone of student life has improved. In connection with this effort of the students to help in the development of a social life, consistent with the demands of our exacting curriculum of study, we should note the action of the Institute Committee (which is now an active body of the undergraduates with a membership truly representative of the different classes and organizations) in recommending to the students the adoption of a point system, which would prevent any student from entering into too large a number of outside activities. This recommendation of the Institute Committee is spoken of in President Noyes' report of last year. Its general and hearty adoption by all students has now taken place, and a record of offices held by individual students is closely scrutinized by the Committee.

Another important work carried on by undergraduates has been the compilation and publication of a book, which gives a concise and complete account of life at the Institute from a student's standpoint. It is called "Concerning the Massachusetts Institute of Technology." This book was completed in the fall of this year and has now been distributed free among all the undergraduates and to students of preparatory schools. The expense of the publication has been covered by subscriptions and advertising cards from the alumni. This book is a fair exhibition of the attitude of the undergraduate to-day towards both the scholastic work and the social life of the Institute.

The Union has done much to promote sociability among undergraduates. Its management has forced a desirable responsibility on student committees. The organizations in connection with the different courses of instruction encourage an interest in professional work, but it seems de-

sirable that there should be some general society of upper-class men, which has for its basis excellence in scholarship. At almost all of the larger universities and technical schools there are such honorary societies, based on scholarly attainments, and their effect is very encouraging to the earnest student.

The work of the first-year instructors in the Mathematical and English departments, in reaching the individual needs of first-year students through their conferences, has been successful, and it has made it possible to a great extent to do away with the assignment of other officers of the Faculty as special advisers to first-year students.

Consultations with individual students have now become the chief work of the Dean. During the past year one hundred and fourteen students were sent to him by vote of the Faculty, and a large number who were not referred directly to the Dean consulted him of their own accord. These personal interviews, and work on the committees, now take up the greater portion of his time, and work which originally was done in this office is being transferred to the office of the President's Assistant. The President's Assistant now has entire charge of the employment of undergraduates. He also inspects the room and boarding-house list and has a printed register of rooms for consultation by all students.

Compulsory physical training for first-year students, which was inaugurated last year, proved to be a good thing in every way. The conduct of the instruction was in charge of Mr. Winfield C. Towne and Mr. H. A. Bruce. At the end of the year Mr. Towne resigned as instructor, his work as attorney-at-law requiring his full time. Mr. Towne has been employed as instructor in the Gymnasium for six years. In accordance with a recommendation made by Mr. Towne, a half-story was added to the locker room of the Gymnasium, and three hundred new steel lockers were put in position, the old lockers being turned over to the Advisory Council on Athletics for use at Technology Field.

Through coöoperation with the Alumni Advisory Council on Athletics an arrangement was made this year to place the gymnasium work in the charge of Mr. Frank M. Kanaly, who is also the coach for the athletic teams. Mr. Kanaly will be assisted by Mr. Joseph McNamara, who has for many years been connected with city gymnasiums.

The course in Physical Training required in the first year, consists of four lectures on physical training and personal hygiene given during the first four weeks of the term, of physical examinations involving the usual anthropometric measurements and strength tests made near the beginning and near the end of the school year, and of regular class work at the gymnasium two hours a week for twenty weeks during the winter months. Each student receives a record in this subject based upon his attention to the work and the improvement shown by the second physical examination. As in other subjects students who failed to do satisfactory work are required to continue the subject another year.

First year students may, if they prefer, substitute track work for the class work in the Gymnasium provided they pass a satisfactory physical examination, but in that case they have to report regularly to the track coach and are marked upon their work.

This innovation proved successful from the first and fully justifies its continuance. The students have taken great interest in the work and much better results have been obtained than ever before.

Physical examinations of the Freshmen began Oct. 4, 1909, and three hundred and sixteen members of the class had been examined and charted on November 8.

Of the class, thirty-three have been excused from the training on account of physical ailments and being over twenty-one years of age. Forty-five members were allowed to substitute track athletics for the gymnastics, and are required to report twice each week with the further requirement of making one of the practice periods Saturday afternoon.

The arranging of the classes commenced November 8 and was completed November 12 and actual gymnastic instruction began November 15. One class is held each day except Saturday and all classes are from 3.10 to 4.10. Each student attends exercises two hours per week, but on two different afternoons.

The method employed is to have one instructor carry on calisthenics while the other instructor notes the character of individual work. At close of the calisthenics each instructor takes a division of the class on the apparatus and works until ten minutes of the hour period when recreative games are played for the remaining time.

STATISTICS OF ILLNESS FOR THE SCHOOL YEAR 1908–09.

Fourth-year Class.

There were three hundred students in the fourth-year class. Of these, fifteen were reported ill during the school year 1908–09. Classified by illnesses, there were the following cases: appendicitis, 2; diphtheria, 1; grippe, 1; hernia, 1; mumps, 1; rheumatism, 1; trouble with eyes, 1; typhoid fever, 1; not specified, 6.

Third-year Class.

In this class there were three hundred and seventy-seven students, of whom twenty-nine were reported ill during the year. The following cases were reported: appendicitis, 1; blood poisoning, 1; cold, 2; grippe, 4; inflammatory rheumatism, 1; jaundice, 1; mumps, 2; pneumonia, 1; surgical operation, 3; tonsilitis, 2; typhoid fever, 1; ulcerated tooth, 1; not specified, 9. There was one death in this class, that of Mr. E. K. Harvey, who died on Oct. 27, 1908, of typhoid fever.

Second-year Class.

This class numbered three hundred and seven students, of whom thirty-seven were reported ill during the year. There were the following cases: abscess, 1; bilious attack, 1; broken wrist, 1; cold, 2; diarrhœa, 1; fever, 1; grippe, 2; jaundice, 1; quinsy sore throat, 1; pneumonia, 2; surgical operation, 1; tonsilitis, 1; not specified, 22. There was one death in this class, that of Mr. G. E. Livingston, who died on March 7, 1909.

First-year Class.

The first-year class numbered three hundred and fifty-eight students. Of this number sixty-three were reported ill during the year. Classified by illnesses there were the following cases: abscess, 2; acute rheumatism, 1; acute urethritis, 1; appendicitis, 1; blood poisoning, 2; bruise of leg, 1; burn on hand, 1; chronic synovitis, 1; cold, 5; diphtheria, 2; dislocated elbow, 1; fractured nose, 1; grippe, 5; influenza, 2; injury to eye, 1; injury to leg, 1; injury to toe, 1; iritis, 1; jaundice, 3; mercuric poisoning, 1; sore throat, 1; sprained ankle, 3; tonsilitis, 2; toothache, 1; trouble with eyes, 2; typhoid fever, 1; not specified, 19. There was one death in this class, that of Mr. A. E. Joyner, who died on May 15, 1909, of pulmonary tuberculosis.

SUMMARY.

	No. in Class.	No. Ill.	No. of Deaths.
Fellows and Graduates	32	0	0
Fourth Year	300	15	0
Third Year	377	29	1
Second Year	307	37	1
First Year	358	63	1
Total	1,374	144	3

ALFRED E. BURTON,
Dean.

REPORT OF THE MEDICAL ADVISER.

There have been no important changes in the routine of the medical work at the Institute in the past year. Consultation hours were held on two afternoons a week throughout the year; and as usual the time was fully occupied by the students and the time of consultation had frequently to be extended to accommodate all those who came for advice. The average extra time needed was thirty-five minutes more than the appointed hour.

The following table gives the number of office visits made and the number of students seen. A few figures of previous years are given for comparison:—

	1907.	1908.	1909.
Total number of office visits made	409	318	432
Total number of different students seen	196	184	318
Greatest number of students seen per day			13
Least number of students seen per day			3
Average number of students seen per day			7
Number of students making more than one visit			85

The number of students coming to the medical office has greatly increased in the past year, averaging two or three more students at each consultation hour throughout the year. The increase is almost entirely due, I think, to the new requirements for Physical Training and the necessity of a doctor's certificate to explain absence from Physical Training and Military Drill on account of physical disability or acute illness. This increased work has demanded very little extra time and has proved valuable in several ways, namely: It has largely prevented absence from Drill and Physical Training without cause; it has put me in touch with the men at the Institute who are less robust than the average; it has brought additional men to see me promptly who needed medical advice on account of acute illness.

The large majority of men found it necessary to make only a single visit; only three men made more than five visits; and seven was the largest number made by any one man. These facts speak well for the general health of the students.

I still find it necessary to point out to the less vigorous men the necessity of taking at least a few weeks' vacation in summer at the end of the spring term and before the fall term begins. It seems very desirable that the officers of instruction who have an opportunity to advise the men about their summer work should emphasize the necessity of some rest at each end of the summer. Each year I find a certain number of men who get tired and whose work suffers early in the fall term from lack of this rest.

A great variety of illnesses were treated at the medical office, the most numerous being digestive disturbances, dis-

eases of the nose and throat, skin, and surgical diseases. About ten men suffered from severe illnesses, such as appendicitis, diphtheria, jaundice, pleurisy, and disease of the kidney, and some of these were sent to the Massachusetts General or Boston City Hospitals. A small number of students were referred to specialists for the treatment of the eye, ear or skin.

In addition to my work at the Institute office I have seen about fifty men at my private office and a much smaller number at their residences. Ten men were examined for the United States Civil Service, and I have many opportunities to help men decide whether or not they are physically fit for certain athletic sports.

The cases of contagious disease among the students have been as usual few in number, probably owing to the scattered residence of the men.

Two talks on personal hygiene were given by the Medical Adviser to the Freshman class covering the following subjects: Bathing, exercise, care of the eyes, the use of tobacco and alcohol, minor ailments, the emergency treatment of injuries, and also the prevalence and danger of venereal disease.

The fact that from six hundred to seven hundred men are living away from home in Boston and its suburbs under conditions which make hospital treatment desirable or imperative, in case of any illness which confines them to bed for more than a day or two, and that at least forty or fifty students suffer from such illness each year, makes it worth while to consider the possibility of a small Institute hospital or infirmary to care for our own students. The Tech man who is sick in a lodging house, away from home, demands our sympathy and care, and it is of course more agreeable for him to spend the time during his illness and convalescence in a small hospital with a few fellow-students than in a general hospital. This plan of a college hospital has been very successfully carried out at many colleges and universities

and I am occasionally asked why we do not have one at the Institute.

The conditions at the Institute are somewhat peculiar and I think do not warrant the attempt to raise funds for this purpose at the present time. We have no group of dormitories, and the residence of the men is scattered. A considerable number of our students come from Eastern Massachusetts, and a large proportion of these live at their own homes, and would not be likely to use such a hospital. The expense of renting or purchasing, equipping and running such a building, in or near enough to the city to be available, would be large. This is especially true since about one-third of the cases cared for would be contagious diseases (diphtheria, scarlet fever, measles, etc.). It seems unwise to go to this expense until the permanent location of the Institute is definitely settled.

On the other hand, it must be remembered that the present plan is really quite satisfactory. The hospitals in Boston are of the highest grade and very accessible to the students. The Institute has one or two free beds at the Massachusetts General Hospital. There is never any delay in admitting students who need hospital care, and there is never any occasion for a poor student to pay for treatment if he cannot afford to, whether or not the Institute beds are filled. There is little or no necessary expense to the student except in contagious cases.

When the Institute moves to a new location out of town, and has a compact group of buildings with dormitories, and most of the students living together, an infirmary will be a very necessary and desirable part of the plant, and an admirable object for endowment.

FRANKLIN W. WHITE,
Medical Adviser.

REPORT OF THE LIBRARIAN.

The total number of books and pamphlets placed upon the shelves of the Library during the academic year ending September 30, 1909, is 6,423, an increase of 1,860 over the previous year. The following table shows the source of these accessions:

TOTAL ACCESSIONS, 1908–1909.

By Purchase	1,466
By Binding	1,321
By Gift, volumes	2,528
By Gift, pamphlets	1,108
Total	6,423

The cost of the purchase of books and periodicals and of placing them upon the shelves, exclusive of salaries, as shown by bills approved by the Librarian, amounts to $8,052.58. The items of expenditure may be classified as follows:

BILLS APPROVED, 1908–1909.

Books and Binding	$5,996.57
Periodicals	1,826.12
Supplies	322.26
	$8,144.95
Less cash received from sale of duplicates	92.37
Total	$8,052.58

The Libraries of the Institute now contain 86,554 volumes and 23,819 pamphlets and maps, representing an estimated investment of capital of $182,226.37. Each year a certain number of entries are cancelled in our record of accessions, either because of the loss or destruction of some books or owing to the binding up of several volumes into one. After deducting such items, the net increase in the Libraries of the Institute has amounted during the year to 4,752 volumes, 1,090 pamphlets, and 135 maps; a total increase over the previous year of 1,556 items.

The way in which these accessions have been distributed to the several Libraries, together with their cost, is exhibited in the following table:

TABLE OF THE NET INCREASE WITH THE COST OF THE SAME DURING THE YEAR 1908–09 AND THE TOTAL CONTENTS OF THE LIBRARIES OF THE INSTITUTE SEPTEMBER 30, 1909.

LIBRARIES.	NET INCREASE.				TOTAL CONTENTS.	
	Volumes.	Pamphlets.	Maps.	Cost.	Volumes.	Pamphlets and Maps.
General Library:						
General	60	131	—	$241.05	7,454	5,209
English	—1*	—4*	—	20.62	3,498	40
Military Science	—	—	—	—	367	9
Walker Memorial	—	—	—	—	485	—
Other Departments	1	—	—	17.97	49	1
Totals General Library	60	127	—	$279.64	11,852	5,259
Architecture	186	7	—	328.76	4,341	268
Biology	157	125	—	389.37	3,694	894
Chemistry	484	232	—	1,061.57	11,779	2,427
Electrical Engineering	245	15	—	456.80	1,703	93
Engineering	553	309	—	1,158.49	14,929	5,332
Geology	291	59	110	258.13	3,999	3,112
History and Economics	1,690	58	—	414.08	14,348	3,809
Margaret Cheney Room	117	2	—	20.10	793	15
Mathematics	126	25	—	350.08	2,037	286
Mining	271	25	25	336.01	5,035	787
Modern Languages	82	—	—	66.21	1,845	56
Naval Architecture	204	49	—	321.98†	1,556	193
Physics	286	57	—	555.32	8,643	1,297
Totals	4,752	1,090	135	$5,996.54	86,554	23,819

During the past academic year the publication of the *Technology Quarterly* was discontinued, and, therefore, the large number of periodicals which had previously been received in exchange for the Quarterly could no longer be claimed in that relation. A number of societies and editors of magazines, however, have continued to send their publications to the Library in exchange for the Bulletins of the

* Decrease. † Including gifts from Dr. Weld.

Institute. For many others it was necessary to subscribe in the usual way. That has made requisite a change in the usual form of the table of periodicals, and all periodicals now received as exchanges are listed as gifts.

The total number in the present table is 1,057, which is 60 less than the number shown in the previous year. This decrease is partially due to the discontinuance of some serials that were not desired, but more to the elimination from our list of gifts of periodicals which had ceased to be sent to us regularly, and for which there was no demand.

The following table shows the total number of periodicals and other serials received for the several Departments and the estimated cost:

TABLE OF PERIODICALS AND OTHER SERIAL PUBLICATIONS RECEIVED DURING THE YEAR 1908–09 CLASSIFIED BY DEPARTMENTS AND METHOD OF PAYMENT.

LIBRARIES.	Number Received.				Estimated Cost.		
	Gifts.	Charged to Department.	Periodical Account.	Totals.	Department Account.	Periodical Account.	Totals.
General	60	15	34	109	$42.47	$115.49	$157.96
Architecture	8	2	30	40	18.20	139.08	157.28
Biology	20	16	37	72	67.61	271.48	339.09
Chemistry	38	46	35	119	191.24	234.18	425.42
Electrical Engineering	6	13	20	39	39.70	82.89	122.59
Engineering	102	66	67	235	209.58	258.90	468.48
Geology	26	6	17	50	30.80	98.87	129.67
History and Economics	68	49	42	159	104.26	123.73	227.99
Margaret Cheney Room	—	6	—	6	17.30	—	17.30
Mathematics	4	7	16	26	22.73	77.17	99.90
Mining	40	11	27	78	38.12	120.67	158.79
Modern Languages	4	—	18	22*	—	74.10	74.10
Naval Architecture	9	12	6	27	59.99	16.91	76.90
Physics	29	15	31	75	69.95	141.80	211.75
Totals	414	264	379	1,057	$911.95	$1,755.27	$2,667.22

The amount of work accomplished during the year in the office of the Librarian is well shown by the number of cards added to the catalogue, which is nearly double the number added during the previous year, the total number added being 10,785, so that the General Catalogue now consists

* 10 kept in the General Library.

of 102,987 cards; and the total of the Departmental Libraries would add another 100,000.

The total number of orders issued for the purchase of new books has been 1,337; and 1,718 orders have been issued for binding; in both cases an increase over the number of the previous year.

It is not possible to keep an accurate account of the use of the Libraries. Probably the greater part of the books used are consulted in the reading rooms; nevertheless, there is a large number of books taken for home study and, where possible, record has been kept of these. The following table shows the data available:

CIRCULATION.

General Library	1,417
Architecture	1,864
Chemistry	1,958
Engineering	1,600
Mining	1,049
Naval Architecture	759

The condition of the shelves has become more crowded than ever, but this congestion has been relieved in a measure in some of the departments. In the Engineering Library a decided increase in the size of the library room has been made by moving a partition and including a room formerly occupied by the assistants in the Civil Engineering Department. In the Chemical Library certain sets of serials have been moved to shelves in Professor Talbot's office, thus making room for books more frequently used in the library. In the Biological Department, the congestion has also been relieved by taking certain classes of books and placing them in the professors' offices. This is a very inconvenient arrangement, but it is the best that can be done under the circumstances.

The General Library has been kept open in the evening as usual, and the total attendance has been, between five and seven o'clock, 1,273, and between seven and ten o'clock, 739, making an average of 7.5 and 4., respectively.

In the previous report of the Librarian mention was made of work then in progress upon a subject catalogue for the Engineering Library. This work was successfully completed by Miss Winn, the Assistant-in-Charge, well within the year covered by this report.

The most noticeable gift received during the year was that of the economic library of General Francis A. Walker, formerly president of the Institute. This library, consisting of 1,336 bound volumes, was presented to the Institute by Mrs. Walker. It has been catalogued and placed upon the shelves in the Library of History and Economics. As a mark of appreciation of this gift a special book plate was engraved and inserted in each volume.

Mrs. Rogers has continued her generous gifts to the Library of the Institute.

Other gifts especially worthy of mention are a collection of seventy-one volumes on Naval Architecture from Rear-Admiral Philip Hichborn, including thirty volumes of the Transactions of the Institution of Naval Architects and five volumes of the Transactions of the Society of Naval Architects and Engineers; from the library of Fred B. Stevens, Jr., '08, thirty-two volumes on engineering subjects; from Mr. Levi L. Willcutt of Brookline, seventy-one volumes of the American Architect; from the heirs of Charles H. Parker a part of the Alfred Greenough collection, consisting of fifty-three volumes on architectural subjects; from Mr. Arthur Winslow, '81, one hundred and fifty-six volumes on geological subjects; from Mr. Stephen Badlam, '00, one hundred volumes, chiefly books on general science, physics, chemistry, and marine engineering, which had formed part of the libraries of his father and grandfather; from Mrs. H. S. Hall, sixty-five volumes on chemical and mining subjects from the library of her late uncle, Lyman Nichols.

From Dr. Gustavus Hinrichs we have received three books of his on theoretical chemistry; from Hollis French, '89. three very interesting old editions of works by Robert Boyle;

from Henry A. Fiske, '91, three copies of Crosby and Fiske's "Handbook of Fire Protection."

Dr. Charles Goddard Weld has continued his gift of a fund for the purchase of books for the library of Naval Architecture, and from this we have purchased thirty-one volumes.

From members of the faculty we have received a number of their works. Professor G. A. Osborne presented a copy of his "Differential and Integral Calculus"; Professor A. A. Noyes and Professor S. P. Mulliken, their "Laboratory Experiments on the Class Reactions of the Organic Substances and Their Identification"; Professor G. L. Hosmer, his book on "Azimuth"; Professor A. H. Gill, his "Handbook of Oil Analysis"; Professor Louis Derr, his book on the "Direct Current Motors"; Professor C. R. Cross, Jeaffreson's "Life of Robert Stephenson" and Hobart's "Electric Motors"; Professors F. S. Woods and F. H. Bailey, the second volume of their "Course in Mathematics."

Among other gifts are: from the Editor of the Technique, "Technique" for 1909; from Gardner Tufts Voorhees, '90, a copy of his work on "Refrigerating Machines"; and from George Lansing Raymond of Washington, D.C., a set of his works, consisting of nine handsomely bound volumes.

ROBERT P. BIGELOW,
Librarian.

REPORT OF THE REGISTRAR.

This report with its tables is based, as is the custom, upon the registration on the first day of November. The registration this year is again larger than that of the past year, the number having risen from 1,462 to 1,479.

Omitting the research associates and assistants and those who are announced annually as lecturers, the total number of members of the instructing staff, as shown by the Cata-

logue this year, is 210; including all there are 241. Not taking into account the research associates and assistants and those who are announced annually as lecturers, the ratio of members of the instructing staff to students in attendance at the Institute is one to seven. Ten years ago this ratio was one to eight and eight-tenths.

Even though the total number is greater this year, the numbers in the classes of the four years are slightly smaller excepting in the case of the second year, where there is a considerable gain. For a number of years the classes have grown smaller as they replace the class next advanced except as the first year class takes the place of the second year class. Here there seems to be for several years a gain instead of a loss. The number of students above the fourth year, resident fellows and other candidates for the advanced degrees, has risen from 26 to 31. This is also a gain over the year previous.

The number of new students entering this year, while not quite as large as the number of new students last year, is, however, with the exception of that year, the largest for more than ten years. The new students are 39 per cent. of the total. Last year this proportion was 41 per cent.

The number of regular students relatively to the special students is also larger this year; last year 65 per cent. were regular while this year 69 per cent. of the students are in regular standing. While there are 31 per cent. of the students not in regular standing, it does not mean that all of these students are not, either actually or prospectively, candidates for the degree. A student is regular when he has a clear record in all of the subjects required up to the point of his connection with the Institute; a student may be special either because he has not fulfilled these requirements, or because he is simply taking a few subjects or less than full work.

The students of the Engineering Courses, regulars and specials, are 83 per cent. of the students of the upper three

years, those in the Scientific Courses are 7 per cent., while those in Architecture are 10 per cent. Those in the first year have not elected their professional course and cannot enter in this calculation. The per cent. of those taking Scientific Courses has dropped slightly, and the per cent. of students taking the Course in Architecture has risen. The greatest gain in any Course is that in Architecture; the number has risen from 85 to 104. There are other gains in Civil, Mechanical, and Sanitary Engineering, with a slight drop in Mining, and Electrical Engineering. This year, for the first time, statistics are gathered for the Course in Electrochemistry, recently set apart from the Course in Physics. The number, therefore, of students counted in the Course of Physics is less than usual. A continuous gain for the last four years has been made by the Courses in Chemical and Sanitary Engineering, and the number in Sanitary Engineering has almost doubled in the past four years, and is now 60.

A count has been made of the number of students pursuing certain leading branches of study and it is found that next to the number of individuals registered for Mathematics the largest number of students is in English. The numbers of students taking Chemistry and Physics follow closely.

The number of students at the Institute who are graduates of this or other colleges is 200; they come to the Institute from 84 colleges and universities. The largest number coming from any one college or university is 17 from Yale. The others sending 10 or more are Dartmouth, 10, Harvard, 14, and the U.S. Naval Academy, also 14. This year the number of new students from other colleges is greater than last year; 183 compared with 170. The largest group of new students from other colleges entered the second year, while last year, by a large majority, the greatest number entered the third year. The number of these new students who come to us after having spent four years in another college is again larger than the number of such students

entering after three, two or one year at their previous college. These 183 members from other colleges are 32 per cent. of the new students, while the number from other colleges last year was 27 per cent., and this was a large gain over the year previous to that.

The number of students who are registered now in the regular Five-Year Courses has risen again materially; and for the first time there are students regularly registered for the Five-Year Courses covering the work of two professional departments. This number of five-year students now is not confined so generally to the Engineering Courses as has previously been the fact, but more have elected the five-year scheme for the Courses in Science. The combinations this year of two Courses are: Civil and Sanitary Engineering, Mechanical and Electrical Engineering, Mechanical Engineering and Naval Architecture, and Electrical and Chemical Engineering.

The number of women students is lower than it has been for a number of years, there being only eight women at present at the Institute. Two are taking special work without course classification. In Architecture there are three women students, one regular and two specials; in Chemistry two, one regular and one special. There is also one special woman student in Biology.

Of the students who were admitted to the Institute this year on the basis of entrance examinations, there is a slight gain in the percentage of those who were admitted clear. There was also, this year, a larger per cent. of first-year students who were admitted, not on the basis of entrance examinations, but either on certificates of other colleges conferring degrees or on the basis of their age or technical experience. Of those who have passed the entrance examinations, a larger number than last year have not entered the Institute.

Last year there was a noticeable rise in the average age of first-year students at entrance. That age was 19 years

and one month and for ten years previous to that it had not exceeded 18 years and 11 months. This year, again, while the average age was not as great as it was last year, it was 19 years at entrance, almost one month less than the average age of the previous first year class. This average age may be due to the fact of the relatively large number entering from other colleges.

The class that was graduated from the Institute last June had, just as the previous class, a relatively large number of students who had attended other colleges, and the number has risen from 60, two years ago, to 81. This year the proportion was more than a third of the total number graduating, and of this portion more than half hold a college degree. The age of the graduating class was one month greater than last year. It was 23 years and 1 month, but the average age at graduation has been as high as 23 years and three months. The 233 graduates of last year raised the total number from 4,128 to 4,361. Half of this number have graduated within the last ten years, or since 1899.

The homes of our students from this country are in forty-three states and two territories, the District of Columbia, Philippine Islands, Porto Rico and the Canal Zone. North Carolina, Idaho, Nevada and Oklahoma have no representatives. Delaware and South Carolina are represented, whereas last year no one came to the Institute from these States. There has been very little change in the relative distribution of the students among the North Atlantic, South Atlantic, North Central, South Central and Western Districts of our country. There has been a slight numerical drop from 51 to 44 students from the South Atlantic district and a slight increase in number from the North Central, the South Central and the Western districts. The number from the North Atlantic district is numerically greater by ten than last year.

The number of foreign students has risen, and the number, 79, is within one of the greatest number of foreign stu-

dents we have ever had. Thirty foreign countries are represented by these students, and China with its 11 and Mexico with its 10 send more than any other two countries. Alberta, Bulgaria, New Zealand and Switzerland send students this year, and are countries that have not been represented for the past seven years.

The number of Massachusetts students has increased again; it has risen from 839 of last year to 852 this year, making 57.5 per cent. of students, which is a slight gain over the past three years. The number of towns sending students to the Institute has increased from 128 to 135. Of the Massachusetts students, 84 per cent. are from Suffolk or the counties adjoining. Boston and the cities or towns bordering the city send 51 per cent. of the students of this state, but this amounts to less than 30 per cent. of the total student body. Last year the percentage of Massachusetts students was slightly greater in the non-engineering Courses than in the engineering Courses. The case this year is reversed.

The registration of 215 of the past Summer School is lower than last year. The ratio of students from other colleges taking work in the Summer School, was, however, greater this year. Work was anticipated to a larger extent than in the summer of 1908, and more generally in Mechanic Arts, Descriptive Geometry, Architectural Design, Modern Languages, Mechanical Drawing, and Surveying, than in the other subjects that were given.

The amount of scholarship assistance given during the school year of 1908–9 was $22,687.50. The total number of undergraduate students assisted from Institute funds was 199. In addition to this, 73 students were aided by the State, of whom 47 were not aided by the Institute; this made a total of 246 students receiving scholarship assistance, or 16.8 per cent. of the total number of students at the Institute.

The statistics from which these conclusions are drawn are printed on the following pages.

THE CORPS OF INSTRUCTORS.

	1906–07.	1907–08.	1908–09.	1909–10.
Professors	39	43	44	44
Associate Professors	18	18	18	14
Assistant Professors	21	25	33	32
Faculty	78	86	95	90
Instructors	69	72	62	69
Assistants	52	52	50	51
	121	124	112	120
Research Associates	8	8	6	12
Research Assistants	3	3	1	1
	11	11	7	13
Lecturers	31	32	31	18
Total	241	253	245	241

STUDENTS BY CLASSES.

Class.	Regular.		Special.		Total.	
	1908.	1909	1908.	1909.	1908.	1909.
Resident Fellows	3	4	—	—	3	4
Other Candidates for advanced degrees	23	29	—	—	23	29
Fourth Year	199	224	146	116	345	340
Third Year	210	191	155	144	365	335
Second Year	190	228	151	167	341	395
First Year	323	318	61	58	384	376
Total	948	994	513	485	1,461	1,479
Non-resident Fellows	—	—	—	—	1	2

YEARLY REGISTRATION SINCE THE FOUNDATION OF THE INSTITUTE.

Year.	No. of Students.	Year.	No. of Students.	Year.	No. of Students
1865–66	72	1880–81	253	1895–96	1,187
1866–67	137	1881–82	302	1896–97	1,198
1867–68	167	1882–83	368	1897–98	1,198
1868–69	172	1883–84	443	1898–99	1,171
1869–70	206	1884–85	579	1899–00	1,178
1870–71	224	1885–86	609	1900–01	1,277
1871–72	261	1886–87	637	1901–02	1,415
1872–73	348	1887–88	720	1902–03	1,608
1873–74	276	1889–98	827	1903–04	1,528
1874–75	248	1889–90	909	1904–05	1,561
1875–76	255	1890–91	937	1905–06	1,466
1876–77	215	1891–92	1,011	1906–07	1,397
1877–78	194	1892–93	1,060	1907–08	1,415
1878–79	188	1893–94	1,157	1908–09	1,461
1879–80	203	1894–95	1,183	1909–10	1,479

GRADUATES BY YEARS AND COURSES.

Year.	Civil Engineerong.	Mechanical Engineering.	Mining Engineering and Metallurgy.	Architecture.	Chemistry.	Electrical Engineering.	Natural History or Biology.	Physics.	General Course.	Chemical Engineering	Sanitary Engineering.	Geology.	Naval Architecture.	Electro-Chemistry.	Total.
1868	6	1	6	—	—	—	—	—	1	—	—	—	—	—	14
1869	2	2	—	—	1	—	—	—	—	—	—	—	—	—	5
1870	4	2	2	—	1	—	—	—	1	—	—	—	—	—	10
1871	8	2	5	—	2	—	—	—	—	—	—	—	—	—	17
1872	3	1	5	—	3	—	—	—	—	—	—	—	—	—	12
1873	12	2	3	1	7	—	—	—	1	—	—	—	—	—	26
1874	10	4	1	1	—	—	—	—	2	—	—	—	—	—	18
1875	10	7	6	1	1	—	—	1	2	—	—	—	—	—	28
1876	12	8	8	—	5	—	2	3	4	—	—	—	—	—	42
1877	12	6	8	4	2	—	—	—	—	—	—	—	—	—	32
1878	8	2	2	3	3	—	—	—	1	—	—	—	—	—	19
1879	6	8	3	1	3	—	1	1	—	—	—	—	—	—	23
1880	3	—	3	—	1	—	—	—	1	—	—	—	—	—	8
1881	3	5	6	3	8	—	1	—	2	—	—	—	—	—	28
1882	2	5	5	3	6	—	1	1	1	—	—	—	—	—	24
1883	3	7	5	1	3	—	—	—	—	—	—	—	—	—	19
1884	5	6	13	—	12	—	—	—	—	—	—	—	—	—	36
1885	4	7	8	2	4	2	—	—	1	—	—	—	—	—	28
1886	9	23	7	1	7	10	1	—	1	—	—	—	—	—	59
1887	10	17	8	1	9	8	1	1	3	—	—	—	—	—	58
1888	11	25	4	5	10	17	3	1	1	—	—	—	—	—	77
1889	14	24	5	3	8	17	1	1	2	—	—	—	—	—	75
1890	25	28	3	5	13	18	3	2	6	—	—	—	—	—	103
1891	18	26	4	6	11	23	3	3	1	7	—	1	—	—	103
1892	22	26	4	13	7	36	6	1	7	4	6	1	—	—	133
1893	25	30	5	2	8	41	2	—	6	8	—	2	—	—	129
1894	21	31	4	14	11	33	1	3	5	12	3	—	—	—	138
1895	25	30	3	15	14	33	—	2	4	11	4	—	5	—	144*
1896	26	34	10	24	17	48	3	3	7	7	4	3	5	—	190*
1897	25	40	7	16	20	33	2	3	7	12	4	1	9	—	179
1898	32	41	7	29	25	33	3	4	6	9	3	—	7	—	199
1899	30	37	9	22	22	32	2	2	1	10	1	—	8	—	173*
1900	32	34	21	21	19	23	3	3	5	11	4	—	9	—	185
1901	37	39	18	21	17	25	1	1	6	14	4	1	16	—	200
1902	24	46	14	18	14	35	5	3	3	9	7	—	14	—	192
1903	26	37	27	15	13	39	1	3	1	10	4	1	12	1	190
1904	34	45	32	24	15	34	3	5	5	7	2	1	17	8	232
1905	46	54	26	12	23	31	3	—	3	13	5	1	24	3	244
1906	47	69	38	22	21	37	2	4	—	10	6	—	19	3	278
1907	37	52	22	21	10	32	—	—	—	14	3	2	10	5	208
1908	48	61	19	19	16	38	4	—	—	15	2	—	5	2	229
1909	50	41	30	18	12	42	5	3	—	13	9	—	5	3	231
Totals	787	965	416	367	404	720	63	54	96*	196	71	14	165	25†	4,338*

Names counted twice, students graduating in two different years	20
Bachelors of Science	4,318*
Masters of Science, not included in the above	44
Doctors of Philosophy, not included in the above	3
Total	4,365*

* Deducting names counted twice (students graduating in two courses).

† Prior to 1909 this Course was designated as Option 3 (Electrochemistry) of Course VIII.

STATISTICS OF ADMISSION.

	Regular.	*Special.*	*Total.*
Admitted clear	129	0	129
" with one condition	66	1	67
" with two conditions	61	3	64
" with three conditions	24	1	25
" with four conditions	3	3	6
" on examination	283	8	291
Total First-year Class	318	55	373

Admitted but did not enter			57
Candidates at June Entrance Examinations			641
Candidates rejected in June	Complete candidates	19	
	Final "	20	
	Preliminary "	43	
	Partial "	29	
		111	
Candidates in September for Entrance and Advanced Standing Examinations			301
Candidates rejected in September	Complete candidates	9	
	Final "	9	
	Preliminary "	8	
Certificates of the College Entrance Examination Board submitted			85

TOTAL REGISTRATION AND NUMBER OF NEW STUDENTS.

YEAR.	(1) Total No. of Students.	(2) No. of Students in the Catalogue of the previous year who remain in the Institute.	(3) No. of New Students entering before issue of Catalogue.	(4) Of those in column (3) the following number are regular First year Students.	(5) No. of New Students not of the regular First year Class.
1900–1901	1,277	789	488	312	176
1901–1902	1,415	844	571	396	175
1902–1903	1,608	949	659	432	226
1903–1904	1,528	1,042	486	249	237
1904–1905	1,561	986	575	295	280
1905–1906	1,466	984	482	213	269
1906–1907	1,397	862	535	272	263
1907–1908	1,415	888	527	273	254
1908–1909	1,462	868	594	323	271
1909–1910	1,479	891	579	317	262

NEW STUDENTS FROM OTHER COLLEGES.

Class, by Year, Joined at Institute.	Years Spent at College.					Total
	One.	Two.	Three.	Four.	Five	
First	13	9	1	3	—	26
Second	12	20	5	25	1	63
Third	1	4	12	45	—	62
Fourth	—	2	2	12	1	17
Graduate	—	—	—	5	6	11
Total	26	35	20	89	8	179

GRADUATE STUDENTS.

Colleges and Universities Represented.

Albright	1	Massachusetts State Agricultural	1
American International	1	Middlebury	2
Amherst	3	Minnesota	1
Anatolia	1	Mississippi Agricultural	2
Arkansas	1	Missouri	1
Armour Institute	1	Nebraska	1
Austin	1	Newberry	1
Bates	2	New Brunswick	1
Beloit	2	New York University	2
Boston College	1	Notre Dame	1
Boston University	2	Oregon	2
Bowdoin	1	Pennsylvania Military	2
Brown	3	Pennsylvania State	2
Buenos Ayres National	1	Princeton	6
Carleton	1	Purdue	1
Central College	1	Queen's	2
Chicago	1	Radcliffe	2
City of New York	3	Rhode Island Agricultural	3
Coe	1	Rochester	6
Columbia	1	Sacred Heart	1
Cornell	3	Saint John	1
Dakota Wesleyan	2	Saint Louis	3
Dartmouth	10	Saint Xavier	1
DePauw	1	Smith	1
Ecole Polytechnic (Montreal)	1	South Carolina	1
Franklin and Marshall	2	South Dakota	1
Greece National	1	Texas Agricultural	2
Georgia School of Technology	1	Texas University	2
Georgia University	1	United States Naval Academy	14
Harvard	14	Virginia Military	3
Havana (Cuba)	1	Virginia Polytechnic	1
Holy Cross	2	Washington and Jefferson	2
Illinois	1	Washington and Lee	3
Japanese Naval Engineering	1	Wesleyan	3
Johns Hopkins	2	Western Reserve	1
Kansas	1	Whitman	1
Kansas State	1	Williams	6
Lafayette	1	William and Mary	1
Lehigh	1	Wooster	1
Leland Stanford Junior	2	Yale	17
McGill	3		203
Marietta	1	Counted twice	3
Maryland Agricultural	1		200
Massachusetts Institute of Technology	15		

Graduates who are candidates for Advanced Degrees	13
Graduates who are pursuing undergraduate work	187
Colleges and Universities represented	84

COURSES OF INSTRUCTION.

REGULAR AND SPECIAL STUDENTS BY COURSES FOR THE CURRENT YEAR.

YEAR.		Civil Engineering.	Mechanical Engineering.	Mining Engineering and Metallurgy.	Architecture.	Chemistry.	Electrical Engineering.	Biology.	Physics.	General Science.	Chemical Engineering.	Sanitary Engineering.	Geology.	Naval Architecture.	Electro-chemistry.	Total.
4th	Reg.	52	49	22	13	7	37	3	—	2	16	12	—	8	3	224
	Sp.	14	16	9	21	9	24	2	—	1	6	4	1	7	2	116
3d	Reg.	39	37	14	9	8	43	—	2	1	19	12	--	8	1	191*
	Sp.	28	18	12	19	11	27	5	—	—	5	11	—	6	3	144*
2d	Reg.	43	48	20	11	3	50	5	2	—	29	16	—	4	1	228
	Sp.	28	34	22	31	5	18	4	—	—	9	4	—	8	4	167
Tot.	Reg.	135	134	55	33	18	131	8	4	3	64	41	—	20	4	643*
	Sp.	70	69	44	71	25	69	11	—	1	20	19	1	21	10	427*
Total		205	203	99	104	43	200	19	4	4	84	60	1	41	14	1,073*

THE SAME CLASSIFICATION FOR FOUR YEARS.

YEAR.	Civil Engineering.	Mechanical Engineering.	Mining Engineering.	Architecture.	Chemistry.	Electrical Engineering.	Biology.	Physics.	General Science.	Chemical Engineering.	Sanitary Engineering	Geology.	Naval Architecture.	Naval Construction.	Electro-chemistry.
1906–07	210	214	100	94	49	192	10	18	0	55	32	2	43	17	—
1907–08	210	226	118	82	53	200	17	20	2	59	39	0	37	16	—
1908–09	195	196	102	85	58	206	20	19	4	71	52	2	41	13	—
1909–10	205	203	99	104	43	200	19	4	4	84	60	1	41	—	14

NUMBER OF STUDENTS PURSUING CERTAIN LEADING BRANCHES OF STUDY.

	First Year.	Second Year.	Third Year.	Fourth Year.	Total.
Chemistry	375	135	118	96	724
English	350	367	38	—	755
French	154	35	17	—	206
Geology	—	49	103	30	182
German	148	60	23	—	231
Mathematics	416	356	136	—	908
Mechanics Arts	—	124	49	125	298
Physics	—	355	326	38	719

*Deducting names counted twice.

REGULAR FIVE-YEAR STUDENTS.

YEAR.	Total.	Civil Engineering.	Mechanical Engineering.	Mining Engineering.	Architecture.	Chemistry.	Electrical Engineering.	Biology.	Physics.	General Science.	Chemical Engineering.	Sanitary Engineering.	Geology.	Naval Architecture.
1st	9	–	–	–	–	–	–	–	–	–	–	–	–	–
2d	10*	–	6	2	–	–	3	1	–	–	1	–	–	1
3d	17*	1	3	3	3	3	2	–	–	–	–	2	–	1
4th	10	–	4	–	–	–	1	–	–	2	–	3	–	–
5th	5	1	2	–	–	–	1	1	–	–	–	–	–	–
	51*	2	15	5	3	3	7	2	–	2	1	5	–	2

WOMEN STUDENTS.

COURSE. Year of Course.	Architecture.		Chemistry.		Biology.		Total
	Regular.	Special.	Regular.	Special.	Regular.	Special.	
Graduate	–	–	–	–	–	–	–
Fourth	–	–	1	–	–	–	1
Third	1	1	–	–	–	1	3
Second	–	1	–	1	–	–	2
Special, without course classifications	–	–	–	–	–	–	2
Totals	1	2	1	1	–	1	8

STATISTICS OF GRADUATION, CLASS OF 1909.

Number receiving degree at end of one year	5
" " " " " " two years	35
" " " " " " three "	26
" " " " " " four "	103
" " " " " " five "	60
" " " " " " six "	4
Total number of degrees of S. B. awarded	233*
Number entering from other colleges	81
" graduates	55
" non-graduates	26

* Including one recommended since June, and one as of the Class of 1908.

FURTHER STATISTICS OF THE STUDENTS FROM OTHER COLLEGES OF THE GRADUATING CLASS, JUNE, 1909.

Yrs. at the Inst.	*Graduate.*	*Non-graduate.*	*Total.*
1	5	–	5
2	33	2	35
3	13	13	26
4	4	8	12
5	–	3	3
	55	26	81

AGES OF THE MEMBERS OF THE GRADUATING CLASS, JUNE, 1909.

Under 20½	1
Between 20½ and 21	3
" 21 " 21½	17
" 21½ " 22	29
" 22 " 23	58
" 23 " 24	55
" 24 " 25	29
" 25 " 26	21
26 and over	20
Total	233*

The average age was 23 years.

AGES OF THE REGULAR FIRST-YEAR STUDENTS.

PERIOD OF LIFE.	1908–1909.		1909–1910.	
	Half-year Groups.	Yearly Groups.	Half-year Groups.	Yearly Groups.
16 to 16½ years	—	—	—	—
16½ to 17 "	3	3	4	4
17 to 17½ "	11	—	17	—
17½ to 18 "	20	31	20	37
18 to 18½ "	50	—	53	—
18½ to 19 "	64	114	70	123
19 to 19½ "	69	—	49	—
19½ to 20 "	31	100	31	80
20 to 20½ "	30	—	16	—
20½ to 21 "	11	41	16	32
21 to 22 "	11	11	16	16
	300	300	292	292

Repeating the first year	4
Students of unusual age	22
Average age, omitting these 26	19 years

* Including one recommended since June.

SUMMER SCHOOL.

	1908.	1909.
Number from other colleges and schools attending	52	44
Number not referring to any other college or school	3	5
Number from Massachusetts Institute of Technology	214	166
	269	215
Number who registered, but did not attend	7	9
Number who applied, but cancelled registration	6	1
Registrations for failures or deficiencies	184	140
Registrations to anticipate work	312	266

NUMBER OF STUDENTS REGISTERED IN EACH OF THE COURSES OF THE SUMMER SCHOOL FOR THIS YEAR AND THE YEAR BEFORE.

	1908.	1909.
Applied Mechanics	48	19
Carpentry	7	7
Chemistry, Inorganic and Analytical	46	37
Chipping and Filing	4	3
Descriptive Geometry	34	34
Design	14	7
English	0	6
Field Geology	0	1
Forging	9	7
French	4	6
German	5	6
Integral Calculus	22	0
Machine Tool Work	16	29
Mathematics (1)	19	17
Mathematics (2)	0	12
Mechanical Drawing	14	20
Mechanical Engineering Drawing	21	15
Mechanism	21	9
Metal Turning	5	0
Organic Chemical Laboratory	8	7
Pattern Work 122–123	8	8
Physical Laboratory	8	5

RESIDENCE OF STUDENTS.

NUMBER OF STUDENTS IN EACH YEAR, FROM 1902, COMING FROM EACH STATE OR TERRITORY.

STATES AND TERRITORIES	1902.	1903.	1904.	1905.	1906.	1907.	1908	1909.
North Atlantic.								
Connecticut	43	44	48	50	36	29	3[illegible]	32
Maine	35	34	26	22	18	23	22	20
Massachusetts	935	869	889	807	764	781	839	852
New Hampshire	34	23	36	32	26	27	24	27
New Jersey	8	13	16	11	15	17	14	14
New York	96	104	94	71	84	82	99	99
Pennsylvania	44	52	56	58	55	57	53	46
Rhode Island	40	28	19	24	23	28	28	30
Vermont	12	11	5	5	4	5	6	6
Total	1,247	1,178	1,189	1,080	1,025	1,049	1,116	1,126
South Atlantic.								
Delaware	4	3	2	1	2	1	–	1
Dist. of Columbia	17	25	7	13	12	10	10	8
Florida	2	2	4	3	3	3	6	5
Georgia	6	4	6	8	4	2	3	4
Maryland	27	25	18	19	17	8	7	12
North Carolina	6	7	1	–	1	–	1	–
South Carolina	4	–	–	1	3	2	–	2
Virginia	7	7	4	7	8	9	11	10
West Virginia	–	–	–	1	2	3	3	2
Total	73	63	52	53	52	48	51	44
South Central.								
Alabama	1	1	1	1	2	4	3	5
Arkansas	1	1	–	1	–	2	1	2
Kentucky	11	9	8	5	5	5	4	4
Louisiana	2	2	5	1	2	–	3	2
Mississippi		4	4	4	5	3	3	3
Tennessee	3	5	2	2	3	6	8	8
Texas	9	11	13	16	15	16	16	13
Total	27	33	33	30	32	36	38	37
North Central.								
Illinois	49	44	43	42	37	31	23	24
Indiana	14	6	10	10	15	12	9	11
Iowa	8	6	9	13	14	16	14	5
Kansas	1	1	4	7	6	5	4	6
Michigan	10	9	9	10	7	8	7	10
Minnesota	10	9	11	13	14	8	8	10
Missouri	20	22	25	29	17	14	6	7
Nebraska	5	4	5	4	2	3	2	4
North Dakota	1	1	1	–	3	4	3	3
Ohio	43	37	35	34	30	26	30	27
South Dakota	1	3	2	–	1	3	3	5
Wisconsin	11	13	14	12	7	12	12	11
Total	173	155	168	174	153	142	121	123
Western.								
California	15	19	18	23	21	14	20	25
Colorado	10	11	16	17	12	10	5	6
Idaho	–	–	–	–	–	–	1	–
Montana	3	2	5	3	3	3	2	3
Nevada	–	–	–	1	1	1	1	–
New Mexico	1	1	2	–	–	1	1	1
Oklahoma	–	–	–	–	–	1	1	–
Oregon	4	7	8	5	2	3	4	
Utah	2	3	3	2	3	3	5	3
Washington	3	3	2	2	5	12	13	11
Wyoming	1	–	–	2	5	1	1	1
Total	39	46	54	55	52	49	54	59

District.	1902.	1903.	1904.	1905.	1906.	1907.	1908.	1909.
Canal Zone	–	–	–	–	–	–	1	1
Hawaii	–	1	1	1	2	2	1	2
Philippine Islands	–	–	4	2	3	1	1	1
Porto Rico	2	2	4	5	2	3	6	7
Total	2	3	9	8	7	6	9	11
Total for the United States	1,561	1,478	1,505	1,400	1,321	1,330	1,389	1,400

Number of Students in Each Year, from 1902, coming from Each Foreign Country.

Foreign Countries.	1902.	1903.	1904.	1905.	1906.	1907.	1908.	1909.
Alberta	–	–	–	–	–	–	–	1
Argentine Republic	–	–	–	–	1	2	2	4
Armenia	–	1	1	3	2	2	2	–
Australia	2	3	1	3	3	3	–	–
Austria	–	–	–	–	–	–	–	–
Belgium	–	–	–	–	1	1	–	–
Bermuda	1	1	–	1	1	–	–	–
Brazil	5	3	3	1	–	2	3	1
British Columbia	–	–	–	–	1	–	1	2
Bulgaria	–	–	–	–	–	–	–	1
Cape Breton	–	–	–	–	–	–	1	1
Cape Colony	–	–	–	–	1	1	1	–
Central America	–	–	1	–	–	–	1	–
Chile	1	1	1	2	1	1	1	1
China	1	2	8	8	7	9	10	11
Costa Rica	–	–	–	–	–	2	3	2
Cuba	2	3	4	4	4	–	2	7
Denmark	1	1	1	1	1	1	–	–
Ecuador	–	–	1	–	2	2	2	1
Egypt	–	–	–	1	2	2	2	1
England	3	4	4	5	6	4	3	–
France	–	–	1	1	–	–	–	–
Germany	1	2	–	–	–	–	–	1
Honduras	–	–	–	–	1	–	1	3
India	–	1	1	1	1	1	2	1
Ireland	1	1	–	2	2	3	1	–
Italy	–	–	–	2	–	2	1	1
Jamaica	–	–	1	–	1	–	1	1
Japan	1	2	1	3	5	5	4	4
Korea	–	–	2	–	–	–	–	–
Malta, Island of	–	1	1	–	–	–	–	–
Manitoba	1	1	–	–	–	–	–	–
Mexico	10	8	4	7	12	12	6	10
New Brunswick	2	1	2	4	3	2	1	3
New Zealand	–	–	–	–	–	–	–	1
Nova Scotia	8	9	4	1	4	3	4	5
Ontario	2	2	5	6	6	4	7	6
Panama	–	–	–	–	–	1	–	–
Paraguay	–	–	–	–	–	1	1	1
Peru	–	–	–	1	1	2	2	1
Poland	–	–	–	–	–	1	–	–
Quebec	–	1	2	1	1	–	1	2
Russia	–	–	–	–	–	2	2	2
Scotland	1	1	2	1	1	1	–	–
Sweden	–	–	1	–	–	–	–	–
Switzerland	–	–	–	–	–	–	–	1
Syria	–	1	1	–	–	–	–	–
Transvaal	–	–	1	3	3	3	2	–
Turkey	4	–	2	1	1	2	1	2
Uruguay	–	–	–	2	1	1	1	–
Total	47	50	56	66	76	80	72	79
Total in school	1,608	1,528	1,561	1,466	1,397	1,410	1,461	1,479

RESIDENCE OF STUDENTS FOR THIS SCHOOL YEAR.

States.	Candidates for Advanced Degrees.	Fourth Year.	Third Year.	Second Year.	First Year.	All Regular Students.	Special Students.	Total.
Alabama	–	1	1	–	–	2	3	5
Arkansas	–	–	–	1	–	1	1	2
California	1	4	3	3	1	12	13	25
Canal Zone	–	–	1	–	–	1	–	1
Colorado	–	1	1	–	1	3	3	6
Connecticut	1	7	1	10	8	27	5	32
Delaware	–	–	–	–	1	1	–	1
Dist. of Columbia	–	–	2	2	1	5	3	8
Florida	1	–	–	1	–	2	3	5
Georgia	–	–	2	–	–	2	2	4
Hawaii	–	–	–	–	1	1	1	2
Illinois	–	3	3	3	1	10	14	24
Indiana	2	1	2	2	1	8	3	11
Iowa	1	1	–	1	–	3	2	5
Kansas	1	–	–	1	1	3	3	6
Kentucky	–	–	1	1	–	2	2	4
Louisiana	–	–	2	–	–	2	–	2
Maine	–	3	6	2	2	13	7	20
Maryland	–	4	4	2	–	10	2	12
Massachusetts	12	124	108	141	230	615	237	852
Michigan	–	2	2	2	2	8	2	10
Minnesota	–	2	–	–	–	2	8	10
Mississippi	–	–	–	–	1	1	2	3
Missouri	1	–	1	1	–	3	4	7
Montana	–	1	1	–	–	2	1	3
Nebraska	–	–	–	1	1	2	2	4
New Hampshire	–	8	1	4	6	19	8	27
New Jersey	–	–	–	5	3	8	6	14
New Mexico	–	–	1	–	–	1	–	1
New York	3	16	16	13	16	64	35	99
North Dakota	–	–	1	1	–	2	1	3
Ohio	–	5	2	7	3	17	10	27
Oregon	–	1	–	–	–	1	6	7
Pennsylvania	1	12	4	4	8	29	17	46
Philippine Islands	–	–	–	1	–	1	–	1
Porto Rico	–	–	1	3	2	6	1	7
Rhode Island	2	3	6	1	5	17	13	30
South Carolina	–	–	1	–	–	1	1	2
South Dakota	–	2	–	1	–	3	2	5
Tennesee	1	3	–	1	1	6	2	8
Texas	1	3	2	1	1	8	5	13
Utah	–	–	–	1	–	1	4	5
Vermont	–	1	–	1	–	2	4	6
Virginia	–	2	2	1	1	6	4	10
Washington	–	4	1	–	1	6	5	11
West Virginia	–	1	–	–	1	1	1	2
Wisconsin	–	3	3	1	1	8	3	11
Wyoming	–	–	1	–	–	1	–	
Total	28	217	183	220	301	949	451	1,400
Foreign Countries.								
Alberta	–	–	–	–	–	–	1	1
Argentina	–	1	2	–	–	3	1	4
Brazil	–	–	–	–	1	1	–	1
BritishColumbia	–	–	–	–	–	–	2	2
Bulgaria	–	–	–	–	–	–	1	1
Cape Breton	–	–	1	–	–	1	–	1
Chile	–	–	–	–	–	–	1	1
China	–	1	–	3	1	5	6	11
Costa Rica	–	–	–	1	–	1	1	2
Cuba	1	1	–	–	4	6	1	7
Ecuador	–	1	–	–	–	1	–	1
Egypt	–	–	–	–	–	–	1	1
Germany	–	–	1	–	–	1	–	1
Honduras	–	–	–	2	–	2	1	3
India	–	–	–	–	–	–	1	1
Italy	–	–	–	–	1	1	–	1
Jamaica	–	–	–	1	–	1	–	1
Japan	–	–	1	–	–	1	3	4
Mexico	–	1	1	–	5	7	3	10
New Brunswick	1	–	–	–	1	2	1	3
New Zealand	–	–	–	–	–	–	1	1
Nova Scotia	1	1	–	1	–	3	2	5
Ontario	1	–	1	–	1	3	3	6
Paraguay	–	–	–	–	–	–	1	1
Peru	–	–	–	–	–	–	1	1
Quebec	1	–	–	–	–	1	1	2
Russia	–	–	1	–	1	2	–	2
Switzerland	–	–	–	–	1	1	–	1
Transvaal	–	–	–	–	–	–	1	1
Turkey	–	1	–	–	1	2	–	2
Total	5	7	8	8	17	45	34	79

RESIDENCE OF MASSACHUSETTS STUDENTS.

County.	No. of Towns.	No. of Students.	County.	No. of Towns.	No. of Students
Barnstable	2	7	Middlesex	29	249
Berkshire	6	10	Nantucket	1	2
Bristol	8	23	Norfolk	20	101
Dukes	2	4	Plymouth	14	35
Essex	21	107	Suffolk	4	256
Franklin	5	6	Worcester	15	25
Hampden	5	24	Total	135	852
Hampshire	3	3			

FROM CITIES WHICH SEND FIVE OR MORE STUDENTS.

Boston	235	Springfield	12	Natick	7
Newton	48	Winchester	11	Revere	7
Brookline	32	Lynn	10	Wakefield	7
Cambridge	28	Salem	10	Barnstable	6
Somerville	27	Taunton	10	Concord	6
Malden	18	Chelsea	9	Canton	5
Lowell	17	Framingham	9	Danvers	5
Newburyport	17	Hyde Park	9	Fitchburg	5
Lawrence	16	Melrose	9	Haverhill	5
Waltham	15	Beverly	8	Marlboro	5
Quincy	13	Holyoke	8	Medford	5
Brockton	12	Weymouth	8	Winthrop	5
Everett	12	Gloucester	7		

DISTRIBUTION OF MASSACHUSETTS STUDENTS, ABOVE THE FIRST YEAR, AMONG THE COURSES.

YEAR.		Civil Engineering.	Mechanical Engineering.	Mining Engineering and Metallurgy.	Architecture.	Chemistry.	Electrical Engineering.	Biology.	Physics.	General Science.	Chemical Engineering.	Sanitary Engineering.	Geology.	Naval Architecture.	Electrochemistry.	Total.	
4th Year	Reg.	28	27	16	5	6	19	3	–	1	7	7	–	2	3	124	
	Sp.	6	7	3	9	7	13	–	–	–	3	2	–	1	2	53	
3d Year	Reg.	24	19	4	5	6	25	–	1	–	14	9	–	1	–	108	
	Sp.	14	8	7	5	6	9	4	–	–	2	11	–	1	2	68*	
2d Year	Reg.	26	27	12	8	2	28	5	1	–	21	12	–	–	–	141*	
	Sp.	18	19	12	16	2	8	4	–	–	4	2	–	5	2	92	
1st Year	Reg.	–	–	–	–	–	–	–	–	–	–	–	–	–	–	230	
	Sp.	–	–	–	–	–	–	–	–	–	–	–	–	–	–	24	
Total	Reg.	78	73	32	18	14	72	8	2	1	42	28	–	3	3	373*	840 Adv.
	Sp.	38	34	22	30	15	30	8	–	–	9	15	–	7	6	213*	12 Deg.
Totals		116	107	54	48	29	102	16	2	1	51	43	–	10	9	586*	852*

WALTER HUMPHREYS,

Registrar.

* Deducting names counted twice.

Reports of Departments.

DEPARTMENT OF CIVIL AND SANITARY ENGINEERING.

The most important occurrence in the Department during the past year was Professor Swain's resignation. The high character of his work at the Institute and his ability as a teacher and an engineer are so widely recognized, that extended mention of them here seems superfluous. It is appropriate, however, to express in behalf of the Instructing Staff of the Department its appreciation of the service rendered by him to the Institute and to the Civil Engineering profession at large in the promotion of high teaching ideals and sound engineering practice; and it is a matter for gratification that he will still remain near by as a counsellor and friend.

Another resignation greatly regretted by colleagues and students was that of Associate Professor Mott, who in August accepted an appointment as Professor of Civil Engineering Practice at the Carnegie Technical Schools, Pittsburg. Professor Mott, of the Class of '89, became, not long after graduation, an Instructor at Cornell University, teaching along the lines of Mechanics and Hydraulics. He returned to the Institute in 1905 and immediately won a high position in the respect and affection of students and fellow-teachers, all of whom wish him the best of success in his new duties.

It is interesting to note that the position which Professor Swain has been called to fill, and that which Professor Mott's resignation has created, constitute the first and the last links of a chain of important teaching positions filled within the year, and that five of those appointed to these positions have been Institute graduates.

Associate Professor Arthur G. Robbins has been advanced to the grade of Professor of Topographical Engineering. He has taught continuously and successfully in the Department since his graduation in 1886.

New appointments are those of Charles M. Spofford to the chair of Hayward Professor of Civil Engineering made vacant by Professor Swain's resignation, and of Harold K. Barrows as Associate Professor of Hydraulic Engineering, the position held by Professor Mott.

Professor Spofford is a graduate of the Class of '93, taking advanced work during the following year. After a short experience in Railroad Engineering, he entered the service of the Phœnix Bridge Company, with whom, during a service of two years and several additional summers, he gained a very valuable practical experience, supplemented by work in designing structures for the city of Boston, the Boston Elevated Railway, and others. From 1896 to 1905, he taught Structures and Bridge Design at the Institute, in this way becoming thoroughly familiar with our work in these subjects. For four years he was head of the department of Civil Engineering at the Brooklyn Polytechnic Institute, which gave him an opportunity of exercising initiative in his teaching work along several lines, as well as of coming into touch with some important engineering projects, notably the Queensboro Bridge in New York. He returns to the Institute with a ripe and varied experience both in teaching and in practice, and the work under his care, both undergraduate and advanced structural work, is progressing most satisfactorily, and fully justifies the wisdom of his choice.

Harold K. Barrows, of the Class of '95, served for a year after graduation as an Assistant in the Department. After several years of practice in general lines of civil engineering, including work with the city of Newton, and with the Metropolitan Water Board in office design, he became Assistant Professor and afterwards Associate Professor of Civil Engineering at the University of Vermont. He left this posi-

tion to enter the United States Government Service as Engineer and as District Hydrographer, positions which he has held to the present. He has also established, and is now carrying on, a general practice, mainly in hydraulic engineering. His work in these connections has not only yielded him an unusual experience in hydraulic lines, but has given him opportunity for valuable acquaintance among hydraulic men. His appointment, just made at the time of writing this report, gives assurance that the hydraulic work will be continued at a high standard of excellence.

Professor Russell, at the close of the summer vacation, had completed the manuscript of his book on Hydraulics which was published in October, and is now in use with all the classes taking this subject. It well fills a long felt need for a text-book upon a subject, in which the fundamental principles of hydraulics should be logically developed and their application clearly illustrated. While published and adapted for general use it has, nevertheless, been framed with full appreciation of Institute needs and kept free from the extraneous matter often found in books on hydraulics.

The work in Hydraulic Measurements (steam gaugings) has been carried on this fall by Professors Porter and Russell, with the aid of Mr. Richard L. Cary, Assistant. By the courtesy of the Proprietor of Locks and Canals, the tube and suspended meter gaugings have been made, as for years past, in the Merrimack and Boott measuring flumes at Lowell, which are especially well suited to the purpose. In 1908, and again this year, the gauging station on the Charles River at Newton Upper Falls, heretofore used for rod meters, was found unsuitable because of the low stage of river and the obstructed condition of the channel. Resort was therefore had to Mother Brook, a cross-cut from the Charles to the Neponset in the town of Dedham, carrying about one-half as much water as the Charles at their junction, but answering sufficiently well for student's work.

The time required from any one student for this course

is moderate, but because of the large number of students (over 70 this fall), the necessity of small field parties for proper instruction, and the limited number of afternoons available, it has become extremely difficult to complete the field work in the period of the term allotted to it. Each field trip requires from four to six hours of the instructors' time, resulting in a large aggregate for the season, because of the repeated trips with the different parties. The establishment of a summer school in surveying would permit this work also to be there given, with economy of time for students and instructors alike, and with simplification of the regular schedule of studies of the fall term.

For the class-room the Notes on Hydraulic Measurements have been revised by Professor Porter, and published for the use of our students.

As Assistants to fill the places of six who had resigned at the end of the year, there were appointed Richard L. Cary, Walter W. Clifford, Frederic R. Faulkner, Frank S. Lovewell, Morse W. Rew, and Arthur L. Shaw. All of these are graduates in the Class of '09, and four of them also hold degrees from other institutions.

Many of the Instructing Staff have been engaged upon professional work during the summer: among the number may be mentioned Professors Breed, Hosmer, and Moore; also Mr. Howard and Mr. Bradbury.

The library of Civil Engineering books has grown during Professor Swain's administration from one or two cases of books to a large and very complete library. As far as I know, it has no superior as a working library of Civil Engineering in this country, and its growth, together with that of the library of Mechanical Engineering, which together constitute the Engineering Library, rendered enlargement of the room absolutely necessary. This has been accomplished by extending the library, part of the space required being taken from the room used as a museum for the Department; while two of the offices have also been reduced

in size and rearranged, so that no encroachment has been necessary upon the space utilized for students' use.

With the demand for advanced work in Structures, Hydraulics, and Sanitary Engineering which seems now definitely established, there is needed a room which can be used both as a lecture and a drafting room for advanced students only. The present accommodations for such students is inadequate. The present fourth-year drafting room is no more than adequate for the regular undergraduate class, and the same is also true of the second and third year rooms.

The most urgent need in the Department is a site and buildings for a Summer School of Surveying. This may properly be considered the Laboratory of Civil Engineering. The field work of general or of railroad surveying cannot be satisfactorily carried on from a large city as a base, as we now attempt to do it. More than half the time assigned is wasted in travel and in getting under way, and satisfactory results are substantially out of the question in the limited time available during one exercise. The present system is not only wasteful in time, but also unproductive in results. While improvements or extensions in many lines of Institute work must be delayed until the question of site for the Institute is settled, provision for the Summer School of Surveying can be made entirely independent of that consideration, and I cannot too strongly urge its necessity. Professor Swain has very fully presented the matter in the last and in previous reports, and not only is the Department unanimously and strongly in favor of it, but finally it has received the endorsement of the Faculty after careful consideration by a special committee.

Upon Professor Swain's retirement as head of the Department, a change was made in the organization of the work previously done by him, by which his administrative duties have been divided. Professor Spofford represents the Course in Civil and Topographical Engineering in connection with Faculty or students; and Professor Porter in similar fash-

ion represents the Course in Sanitary Engineering. The Department of Civil and Sanitary Engineering in its general and administrative work is represented by Professor Allen. In addition to this division of duties, more control and initiative is expected to be exercised by Professors Porter, Robbins, Spofford and Allen in the lines of Hydraulics, Surveying, Structures, and Railroads, respectively. This arrangement is more democratic and seems to be thus far effective and satisfactory in its workings, while it appears to meet with general favor among the members of the Department.

As for some years past, two important lectures were delivered near the close of the school year by Mr. Henry E. Warren, Superintendent of the Lombard Governor Company, on the Governing of Turbines. The lectures were given jointly to the students in the Courses in Civil, Mechanical and Sanitary Engineering.

Gifts have been received for exhibition purposes from Mr. A. Guerin, Middleboro, Mass., and from George N. Newhall Engineering Company, Philadelphia. Special courtesies have also been extended to the Department by the Boston & Maine Railroad through Mr. Henry C. Robinson, Superintendent of the Southern Division, and the Department is indebted to the same railroad for special rates granted to our students for their trips to Lowell on Hydraulic Field Work.

C. FRANK ALLEN.

THE COURSE IN CIVIL ENGINEERING.

There have been no important changes in the curriculum during the past year. This year, however, it becomes possible for the first time to observe the full effect of the change made in the course of studies in 1906 by the reduction of the time allotted to modern languages. The present senior class is the first to enter since this change was made and

shows, I believe, a decided gain in professional efficiency as compared with classes reaching the fourth year without receiving the advantage of the extra training in fundamental professional subjects made possible by this change. In connection with this topic it may be interesting to note that of the students in this class twelve per cent. studied a modern language as an elective in the third year, and thirty-four per cent. took more modern language than is required in our own Course, at other schools or colleges before entering the Institute.

On returning after four years' absence, I am more than ever impressed by the increasing difficulty of giving proper instruction in surveying and railroad field-work during the college year. The disadvantages of the present arrangement were so plainly stated by Professor Swain in his last annual report that enumeration of them here is unnecessary. I wish, however, to express my strong belief in the wisdom of giving these courses hereafter in a summer camp in accordance with the plan already sanctioned by the Faculty. This change I consider to be essential to the proper teaching of these subjects and to the future development and strengthening of the entire course.

The number of students from other colleges registered in Civil Engineering this year continues large. Of sixty-six students in the senior class, thirty-five per cent. entered from other colleges, and twenty-six per cent. are holders of the Bachelor's degree. Out of a total registration of two hundred and ten in the three upper classes, twenty-eight per cent. entered the Institute from other institutions. Advanced courses are now being given to a number of students amongst whom is one candidate for the degree of Master of Science in Civil Engineering. The importance of advanced work of the character given at the Institute is becoming more widely recognized by men wishing to specialize in certain branches of Civil Engineering, and it is intended to emphasize such work more fully hereafter.

With the completion of Professor Russell's book on Hydraulics, books prepared by our own professors are now available for instruction in three of the four fundamental civil engineering subjects. The subjects thus included are Surveying, Railroad Curves and Earthwork, and Hydraulics. The fourth basic subject, Structures, is given this year from mimeographed notes prepared by myself which will eventually be put into book form. The advantage of having these four fundamental subjects taught from texts prepared by our own staff and in complete harmony with the system of instruction in the Department is believed to be considerable.

The demand for our graduates continues active. Statistics showing the total number of applications during the year are not at hand, but since September 1st requests have been received for twenty-five men. Some of these applications have been for men to fill important positions for which it has been possible to recommend men already holding good positions. Most of them, however, have been for recent graduates and in only one or two instances has it been possible to fill these, owing to lack of available men.

CHARLES M. SPOFFORD.

THE COURSE IN SANITARY ENGINEERING.

Within the past two or three years there has been a noticeable increase in the number of students electing the Course in Sanitary Engineering. Differentiated from the Civil Engineering Course some twenty years ago by the introduction of Biology and somewhat advanced chemical work, with a corresponding curtailment of railroad, structural and some other studies, it has usually furnished from three to six students for graduation. This year there were nine, and at present there are altogether about fifty students in the

three higher years. A majority of the graduates have gone into sanitary engineering work, and some have achieved marked success.

Experience having indicated that the curriculum of this Course might be changed to advantage, a committee of seven was appointed by the Faculty last spring to consider the matter. The committee solicited and received valuable suggestions from several prominent alumni of the Institute engaged in sanitary engineering practice in New York and elsewhere, and was especially favored by having the co-operation of Messrs. Leonard Metcalf, William S. Johnson, and Robert Spurr Weston, of this city. As a result of its study the committee has recommended to the Faculty a very considerable increase in the time devoted to chemistry in the second and third years, and a resulting reduction in the number of distinct studies undertaken in the latter of these. The change, last referred to, will largely remedy the extreme diffusion of the student's time among many subjects, which has hitherto been required; and with the grouping of the students of this Course into distinct sections whenever practicable, to the peculiar needs of which their instruction may then be confined, it is fair to expect a decided improvement in the results accomplished, and therefore in the usefulness and attractiveness of the Course.

Advanced instruction in Sanitary Engineering has been elected this year by four graduate students, one of them from our own class of '08, and one each from Armour Institute of Technology, University of Minnesota, and Purdue University.

DWIGHT PORTER.

DEPARTMENTS OF MECHANICAL ENGINEERING AND APPLIED MECHANICS.

In the report of last year reference was made to the fact that, notwithstanding the period of business depression existing in June 1908, all the graduates in Mechanical Engineering of that year had found employment by the middle of October. The graduates in Mechanical Engineering of June 1909 have had better opportunities, the number of applications for men having been double the number available.

The 500 K. W. Westinghouse Parsons Steam Turbine which was installed last year was provided with a hydraulic brake, but during the past summer a 60 cycle 2,300 bolt generator has been substituted for the brake thus enabling us to conform in its operation more nearly to the conditions of practice. If one or two motor generator sets were to be added, which would enable us to transform the alternate into a direct current, this turbine would be able to supply all the power needed in the buildings of the Institute which are situated on Boylston, Clarendon Streets, and Trinity Place. A considerable saving could thus be effected, as at present the power has to be used up in heating the water of a water rheostat.

A considerable amount of original work has as usual been performed in the laboratories of the Department, and of the twenty-seven theses performed by the forty-six members of the graduating class in Mechanical Engineering, ten were performed in order to solve some industrial problem that had arisen in the business of some firm which, in the greater part of these cases, furnished, at its own expense, most of the material used, or provided facilities and set up apparatus for making the tests. Six had for their object the solution of some industrial problem of general interest in engineering, while the purpose of eight was to

work upon some stage of an investigation which, when completed, would serve to solve industrial problems. Of the first class may be mentioned:—

1. Lift and discharge of safety valves, regarding which there is considerable difference of opinion among manufacturers.

2. Tests of certain reinforced concrete beams of unusual depth to furnish evidence regarding the proper method of proportioning some important constructions of the present time.

3. Test of a 750 K. W. Allis Chalmers Parsons Steam Turbine the results of which were of importance to the firm using the turbine.

4. Service test of the turbine steamer "Harvard" for power speed and economy.

5. The behavior of locomotive driving springs under repeated stress, this being one phase of an investigation of locomotive springs, for the prosecution of which materials and facilities have been furnished by three firms.

Of the second class may be mentioned:—

1. Investigation of the effect of water vapor in the explosive mixture of an oil engine.

2. Investigation of the ideal marine engine for horsepower and full consumption at various speeds.

The following gifts and loans have been made to the Department:—

A gift of a pulsometer pump, 3 inch discharge, by the Emerson Steam Pump Company; a gift of a three ton Harrington Hoist, presented by the makers; both of which were obtained through the kindness of Mr. Harold L. Bond, who has also informed me that a centrifugal pump will be presented by the Lawrence Pump and Engine Company. Mr. Alfred W. French, '89 is now constructing an hydraulic accumulator as a present to the Department. Very complete sets of blueprints of the details of four power stations of the West End Road have been presented by Mr. Paul

Winsor, '86, and by Messrs. Stone and Webster, '88. A complete set of blueprints of a re-enforced concrete factory building has been presented by Mr. J. R. Worcester. A vertical simple engine has been loaned by the B. F. Sturtevant Company, and a twelve horse-power Gray gasolene engine has been loaned by the makers.

The most pressing needs of the Department are:—

A refrigerating plant; an impact testing machine; a gas producer plant; a large blower and auxiliary apparatus to enable us to carry on experiments on a larger scale than heretofore upon the lift and drift of various surfaces for aëronautic purposes; a stationary plant for testing locomotives; a modern electric blueprint apparatus, as what little we now have can only be used in sunlight, is worn out, and is entirely inadequate for the needs of the Department.

More room is also needed to relieve present crowding; to furnish room for students to carry on thesis work upon apparatus brought in from outside; and to provide storage room for large and miscellaneous apparatus to be used on thesis work conducted outside. Room is also needed for stripping machines for the purpose of Machine Drawing, and for making and storing re-enforced concrete beams, columns, etc., for testing purposes.

Another need of the Department which was explained in detail in the report of January 1908 is to have certain special assistants of the grade of instructor, whose duties should be confined to the carrying on of prolonged investigation, to the preparing for publication of their results, and also of those of the many investigations that have already been made in the Laboratory. Also it would be necessary to provide some channel where these results would be regularly published.

Instructor Royal R. Heuter has been granted a leave of absence for two years and is studying in Germany.

GAETANO LANZA.

DEPARTMENT OF MINING ENGINEERING AND METALLURGY.

Need of Space.—This has been very pressing. A little temporary relief has been gained by transferring some of the less used books from the library up into the old "cage" in Rogers Building. This transfer means that these books are not so readily accessible. A hole has been cut through to gain access under Room 7. This allows us to store away ores and fluxes which formerly had to be kept up on the floors. The cutting of this hole necessitated the temporary disuse of the roasting kiln in the metallurgical department and also the rearrangement of some of the smaller furnaces. The parts of the kiln have been stored however so it can quickly be restored if needed.

New Apparatus.—In the line of new equipment we have added four new assay button balances, which replace an equal number of old ones, a much needed improvement. Besides these we have put in several new pouring tables and a new and improved type of bottle agitator. A cast iron tapping spout has been installed on the reverberatory furnace to be used in the copper refining run. With its use we are able to tap and cast the copper very easily. In former times this operation was unsatisfactory and at times somewhat dangerous. The screw feeder for the trommel has been remodelled so that no trouble is had in its working. A new hand jig, 12 inches square, and a tank to correspond, make our hand jigging set sufficient to answer our requirements. The machine lathe, purchased from the Mechanical Department has proved of great service and enables us to have work done here which we should otherwise have been obliged to send out at an increased expense. The iron sampling floor has been extended, giving about double the former area. The compressor previously installed has been piped up and compressed air is available for various purposes in the laboratory

work. The large 7 x 10 inch Blake breaker which was installed last year has done excellent work and shown its superiority over its predecessor. The Triplex rolls have been experimented with to some extent, but they are not yet a fully demonstrated laboratory machine. An Allis-Chalmers wall feeder capable of handling large quantities of material was installed during the summer to be used especially in connection with the new pulsator jigs. The development of these jigs has been going on in the laboratory and two models are now available for experimental work.

In making a pyritic run last year it was found that the tuyere-area of the blast furnace was not sufficiently large. To correct this, three 3-inch tuyeres have been added to the four 2-inch tuyeres with which the furnace has so far been provided. In connection with this work new and larger air pipes have been put in from the blower.

The new soft coal assay furnace, the laboratory crusher, and the disc grinder which were installed last year have not only given great satisfaction to the Assaying Department, but have also been very useful in the ore-dressing and metallurgical work.

Changes in Work of Instruction.—The time assigned for lectures and laboratory work in metallography has been increased. Many new diagrams have been prepared for the lectures in metallography and non-ferrous metallurgy, and they have been photographed to enable the students to obtain copies at a very low price, thus doing away with much drudgery in the class room.

Beginning next term a new course, Metallurgy of Engineering, will be given to the students of Course XIIIA. It is to cover the industrial use of fuels and the production and properties of metals and alloys used in construction. The changes inaugurated last year in the metallurgical laboratory have proved very satisfactory. It is proposed to add next year, to the typical operations so far carried through, the process of converting matte.

Course Scheme.—A marked improvement has been made in the revision of the Course scheme and it is now felt by the Department to be in more satisfactory form than for many years. The radical changes which have come about are as follows: One year of language has been dropped and mineralogy has been moved forward a year. The three options are retained, but Option 3 becomes more distinctly a special geological option to be taken by those men who have a strong inclination toward geology. Options 1 and 3 are uniform up to the end of the third year. Time for exercises and preparation has been made uniform for the various options. Applied mechanics is now all finished in the third year by all options. Physical laboratory is begun in the second year. With the additional time gained by the dropping of a year of language, an increase is obtained in second year English, European history, hydraulics, assaying, in new courses in sanitary science, electrical laboratory, and forging. Adequate time is provided in each term for chemical laboratory, and the subject of analytical chemistry is finished by all except Option 2 at the end of the third year. To gain all this it was necessary to transfer the mineralogy from the second year to the third year and advance geological subjects correspondingly.

As soon as the necessary arrangments can be made the subject of surveying now given in the second year is to be transferred to the summer. By vote of the Faculty this summer school is to be held between the second and third years, although for the Mining Department the better time would be between the first and second years. When this change comes it will make surveying instruction more complete and satisfactory and at the same time give additional hours during the school year.

On account of the short time allowed for fire assaying in the schedule it is suggested that an optional course in advanced fire assaying be added to the curriculum as soon as provision for it can be made. This course should be of

value to men who wish to take up this line of work and would also help to train men for assistants in our laboratories.

Thesis Work.—Among the theses of last spring the following perhaps deserve special mention: Three theses upon concentration of ores from Cobalt, Ontario. This is a very live problem and the results were satisfactory. A thesis on the washing of Mexican coal which yielded valuable results. A thesis on South African gold ore which marks the beginning of our experimental work upon this lot of ore. Mr. Tse's Master's degree thesis on the Wilfley table, and also Mr. Wen's Master's degree thesis on heat formation of some ferro calcic singulo silicates.

Advanced Students.—There are no candidates for the Master's degree this year, but two men are doing advanced work. Professor Katsura, who comes to us from the University of Tokio, has studied in the schools of Europe and has made an extensive trip through the metallurgical plants of the United States during the past summer and now will spend a year with us studying our methods. Mr. James A. Grant, who has been engaged in practical coal mining in Montana, is making a special investigation at the Institute on the relation of dust to explosions in coal mines.

Assistants.—Messrs. Lowry D. W. Bender, Charles A. Gibbons, Jr., and Leon A. Dickinson have left. This year Mr. Henry R. Batcheller and Mr. Thomas G. Chapman have been secured as Assistants in Ore Dressing; Mr. Frederick Jaeger as Assistant in Metallurgy, and Mr. Edward T. Almy, Jr., as Assistant in Assaying. The latter is a new appointment and Mr. Almy is especially fitted for the work, having had considerable outside experience. Owing to changes in the tabular view for next year which brings all of the assaying into the second term it may be necessary to increase the number of instructors in Assaying. In regard to Mr. Batcheller circumstances made it desirable for him to spend the winter in Boston and the Department considers it especially fortunate in securing the services of such an experienced man.

Students.—The student numbers remain about the same as for last year, namely, thirty each in the third and fourth years, and thirty-five in the second year.

Summer School.—For the first time since 1871 there has been no summer school. It was found that positions for undergraduates during the summer had been obtained in such numbers that all students in mining who applied for practical work last summer were able to get it. The Department feels that it is better for a student to spend the whole summer in practical work than a month in a summer school. It will be the policy of the Department to offer the summer school in the future only when five or more men apply for it. The efficiency of the teaching appears to be helped very much by the experience which a student thus gains during the summer and it is a question whether a student should not be required to have spent at least one summer in practical work before he takes his degree.

Positions for Graduates.—The graduates of last year obtained positions very quickly and applications for men have come to us which we could not fill. This state of affairs will probably continue with the general prosperity of the country. The Department has received several applications for teachers and it is along this line that we have special difficulty in supplying men.

June Reunion.—A large number of the former students of the Mining Department returned for the Reunion and testified to the progress that our graduates are making in various parts of the world. The graduates of this Department are perhaps more widely scattered than those of any other department of the Institute.

Professional Work.—Professor Richards made an extensive trip during the summer, visiting concentrating mills in Colorado, Arizona, Utah, Montana, and Ontario. He also made a visit last February to a concentrating plant in Pennsylvania. Professor Hofman carried on last summer some large-scale experiments with the Longmaid-Henderson process

for the treatment of sulphide copper-nickel ores at the works of the Pennsylvania Salt Manufacturing Company, Philadelphia. Professor Locke spent the summer largely on professional work and made trips to New York state in connection therewith.

Gifts.—Mr. W. A. Paine presented a copy of Steven's Copper Handbook for 1908 and Mr. E. D. Mellen a Wagner Mica Plate Electro-static Machine.

ROBERT H. RICHARDS.

DEPARTMENT OF ARCHITECTURE.

The present school year of the Department of Architecture opened with a second-year class of forty-three, the largest number of students with one exception that this class has ever recorded. There are nine students in the graduate course, of which five are candidates for the advanced degree. The universities and colleges continue to send us a large quota. There were newly registered with us this term graduates from Brown, Dartmouth, Harvard, and St. Louis universities and from the State Universities of Illinois, Nebraska and Oregon; one from the Mississippi Agricultural and Mechanical College, one from Radcliffe, and one from the Rhode Island School of Design.

The curriculum was readjusted last winter so as to permit moving a large part of the preparatory technical work from the third to the second year. More opportunity will thus be afforded in the last two years for studies of a strictly professional nature, and a broadening of the course in the History of European Civilization and Art. The first and second year students are now working according to this schedule.

The Option in Architectural Engineering is being taken by an unusually large number of students. Its graduates are always in great demand, and to the architect who leans

more to the construction side and is fond of mathematics this course offers excellent opportunities.

The Rotch Travelling Scholarship, giving opportunity for two years' study in Europe, was this year awarded to Mr. Horace G. Simpson, '03.

The Rotch Prize for the regular student in the Department of Architecture at the Institute was awarded this year to Mr. Lester H. King; the Prize for the special student was divided between Messrs. Louis Svarz and Kenneth E. Carpenter. Messrs. King and Carpenter are now following the graduate course.

The two Boston Society of Architects' Prizes of fifty dollars each were awarded to Mr. Alvin F. Menke, a regular student, and Mr. Louis Svarz, a special student.

The 1909 Travelling Fellowship of one thousand dollars was won by Mr. Ralph J. Batchelder in competition with nine others. Mr. Batchelder is now in Paris after six weeks' travel in England. He is following a course laid down by the Department.

Mr. Andrew N. Rebori, the beneficiary of the 1908 Travelling Fellowship, returned a month ago. His work accomplished while in Europe now hanging in our exhibition room is most interesting, and is a good example of the value of this opportunity to the student of architecture for rounding off his school work. Mr. Rebori's drawings show great skill in draughtsmanship and appreciation of color. His greatest effort, a large drawing in color of a part of Raphael's Loggia in the Vatican, he leaves to the Department.

I again take this opportunity to call attention to the generosity of Mr. Guy Lowell, without whose help this fellowship could never have been started, and upon whom its success depends.

The prize of the American Academy in Rome, which is the highest in value and in honor offered to American architectural students, was won by Mr. Edgar I. Williams, '08, last January. In the preliminary competition, in which nine

of the American schools of architecture were eligible to join, the number of competitors was reduced to four, of which three were from the Institute. The final competition gave the prize to Mr. Williams. Mr. Williams also completed the graduate course and gained the Master's degree. He is now in Rome at the American Academy.

A gift of fifty valuable books formerly belonging to Mr. Alfred Greenough was made to us by the heirs of Mr. Charles Henry Parker. We were asked to have a book plate inserted in each book to bear the inscription, "From the Alfred Greenough Collection." This has been done. The greater part of Mr. Greenough's collection was given many years ago by Mr. Parker to the Museum of Fine Arts.

Mr. David A. Gregg, so well known in the profession for his expertness in architectural rendering, and who has served loyally the Department during twenty-two consecutive years teaching this subject, presented the Department this term with a large pencil drawing beautifully done from one of Bacon's sketches of the Assos Expedition.

An interesting event to the Department was the visit of Professor Reilly, Professor of Architecture at the University of Liverpool. He had come to America to study our schools of architecture. He was much impressed by our methods, and took away a number of examples of our student work in design.

Mr. William F. Dolke, who is a half-time instructor, helping mainly in Option 2, has shown himself very capable and is doing good service in that course where it has been most needed. Mr. Tashjian will give next term a short course of lectures on Reinforced Concrete Construction.

The first number of the third volume of the Technology Architectural Record will make its appearance in December. Its scope has been enlarged to embrace illustrations of work accomplished in actual practice by our former students, and more space will be given to the subject of Architectural Engineering. It will publish the investigations of

the Institute laboratories in subjects of interest to the architect, which until now have appeared only in the Quarterly, recently discontinued, or in scientific journals.

So much depends upon our ability to offer a travelling fellowship as a reward for scholarship that I must make my regular appeal for it. As you may not know, ours is the only architectural school of any standing in this country that cannot offer a yearly prize of this kind, and we are the oldest school besides. To this end we should have a travelling fellowship of the value of fifteen hundred dollars; one thousand of which should be paid to its beneficiary for foreign study and five hundred as a salary for six months' instruction at the Institute immediately upon his return to this country. His duties as an instructor should be to devote himself impartially to our second, third, and fourth year classes in design. Such an association of our students with one of our recent graduates, only a little older than themselves, who had achieved conspicuous success and would show how he had attained it, would be invaluable; and this instruction would come at the opening of the school year just at the time when the aid of fresh young talent would be most inspiring.

A further improvement of our Course must be to bring our students into more intimate association with the foremost practicing architects of the day, whom they are to succeed in the next architectural generation. We should have the History of Modern Architecture told to our fourth-year men by the most distinguished practicing architects of to-day. We should be given the opportunity to invite them to tell the story of their own work, two or three lectures from each; say fifteen lectures in all. In no better or more interesting way could this intimate and most valuable connection be brought about of theory and practice; of the student and the architect.

F. W. CHANDLER.

DEPARTMENT OF CHEMISTRY AND CHEMICAL ENGINEERING.

The record of the past year is one of general prosperity and successful achievement. for which credit is due to the loyal and efficient service on the part of the entire staff of instruction. The personnel of the staff has undergone considerable change with respect to its junior members, two instructors and nine assistants having resigned at the close of the year, of whom seven entered technical positions, one accepted another teaching position, one a position as research associate, and one (Mr. Paul S. Fiske) was granted the Dalton Fellowship for study abroad. Among the number thus resigning was Dr. Peter S. Burns, who has given the Department long and devoted service, and has made many friends among our students and graduates. The vacant instructorship in Inorganic Chemistry has been filled by the appointment of Dr. Stroud Jordan, of the University of North Carolina, while that in Theoretical Chemistry is occupied by Dr. Fred H. Heath of Yale University. Of the ten new assistants in the Department, three are graduates in Chemical Engineering, five in Chemistry, one in Sanitary Engineering, all of the class of 1909, and one is a graduate of Harvard University. The other staff changes include the merited promotion of Dr. Augustus H. Gill from Associate Professor to Professor of Technical Analysis, and the transfer of Mr. Frederick R. Kneeland from Analytical to Organic Chemistry. It is a pleasure to report that Professor Sherrill is able to resume his duties in connection with the work in Theoretical Chemistry.

The number of students taking the Course in Chemical Engineering has increased to a marked extent, forty-eight being registered in this Course in the second year. On the other hand the number registered in the Course in Chemistry has diminished somewhat, although the second-year

students in this Course number eleven at the present time. This increase in registration in the former Course is attributable to increased interest on the part of our students in Chemical Engineering as a profession, on account of the statements made by various persons entitled to speak with authority regarding the important part which this profession seems likely to play in the more immediate future of our industries, and to the fact that students who have expressed an inclination to take up technical chemistry as a life work have been advised to enter this Course. A considerable number of students from other colleges have also elected this Course, thus adding to the numbers enrolled in the higher years as well. Others of the incoming college men have entered the Course in Chemistry, and it is the hope of the Department to be able to enlist the interest of an increasing number of able men in a preparation for a career of research in chemical lines or in the teaching of the science, such as this Course affords, two fields which also present much of promise and attractiveness just now.

It has again been necessary to make alterations in our laboratories to meet the unavoidable demands upon them by the increase of students taking chemical subjects. A portion of the Laboratory of Inorganic Chemistry on the upper floor of the Walker Building has been rearranged to accommodate combustion furnaces for the work of the third and fourth years, and the combustion room on the third floor has been thrown into the Laboratory of Inorganic Chemistry on that floor. This change was made imperative by the increased number of first year students who elected Courses in which chemical subjects are given in the higher years, this group of students being now treated by themselves in the second term of the first year. It is probable that even the enlarged laboratory will be filled this year.

The very difficult conditions under which the work in sanitary chemistry has been carried on have been emphasized

in recent reports, and it is a pleasure to record that slight relief from the most oppressing conditions has been afforded by the division of the laboratory by partitions in such a way as to provide separate rooms for the Air and Water Analysis, on the one hand, and Food Analysis on the other. A slight additional space is gained through the sacrifice on the part of Mrs. Richards of a considerable part of her office. The advantage to the work in water and air analysis is considerable, and the addition of an auxiliary ventilating fan now makes it possible to carry on this work under relatively favorable conditions which have been lacking for some time. Advantage has been taken of the opportunity to refit this portion of the laboratory with a modern equipment including approved electrical heating and lighting devices which will not only permit of more efficient instruction, but will permit of research work in these lines. A part of this added equipment has been provided through the generosity of Mrs. Richards and her friends. An additional half-time assistant has also been provided for Air and Water Analysis, and also one for Food Analysis. While considerable in the way of efficiency has been gained by these changes, the congestion is still great and it is a difficult problem to accommodate the number of students entitled to instruction in these subjects within the combined space of the two laboratories.

During the past year the permanent equipment of the Department has been increased by the purchase of an electrically lighted and heated polariscope for use in food analysis; a thoroughly equipped Zeiss microscope for use in metallographic work in the Research Laboratory of Applied Chemistry; a gas furnace and blower for use in the Industrial Laboratory; an additional Junker gas calorimeter; electrically heated stills for water analysis, and an electrically driven pump for the supply of air-blast and suction to the Chemical and, in part, to the Physics and Mining Departments. Some progress has also been made in completing the more valuable sets of periodicals in the

William Ripley Nichols Chemical Library which are not to be found in other libraries near Boston.

A memorial tablet to the late Dr. Thomas M. Drown, Professor of Analytical Chemistry at the Institute from 1885 to 1895, who was also in charge of the Department for nearly the same length of time and later President of Lehigh University, has been placed in the Chemical Library through the aid of a memorial fund, of which the major portion has been used to erect a social hall, known as Drown Memorial Hall, at Lehigh University.

The Department is indebted to the following firms for sets of color samples used by Professor Mulliken in the preparation of the third volume of his work on the Identification of Pure Organic Compounds, now in press: Cassella Color Co.; Badische Co.; Kalle & Co.; Farbenfabriken of Elberfeld Co.; A. Klipstein; Meister Lucins and Brünig; Berlin Aniline Co.; and Leirnstein & Co.

The Department was again requested to name a second-year student to enter the laboratories of Harrison Brothers and Company for summer work. Mr. John R. Bell of the Course in Chemical Engineering was recommended and, with Messrs. Lunt and Christie, the two previous nominees, spent a portion of the summer in technical work at Philadelphia, with generally favorable results.

The Courses in Chemical Engineering and Chemistry have not undergone any material changes during the past year. There has been an increased effort throughout the Department to secure closer contact between instructor and pupil through more frequent conferences and increased classroom instruction. This is particularly true in the instruction in the first year, in which somewhat radical changes have been made with a view to securing more systematic study on the part of the student through the elimination of some of the formal examinations, and by a better arrangement of the instructor's time in the laboratory. While some of the former difficulties have been lessened or removed, some

new ones have appeared, as is inevitable in such cases, and a final decision as to the most desirable procedure has not yet been reached.

In each Report for the last few years, particularly in that of last year, the urgent need for increased and better arranged space for the Departmental work has been emphasized. It is evident that the desired relief cannot be given until certain broad questions of general policy have been settled and it seems unnecessary to present again those appeals the justice of which there is reason to believe is generally acknowledged. It is, however, a duty to point out the fact that the number of students entering the professional Courses in which chemical subjects are offered is increasing, particularly in the Courses in Chemical Engineering and in Sanitary Engineering, and that in the latter Course some much-desired additional chemical instruction has been recently introduced. More college men also are coming to us each year. Our laboratories of analytical chemistry are, however, completely filled this year; the laboratories of organic chemistry, already operating at a disadvantage, will be overcrowded next year; in the year following, if not earlier, the laboratory of industrial chemistry will not accommodate the students entitled to instruction; and the same may be true even next year of the laboratory of water analysis, in spite of our attempts to give relief to this branch of the work and possibly in theoretical chemistry as well. Over against these demands, which, so far as can now be determined must be met, stands the fact that there seems to be no more space within the present buildings of the Institute which it is proper, (if it is even possible) for the Department to ask to have appropriated to its use, or if appropriated, would even approximately serve our purposes. The problem of properly accommodating our students and of maintaining the efficiency of our instruction is, therefore, increasing in difficulty to a point which baffles our best efforts to find a solution under existing general conditions, and it is the hope

of the members of the Department that the situation here presented may constitute one important ground for an early determination of these general policies upon which the possible erection of new quarters for the Department must first depend.

H. P. TALBOT.

THE RESEARCH LABORATORY OF PHYSICAL CHEMISTRY.

During the past year the Research Laboratory has been under the charge of Professor Gilbert N. Lewis; and its continued progress has been largely due to his devotion to its interests and to his ability as an investigator. All the Research Associates in the Laboratory, Dr. William C. Bray, Dr. Charles A. Kraus, Mr. Roy D. Mailey, Mr. Arthur C. Melcher, and Mr. Richard C. Tolman, have also contributed very greatly to the success of the research work.

Professor Lewis is pursuing, with aid of assistants and graduate students, as one of his main lines of research, the experimental determination and computation of a system of values for the free energy of chemical substances analogous to the system of values for the total energy previously developed by thermochemical investigators. The problem is one of fundamental importance to the science of chemistry, since from the free-energy data for the substances the equilibrium of the chemical reactions in which they are involved can be computed.

During the past year Professor Lewis, in conjunction with Mr. Richard C. Tolman, has also given much attention to the newly developed basic principle of physical science known as the Principle of Relativity, and they have published articles upon the subject which have attracted much attention from physicists.

Dr. William C. Bray has completed the work upon the

new system of qualitative analysis including the rarer elements, which had been in progress in the laboratory for a number of years under the direction of Professor Arthur A. Noyes. The work has already been published in scientific journals, and will be issued in text-book form during the coming year.

Dr. Kraus and Mr. Mailey have been engaged in an investigation upon alternating current rectifiers. The problem is one of great technical importance; and the results already attained make it certain that the investigation will prove an important contribution to the subject.

The physico-chemical research on the properties of salt solutions in relation to the Ionic Theory which, with the view of developing that theory, has been carried out for a number of years under the direction of Professor Noyes, has been continued during the past year with the assistance of Mr. Melcher, Dr. Bray, and Mr. Gale. It has again been aided on the financial side by a grant of $3,000 made to Professor Noyes by the Carnegie Institution of Washington.

With the opening of the new school-year the number of research workers in the laboratory has been largely increased. Two new men have been added to the staff as Research Associates, Dr. K. George Falk from Columbia University, and Dr. William D. Harkins from the University of Montana. Mr. Franklin L. Hunt, M. I. T. '09, has been appointed Research Assistant in place of Roger D. Gale, who has taken a technical position. Three new candidates for the degree of Doctor of Philosophy have also entered upon research work in the laboratory.

ARTHUR A. NOYES.

THE RESEARCH LABORATORY OF APPLIED CHEMISTRY.

The experience of the year just closed has, in a large measure, justified the foundation of this Laboratory, inasmuch as the opportunities which have been offered to us to serve both the Institute and the manufacturing public have been more than our facilities make it possible to undertake. The fundamental idea that chemical research carried on with a view to obtaining results of immediate value upon some subject of interest to one or many industrial organizations has been shown to be a practical one, and to provide a plan capable of great extension so soon as adequate laboratory facilities are available.

The laboratory course for engineering students developed by Dr. Burns, as mentioned in the report of last year, has been put into effect with some of the Institute classes with gratifying results. With the changes suggested by experience, this work promises to provide a series of experiments with which to teach the chemical properties of the more commonly employed engineering materials, and the more important chemical reactions to which such materials are susceptible.

An investigation of the difficulties incident to the manufacture of galvanized sheet iron, undertaken on behalf of the American Sheet and Tin Plate Co., has progressed in a very satisfactory manner, and this work will be carried through the present year by Mr. Raymond E. Drake.

Supported by funds supplied by the I. E. du Pont de Nemours Powder Co., the Laboratory has commenced a comprehensive study of certain phases of the supply and production of glycerine. Mr. John S. Coye is in charge of this investigation which it is expected will extend beyond the present year.

An investigation of the properties and possible uses of the

metal Cerium is being carried on by Mr. Alcan Hirsch. Through the courtesy of the Department of Electrochemistry this Laboratory has been able to use the splendid equipment of that Department for the electric furnace work, and encouraging results have been obtained.

A paper published by this Laboratory last spring on Paint and Varnish Films as Accelerators in the Corrosion of Metals has attracted much attention, and with the co-operation of the American Society of Testing Materials and the American Paint Manufacturers Association, the subject is being thoroughly investigated by Mr. Maurice T. Jones, Jr. Few problems are of more general interest or of more immediate importance than an adequate protection for iron and steel structures. Work already published by the Laboratory has done much to establish the conditions which must obtain in order that iron and steel will not deteriorate through corrosion, and the results of the present work are awaited with interest.

WILLIAM H. WALKER.

DEPARTMENT OF ELECTRICAL ENGINEERING.

Important changes have been made in the Department staff since my last report. Professor Harry E. Clifford resigned to enter a professorship in Harvard University, and his place was filled by Dr. Harold Pender. Associate Professor George C. Shaad resigned to become head of the electrical enineering department in the University of Kansas, and his place was filled by the appointment of William E. Wickenden to an assistant professorship.

Dr. Pender is a graduate of Johns Hopkins University, class of 1898. He received the degree of Doctor of Philosophy from the same university in 1901, after graduate study in physics, electrical engineering and chemistry. He gained scientific reputation for his thesis and his succeeding researches on the magnetic effect of moving electrostatic

charges of electricity, and was called to Europe to demonstrate the results of his researches to European scientists. Upon returning to this country in 1903, he entered professional service in electrical engineering and has been associated with important electrical engineering installations. He is author of a number of articles and monographs which have appeared in the Philosophical Magazine, Journale de Physique, Comptes Rendus of the French Academy of Science, Electrical World, and other journals. Professor Pender's duties in the Department include the direction of the important undergraduate course in the Elements of Electrical Engineering which is provided in the curriculum for the third year students in Electrical Engineering, Electrochemistry, and the Naval Constructors, and which is at the foundation of all of our professional instruction in electrical engineering. His duties also include advanced lectures on Alternating Currents and the Problems of the Electrical Transmission of Power for graduate students, and the direction of investigation and research carried on by advanced students.

Professor Wickenden is a graduate of Denison University, class of 1904, from a course strong in mathematics and physics. He thereafter taught for a period and then entered upon graduate study of physics and electrical engineering. For the past three years he has been on the staff of the electrical engineering department of the University of Wisconsin, where he made an enviable reputation as a teacher. He is the author of several articles on electrical engineering subjects and has a book in press which deals with the important subjects of illumination and photometry. Professor Wickenden's duties include the instruction of fourth year men in professional studies like Central Station Operation and Management, Electric Railways, and Technical Reports. He also has charge of some instruction in electrical engineering for Naval Constructors, and the instruction of advanced (graduate) students in the design of generating stations and distribution systems.

At the end of the first term of the Institute year 1908–9, Instructor Charles H. Porter and Assistant Clarence C. Knipmeyer resigned, the latter to go to a desirable position in the Rose Polytechnic Institute. The vacancies were filled by the appointments of Messrs. Lester W. Brock, Technology '07, and Oliver S. Jennings, Brown '06 and Technology '08 as assistants for the remainder of the year. It has seemed desirable to go to some inconvenience rather than refuse to release in the middle of the year younger men of the staff who may have calls to greater responsibilities in teaching or scientific research elsewhere. This is on the theory that our duty lies in aiding the interests of engineering teaching and of scientific research anywhere in the country, in addition to carrying on our own teaching and research in the most effective manner practicable.

Mr. Harry L. Burgess, Technology '08, was also appointed an assistant for the second term on account of the absence of Professor Smith, who was away on leave. Instructor Harold G. Crane resigned at the end of the Institute year 1908–9, to become Instructor at Harvard University. Evan J. Edwards, Charles W. Green, Ralph G. Hudson, and George B. Thomas were promoted from assistants to instructors. Messrs Robert C. Glancy, Technology '09, George H. Gray, Technology '09, Edgar P. Slack, Technology '08, and Isaac H. Van Horn, Wisconsin '09, were given one year appointments as assistants.

Associate Professor Harrison W. Smith was granted leave of absence for the last term. He spent the time in a trip around the world. Sailing from San Francisco on February 2, 1909, he touched at various Pacific islands port on the way to Batavia, Java. Here, he collected specimens and made photographs. Returning to this country by way of the Suez Canal, he arrived in this country in the latter part of September, bringing scientific specimens and an extended collection of photographic negatives.

The Department Staff now consists of two Professors,

three Associate Professors, one Assistant Professor, five Instructors, and four Assistants. The reduction in the proportion of first year Assistants, compared with former years, is a decided improvement and makes for the stability of the staff.

With reasonable provision for promotions to the staff, and proper additions to meet the requirements of additional hours of teaching, the staff ought to have a steadily increasing influence in the electrical engineering profession. Some more rational process of promoting the younger men of the staff than has heretofore been in operation needs to be adopted before the most effective results may be hoped for. It is obviously not for the welfare of the Department nor of the Institute to continue the scale of salaries for the younger men so low and the rate of promotion so slow that the abler individuals feel compelled to turn away from teaching, study, and research and to go into purely commercial callings. Our instructors are several years from the day of their graduation and are between twenty-four and thirty years of age,—an age at which it is natural for young men to seriously consider marriage; but our instructors' salaries are ridiculously inadequate to support such ventures. The pecuniary deficiency may be partially overcome by each individual turning to "pot boilers" which are aside from his direct line of teaching, study, and research; but the distinction and influence of the Institute must ultimately be sustained by the scientific attainments and civic accomplishments of the younger men who may gradually rise to more important positions, and it therefore can be only a misfortune, at this critical time of their service, to crowd these men by a process of pecuniary starvation into fields which lead them away from productive study and research.

As I pointed out two years ago in a similar communication, engineers in academic life possess undeniable large compensations for the advantages otherwise found in engineering practice and the executive positions of industrial life,

but the responsibilities which they bear to their students and to the public are heavy, and the cost and effort required to maintain an adequate knowledge of the progress of science and engineering in their respective branches are large. The men who can bear these duties most fruitfully are also men who can bear important responsibilities and command unusual consideration in industrial affairs. If we are to have the opportunity of selecting from our younger men those of peculiarly admirable qualities as leaders and teachers, we must be able to offer rational salaries and rates of promotion within a few years after graduation to those who have properly prepared themselves for our service.

The undergraduate and graduate instruction of the Department is steadily progressing. The numbers of students are increasing in both the undergraduate and graduate work. The improved curriculum approved by the Faculty two years ago went into use with the third year class in the fall of 1908 and has now come into use with the fourth year class. I believe that it gives an unusually well balanced electrical engineering course, but that some additional modifications may be made with wisdom. These will receive the consideration of the Department from time to time.

The policy of the Department is to do work for the Course VI. students as thoroughly and wisely as we know how, and to also undertake instruction of students of other Courses whenever the curricula of those Courses afford the opportunity. Changes made in several other Courses within the last two years have consequently imposed on the Department, especially on the laboratories of the Department, responsibility for the instruction of a considerably larger number of students than ever before. Taken in association with the increasing numbers of students in the upper classes of Course VI., this will in another year require us to take care in our laboratories of perhaps twice as many student-hours of instruction as were imposed on the laboratories three years ago. The staff is too small to bear the burden and I

shall have to ask for more assistants in my next estimate. The increased instruction which we are giving to students of other departments seems a matter of importance to the welfare of the Institute, as the uses of electrical power are invading nearly every branch of industry, and all engineers should have some laboratory instruction in electrical science.

It is significant that forty per cent. of the men graduating from our Electrical Engineering Course last June had previously received college degrees and had thereafter spent from one to three years in electrical engineering studies with us. It is also a matter of marked interest and significance that sixteen per cent. of the men who graduated from our Electrical Engineering Course last June became teachers of electrical engineering or physics. It is surely an admirable ideal for young men to enter the field of teaching; and I believe the Department may justly cultivate such an ambition among its best students without lessening its direct influence on industrial affairs.

Some distinct improvements have been made in the laboratory equipment during the past two years, but we still have crying needs. In the way of special apparatus, an adequate storage battery is very desirable. I hope that this may be soon afforded. It would be particularly useful as a source of steady current for purposes of research. The voltage regulation of the service plant will be improved by the application of the recently purchased Tirrell regulating apparatus, but the absolute steadiness of battery current is needed in many kinds of work. The Department library also needs more liberal support and will soon need more room.

In respect to the floor space for our work, we are particularly cramped in the Standardizing Laboratory, also for lack of small rooms for research and for want of at least one more class-room assigned to the exclusive use of the Department. During the recent vacation we had two small laboratory rooms divided by partitions, thus making four re-

search rooms out of what had been two. We also converted Mr. Lyon's office into a lecture and seminar room for advanced classes, at the same time dividing up the room which had been used for the latter purpose into several offices for laboratory instructors. These changes have added considerably to our convenience. A store room is now to be arranged underneath the lecture-room, which will give some additional relief.

Mr. Frederick P. Fish, of the Corporation, again generously provided funds for defraying the expenses of inspection visits to other engineering schools by members of the staff, and Mr. Charles A. Stone, also of the Corporation, contributed funds to the same end. Professors Laws and Shaad and Instructors Edwards and Green consequently made inspection visits to several schools. Brief written reports of the observations have been made to me and I will transmit abstracts of them to the donors of the funds. A small balance yet remains to be used, and I have, therefore, not yet made my accounting to the generous givers. I believe these inspections are sure to bring us multiplying returns.

Of the same order is attending meetings of the professional societies. During the past year one member of the staff attended the annual convention of the American Institute of Electrical Engineers, one member attended the annual convention of the National Electric Light Association, and several attended the annual meeting of the Society for the Promotion of Engineering Education. I served on the Committee on Education of the American Street and Interurban Railway Association, which formulated and reported a plan for suitable apprenticeship and vocational school processes to be adopted by electric railway companies. I have been and am serving on certain committees of the American Institute of Electrical Engineers. The participation in the proceedings of such societies seems to me a part of our duty to the electrical engineering profession and the electrical en-

gineering industries, and I do not believe that we are yet meeting our full obligations; but our present limitations of salaries and of time necessarily curtail such activities. Moreover, the staff is not without civic activities which consume time and thought.

Researches which have been carried on during the past year, or are being carried on by, or under the direction of the staff embrace investigations of the error in photometric work due to the concentration of light rays by reflectors; relative precision of Lummer-Brodhun and grease-spot photometer screens for commercial work; the effect of heat treatment on silicon steel; the strength of wooden poles and the effect of wind pressure and changes of temperature on wire spans; the capacity and self-induction of transmission lines; the attenuation, distortion, and reflection of the current waves in telephone circuits; a method for determining the characteristics of "current transformers;" and the development of a mechanical rectifier of single-phase alternating currents; besides some investigations and tests for commercial purposes.

The Department has received a number of gifts during the year. These include the money to defray the expenses of the inspection visits to other engineering schools already described, and money to defray the expenses of two dinners of the Electrical Engineering Society at which Mr. Louis A. Ferguson, Technology '88, President of the American Institute of Electrical Engineers, and Mr. Frank J. Sprague of electric railway fame, were respectively present and addressed the Society. Mr. Charles L. Edgar of Boston presented the Department with an interesting framed photograph of Mr. Edison and Dr. Steinmetz sitting in conversation, which will hang in the reading-room. The General Electric Co. made liberal concessions in the price of the turbine-generator outfit which is being installed in the service plant. The Pittsburg Transformer Co. presented a transformer of 5 kilowatts capacity; Stone & Webster presented

wooden poles for use in the researches on the strength of poles; the American Sheet and Tin Plate Co. presented sheet steel for use in the researches on the effect of heat treatment on silicon steel; and various other gifts of a corresponding nature have been received.

DUGALD C. JACKSON.

DEPARTMENT OF BIOLOGY.

The Department of Biology offered this year for the first time a regular course by Professor Winslow, in Industrial Hygiene and Sanitation, consisting of lectures and conferences dealing with the various prejudicial effects of factory life upon health, including occupational accidents, industrial poisonings, and the effects of defective ventilation and dusty trades upon the prevalence of tuberculosis and other diseases.

A course in Chemical Biology was also given by Professor Phelps for the first time. In this, an attempt is made to interpret in terms of physical chemistry certain fundamental phenomena associated with life processes.

In addition to creditable researches in Sanitary Science made by the younger members of the Staff and referred to in the next section under the report of the Sanitary Research Laboratories and Sewage Experiment Station, a valuable investigation was made during the summer by Professor Prescott, in collaboration with Professor R. S. Breed, of Allegheny College, who came to Boston and gave up a large part of his summer vacation for the purpose, upon the occurrence and distribution of leucocytes (white blood corpuscles) in milk and cream. This investigation bids fair to bring about a considerable change in the determination and interpretation of the presence of these interesting bodies in one of the commonest and most important articles of human food, and is sure to be received with wide-spread interest by physiologists, dairy experts and sanitarians. When

leucocytes were first observed in milk they were thought to signify that the cows from which they came must be more or less diseased, but this work of Professors Prescott and Breed confirms and establishes the more recent idea that leucocytes are common constituents of normal milk and cream.

The growing interest everywhere manifest in questions touching the conduct of life and especially the life of modern communities with their vexed problems of public health, public safety, public comfort and public convenience, is one of the striking features of an otherwise industrial age. And in response to this interest we find the attention of an increasing number of students turning towards professions like sanitary engineering and applied biology, which naturally minister to this newly felt want, and finding in such service their satisfaction and their support. It was perhaps inevitable that the first struggle of a scientific and industrial age should be to liberate mankind from the servitude of heavy manual labor, and to give it food and freedom. Now, however, that man has mastered to a large extent his lifeless environment, he appears to be turning with equal interest towards control of the living world. The increase of interest in biology is, however, thus far mostly confined to graduate students from other colleges and universities, for the public which sends its younger sons to the Institute does not yet realize either what biology is, or what it is in the future to become. Some of these graduate students remain with us long enough to take our Bachelor's or Master's degree, but many, largely because of the exhaustion of their resources, remain only one year. Even these, however, readily find positions of usefulness in the public service or elsewhere and, added to the regular graduates help to strengthen our annual output, and add greatly to the serviceableness of the Department.

The personnel and material equipment of the Department have remained practically unchanged during the year. The

Degree of Bachelor of Science was awarded in June to five candidates, two of whom have returned as candidates for the Degree of Master of Science. We now have four candidates for advanced degrees, one for the Degree of Doctor of Philosophy and three for the Degree of Master of Science.

WILLIAM T. SEDGWICK.

SANITARY RESEARCH LABORATORY AND SEWAGE EXPERIMENT STATION.

The work of the Sewage Experiment Station has undergone important changes and developments during the past year. The old Station at Albany Street had been practically outgrown and it has been made possible by the generosity of the donor, who has throughout supported the Station, to erect a new experimental plant much better fitted to the Station's need. The new plant is situated, through the courtesy of the City of Boston, on the land adjoining the Dorchester Pumping Station of the Boston main drainage works. Here ample room is available, and furthermore sewage is obtained directly from the main outfall sewer of the City of Boston without the artificial conditions created by the use of such small pumps as are necessarily used at almost all similar experiment stations. The new plant includes three trickling filters, equipped with the gravity distributor devised at the old Station, with Waterbury sprinkling nozzle, and with a travelling distributor of the Fiddian type especially constructed in London for the use of the Station. There is also a sand filter working under normal outdoor conditions and having an area of approximately four hundred square feet. The plant includes in addition a septic tank and sedimentation tank of special design, and a Dibdin plate bed, the latter being well adapted for a study of the most advanced problems in the art of sewage treatment.

The Laboratory of the Station has been removed to Room 24 Pierce Building, thus bringing the work of the Station in closer contact with the work of the Institute student.

It has also been possible to broaden the work of the Sanitary Research Laboratory by taking up specifically certain problems of ventilation and dust control which are of pressing importance. The first question to be attacked is that of the prevention of occupational disease among granite cutters, and Mr. Royce W. Gilbert is making for us a careful study of the dangers incident to this industry and of the practical methods of prevention.

The actual conduct of the work of the Station remains as hitherto mainly in the hands of Professor Winslow, as Biologist-in-Charge, and Professor Phelps, Resident Chemist and Bacteriologist, to whom is due the credit of planning the new Station and supervising its construction. We are also indebted to Mr. Andrew D. Fuller, C.E., for valuable advice and assistance on this side of the work.

Another volume, the fifth, in the series of papers giving the results of the work of the Station and Laboratory, has recently been issued. Most of the earlier volumes are already out of print, owing to the large and unexpected demand for them.

The anonymous donor, to whom we stand indebted for the opportunity to do this work, still maintains single-handed the entire enterprise. It is earnestly to be hoped, however, that others who realize what may be done for the public health and public welfare, not only by scientific investigations and the dissemination of information, but also by the education of capable young men going out into all parts of the world and ready and eager to apply the principles which they have learned at the Institute, will be found to help to maintain and extend this work.

WILLIAM T. SEDGWICK,
Director.

DEPARTMENT OF PHYSICS.

During the last year there have been no such changes in the methods of instruction in General Physics and the Physical Laboratory as to call for especial notice, although for many years past continual modifications in the details have been made which, in the aggregate, largely increase the efficiency of our instruction. In the recitations, which accompany the lectures in General Physics of the second year, we are hampered in an endeavor to increase the number of sections and so to diminish the average, and especially the maximum, number of students per section by the lack of a sufficient number of recitation rooms and by the crowded state of the tabular view as well. The appointment of an additional instructor for the present year will, to some extent, remedy these difficulties by allowing more flexibility in the sectional arrangements.

A year since, in connection with this Course, there was introduced, largely as an experiment, a definite system of conferences similar to those instituted a year before for the benefit of certain courses in the first year. For this purpose the instructor sets aside certain stated hours for individual conferences with such students as are especially in need of advice, and their attendance is compulsory. The conferences are open, moreover, to all students desiring this. These consultations which are personal in their character are not intended primarily for the purpose of definite instruction, but rather to bring about a clearer mutual understanding between instructor and student, and to allow of such individual help as this knowledge may suggest. The results, on the whole, were very satisfactory and the system is well worthy to be made permanent.

A change which should be noted in the general laboratory instruction is the accomplishment of the long desired transfer of the beginning of this work for the Course in Min-

ing Engineering from the third to the second year. With this revision of the schedule all students except those in Chemical Engineering will take their physcial laboratory work in close connection with the corresponding lecture and class room instruction to the mutual advantage of each. The desired increase of time in the second year for laboratory work to allow the introduction of certain work in electrical measurements, which was referred to in my report of last year, has not as yet been found feasible.

The course of lectures on Heat, taken by all regular students in the third year, has been made to touch more closely than hitherto upon the applications of the principles and laws of that agent to engineering problems. This is now possible, as was not formerly the case, since the students now enter the Institute with some knowledge of physics.

I have to record a continued steady increase in the apparatus of the Department available for purposes of instruction and investigation. Two important optical instruments have been purchased from the income of the bequest of Mrs. Augustus Lowell, which is allotted to the purchase of physical apparatus.

The number and value of the instruments, which the Rogers Laboratory owes to this source, have become so considerable that I think it proper to put more formally on record a list of these. It has been customary to apply this special appropriation to the acquisition of costly apparatus which is likely to be of permanent value, rather than to pieces of minor importance.

The following is a list of such, with the name of the maker and the date of the purchase.

1896. Cathetometer with two Telescopes; Société Génevoise, Geneva.
1898. Automatic Air-pump; E. S. Ritchie & Sons, Brookline.
1899. Koenig Spectrophotometer; Schmidt & Haensch, Berlin.
1899. Michelson Interferometer; Gaertner, Chicago.
1900. Landolt-Lippich Polariscope: Schmidt & Haensch, Berlin.
1904. Littrow Spectroscope, Michelson's pattern; Gaertner, Chicago.
1904. Weston Lecture Room Ammeter and Voltmeter; Weston Electrical Instrument Co., Newark.

1906. Ultra-violet Microscope; Zeiss Co., Jena.
1908. Abbé Crystal Refractometer; Zeiss Co., Jena.
1909. Brace Spectrophotometer; Schmidt & Haensch, Berlin.
1909. Martens Polarization Photometer; Schmidt & Haensch, Berlin.

The advanced work carried on in past years in the Laboratory of Heat Measurements, under the charge of Professor Norton, has been continued so that its equipment is now fairly adequate for the work in hand. Instruction is given to substantially all students of the fourth year, excepting those in Civil Engineering and Architecture, in the measurement of high temperatures, the determination of the heat of combustion of fuels, and the efficiency of heat-insulating materials. Furthermore, special instruction bearing upon their particular professional studies is given students in Metallurgy and Chemistry. During the past year, the students pursuing the short course in Concrete Design in the Architectural Department undertook some experimental work in this laboratory, in the study of the action of fire on Portland cement concrete.

Much experimentation has also been carried on in the way of measurements of the thermal conductivity of substances used for heat insulation at both high and low temperatures. Beginning with the thesis work of a graduate student in Architecture, there has been developed new apparatus for the study of the insulating value of the numerous substances now employed in protecting the steel work of modern buildings from fire. The precise methods of electric heating, together with the exceptional facilities which the laboratory possesses for high temperature measurement, have made possible the collection of valuable data on the effectiveness of the protection afforded by fire-proofing materials and methods. Likewise the study of those substances which are used for insulation in refrigerating devices, cold storage plants, and the so-called fireless cookers has been undertaken on specimens of considerable size. As a result the laboratory is now equipped to furnish instruction and to carry on research in these directions.

A study has been made of the physical effects of temperature upon the materials used in building, and data have been collected concerning the physical properties of concrete, stone, brick, etc., at conflagration temperatures. In particular, the coefficients of expansion, the mechanical strength, elasticity, and specific heat of concrete at high temperatures have been the subject of much investigation. The ability of reinforced concrete to withstand sudden exposure to high temperature is now being studied, and numerous specimens of beams and columns of considerable size are ready for test.

The additions to the apparatus of the laboratory during the year include several pyrometers, a number of electric furnaces and rheostats, two new combustion bombs, and apparatus for testing the thermal conductivity of materials used in construction. A 15 kilowatt transformer, with divided secondary, has also been constructed, according to the design and specifications of Professor Derr. The available working space of the laboratory has been somewhat increased by the removal of the direct current generating set, this being no longer necessary in view of the increased alternating current supply now available from the general electric power plant.

Acting upon the recommendation of the Department and Faculty, the Corporation of the Institute towards the close of the last school year decided to establish as a separate Course, the scheme of studies, which for the previous eight years have been the Electrochemical option of the Course in Physics (VIII.) and which has thus been constituted Course XIV.—Electrochemistry. The new Course will continue to be under the charge of Professor Goodwin, and the laboratories of Electrochemistry will as heretofore form a portion of the Rogers Laboratory of Physics.

It may not be inappropriate at this time briefly to recall the purpose and leading features of this Course. As originally laid out by Professor Goodwin in 1901, it aimed to

supply an opportunity for students to obtain a combined training, at that time unprovided for at the Institute or elsewhere in this country, in the theory and practice of applied electricity and of theoretical and applied chemistry, the essential features of Courses V. and VI., together with a considerable amount of distinctly professional work in electrochemistry. It was believed that there would be an increasing demand for graduates having a training, such as that proposed, in the rapidly developing electrochemical industries of the country, and that such has been the case, is shown by the recent establishment of similar courses of instruction in a number of our leading universities and technical schools. At present there are fifteen students registered in the Course. The total number of graduates, 1903–1909, is twenty-five, all of whom have obtained good positions and some very important ones. While the Course was planned to lead up to professional work in electrochemistry in the fourth year, it was believed that the instruction in the fundamental studies of chemistry and electricty should be of so broad and thorough a character, that a graduate would be well equipped to enter other fields of work than that of electrochemistry in its restricted sense, if he so desired. That the curriculum, which remains in its essential features as originally planned eight years since, has satisfactorily met this requirement, is shown by the wide range of occupations of the present graduates. Thus while about one-third are engaged in strictly electrochemical and electrometallurgical work, another third are engaged in electrical, mining and general engineering, while the remainder are well placed in various bureaus of the United States Government, or are engaged in patent law, scientific research, or teaching.

The Course in Electrochemistry is necessarily somewhat rigorous in character, involving as it does a knowledge of the theory and practice of two sciences, chemistry and electricity, the latter highly mathematical in its nature. Only students of good ability have been advised to elect it, and

no attempt has been made to attract large numbers. In fact, owing to the present congested condition of our laboratories, provision has not been made for more than ten or twelve students in the senior year.

The Electrochemical Laboratories, in which the advanced work of the Course is carried out, consist of two rooms in the basement of the Walker Building. These were thoroughly equipped in 1903, one with twelve desks provided with every facility for electrochemical measurements of all kinds, the other with direct and alternating current electric power, electric furnaces, etc., for testing technical processes on a fairly large scale. Since the establishment of the Laboratory, it has been the policy to add each year such apparatus and accessories as would keep it up to date in its facilities for advanced instruction and research work. The most important acquisitions during the past year are an induction furnace, built by the American Furnace Co., for electrometallurgical work, this being one of the first of its kind to be installed for purposes of instruction in the country, and a new type of resistance furnace of 25 kilowatts capacity, built by the Hoskins Co., for maintaining temperatures up to 2000° C. With the growth of its work and added equipment, the laboratory of Applied Electrochemistry has now reached a very crowded condition, and additional space, as well as power, will soon be necessary, if the Laboratory is to continue to provide adequate facilities for all students desiring to elect this work.

While this laboratory was primarily equipped for giving instruction to students making Electrochemistry their specialty, its facilities are available to properly prepared students in other Departments, such as those studying Mining, Chemistry or Chemical Engineering and Electrical Engineering. The lecture courses offered are also open to graduate students in these Departments. The instruction in Theoretical Electrochemistry is given by Professor Goodwin, and that in Applied Electrochemistry by Professor

Thompson. Mr. Read, a graduate of the Course, assists in the laboratories.

A number of valuable researches have already been published from the Laboratory Among those completed during the past year, or which are in progress at the present time, the following may be mentioned: the separation of oil from condenser water by means of electrolysis,—the properties of metallic conductors at very high temperatures,—the free energy of formation of carbides,—the electrolysis of solutions containing cuprous salts,—and the electrolytic reduction of aluminum.

CHARLES R. CROSS.

DEPARTMENT OF GEOLOGY.

In the geological studies of the Mining Course, changes involving Mineralogy, Petrology, and Economic Geology were adopted in the spring of 1909. Mineralogy is transferred to the third year, the metallic and useful non-metallic minerals being treated in the first term, and rock minerals in the second. The second-term work leads directly into Petrology, both subjects together occupying four hours a week throughout the term. A new collection of rocks designed for the course in Petrology has been arranged by Dr. Loughlin. The specimens are studied primarily without microscope, with a view to such questions as the average mining engineer would meet in his professional work. All mining students, except those specializing in Metallurgy, are required hereafter to study Petrology as a preparation for Geological Surveying and Economic Geology. The third year course in Economic Geology has been discontinued, while that of the fourth year has been strengthened and is hereafter required of students of both the technical and geological in Mining. The course in Microscopical Petrography is retained for students specializing in Geology.

Professor Jaggar secured subscriptions from friends of the Department in January, 1909, whereby he was able to send eight hundred dollars to Mr. F. A. Perret in Naples, for scientific investigation of the Messina earthquake. This sum was supplemented by money from the Volcanic Research society of Springfield. Mr. Perret was appointed American consular agent from Naples and he was among the first to visit the scene of the disaster and aid in the work of rescue. He has published a preliminary report on his studies and has visited Sicily from time to time through the year in continuation of the work. As he is in close touch with Professor Mercalli at Naples and is continually at work upon problems concerning the physics of the active Italian volcanoes, Mr. Perret has become a valuable associate of this Department. A portable seismograph of his invention is being constructed in Springfield.

Through the continued interest of the trustees of the Caroline A. R. Whitney Estate, a tentative offer was made to the Department of Geology in the autumn of 1908 to build a Geophysical Observatory which should combine seismology and some geodetic and magnetic work, Twenty-two hundred dollars was secured from Boston subscribers toward an income fund for this project. It was at first proposed that the observatory should be in the Blue Hill Reservation, in Boston. In February Professor Jaggar was granted leave of absence for a journey to Hawaii and Japan to study volcanoes and earthquake establishments. While he was in the Hawaiian Islands a committee of the Chamber of Commerce of Honolulu raised by subscribed pledges an annual fund for five years, conditional upon the transfer of the proposed observatory to the island of Hawaii, the Institute to retain exclusive control of the work. As Hawaii is a volcanic and seismic center of world-wide interest, this proposition has been hospitably entertained, and it is hoped that such a transfer may be completed. While in Japan, Professor Jaggar received many courtesies from the officers of the

Universities of Tokyo, Kyoto and Sapporo, and spent some weeks in the study of the work of the Imperial Earthquake Investigation Commission and in a journey to the remarkable active volcano Tarumai in Yezo. He wishes here to record his grateful appreciation of these attentions, and also the gratitude of the Department to the several subscribers of money in Boston and Honolulu, above referred to.

This year a graduate course on the Geology of the Igneous Rocks was given by Professor Daly for the first time. He has nearly completed the report on the Geology of the North American Cordillera at the Forty-ninth Parallel of latitude. Its final preparation for the press awaits two of the topographic sheets which the topographers of the International Boundary Commission are providing for the geological atlas of this survey. During the year Professor Daly has edited a scientific work on Labrador by Dr. W. T. Grenfell and others, and has contributed thereto a chapter on the geology and scenery of the northeast coast.

After a profitable visit to the Yellowstone Park, he spent the summer in a study of the Hawaiian volcanoes; the visit to the Kilauea lava-pit, where he spent nearly four weeks, has convinced him that it is the most favorable place in the world for the establishment of a permanent volcanic observatory. He heartily concurs in Professor Jaggar's view that such an observatory should be established at once. Professor Daly is preparing for publication papers on the origin of the alkaline rocks, and on the chemistry of the average eruptive-rock types.

The rock collection has been enriched by a fine specimen of orbicular gabbro from Dehesa County, California, presented by Mr. R. C. Hillis, of Los Angeles. The mineral collections have been increased by the purchase of two private cabinets of minerals, chiefly ores, offered for sale by the executors of the estates of local collectors. The petrographic collections have also received additions through collection by members of the Department and graduate students.

Four petrographic microscopes have been added to the laboratory equipment. Two of these are of the Bausch and Lomb pattern, and are intended for undergraduate work. The purchase of one of these was made possible through the kindness of the Mining Department. The other two instruments are of the large Fuess type, fitted with mechanical stages, so as to make them available for the quantitative study of rocks. These instruments are reserved for the use of members of the Department and graduate students, and were presented to the Department through the generosity of Mrs. William Barton Rogers.

During the past summer a most important mineralogical discovery was made in one of the granite quarries of Quincy, Mass. This consisted of a large mass of pegmatite, showing a wonderful development of unusual minerals. A careful study of these is being made in the mineralogical laboratory. The results will throw light on vexed problems of the "Blue Hill Complex."

The summer was spent by Professor Warren in the field, studying the Blue Hill area. The laboratory study of his collections is now in progress. On account, however, of the very considerable amount of careful chemical analysis required, probably not less than a year's continuous work will be necessary for completion of this investigation.

In the Course in Advanced Petrography, studies have been carried on by graduate students on the Hedley mining district, British Columbia, and on the igneous rocks of Essex County, Mass.

Mr. Waldemar Lindgren, M.E., Geologist in charge of the Section of Mining Geology and Metal Statistics of the United States Geological Survey, has been reappointed Lecturer in Economic Geology for 1909–1910, to direct the advanced courses in that subject. Mr. Lindgren began his work November 17, on leave of absence from Washington for five weeks. During this time, while residing in Boston, he gave a course of thirty-five lectures and conferences on Economic

Geology, with particular reference to ore deposits. His course places special emphasis on the mining development of the Western states. During the spring and summer, Mr. Lindgren, in the course of his official work for the Geological Survey, has travelled extensively in the Cordilleran districts, and has had opportunity to observe the latest development in the science of ore deposits.

Professor Crosby has been chiefly engaged during the past year in the investigation of the geology of Long Island and the Valley of the Hudson River. This work has been done primarily in his capacity as Consulting Geologist to the Board of Water Supply of the City of New York. Professional economic work has also taken him twice to the Pacific Coast. He spent the month of July with the Sierra Club, in the High Sierra of California, studying the glacial geology and physiography of the region. Other research work in preparation during the year by Professor Crosby includes the geology of the Boston Basin, and the structural and genetic relations of parallel and intersecting joints.

During the past year, the paleontologic and stratigraphic division of the Department of Geology acquired by purchase some preparations of recent marine invertebrates, to show the relation of the soft parts of the animals to the parts preserved as fossils.

The Department acknowledges a gift of tertiary fossils from California by William F. Jones, and some tertiary and mesozoic fossils from Vancouver Island by C. H. Clapp.

There are three graduate students who are taking minor work for the degree of Doctor of Philosophy in paleontology. Professor Shimer is engaged in research work on the Pleistocene problem of Sankoty Head, Nantucket, Mass., and the correlation of the Permo-Carboniferous of Arizona and Utah, also other stratigraphic problems in the same states. He has completed, in collaboration with Professor Grabau of Columbia University, the first volume of a valuable handbook on Index Fossils, after seven years of laborious work on the subject.

Dr. Loughlin is preparing a syllabus of questions for the elementary courses in Petrology and Building Stones. With Professor Warren he has revised the course in Microscopic Petrography. During the summer, he extended his studies for publication, in Connecticut, Rhode Island and near Boston. These investigations deal with the age relations, structure and petrographic character of granites and associated rocks. With Professor Crosby, he is collecting material for a handbook on the building stones used in Boston, and a general text on the study of building stones.

Dr. Loughlin continues to teach elementary geology in Boston University. He has co-operated with Professor Crosby in some of the latter's New York Water Board studies and in several private examinations.

Mr. Clapp has, during the past year, completed the minor subjects of his course of study leading to the degree of Doctor of Philosophy, paleontology and physical chemistry. He is conducting his major work in the petrographic geology of the igneous rocks in Essex County, Massachusetts.

During the past summer, he continued the exploration of Vancouver Island for the Geological Survey of Canada. In the past two seasons an area of about four thousand square miles has been explored. This area from a geological viewpoint was virtually unknown, and a part of the area was almost unexplored.

Mr. John A. Allan, Assistant in Geology, is making a study of the rocks in the Middlesex Fells. During the summer of 1909, in the employ of the Geological Survey of Canada, he made a detailed examination of the rocks in the southeastern portion of Vancouver Island, in the Mt. Sicker district, and a reconnaissance survey to the interior of the island. Two other graduate students, Messrs. Stuart J. Schofield and Norman L. Bowen, are pursuing advanced studies in the Department of Geology. There are now three candidates for the degree of Doctor of Philosophy at work in the laboratory of Geological Research. The acquisition of a room

for the use of these men has given great satisfaction. Additional cases have been added to the Geological Library and 10 Engineering B has been remodelled.

T. A. JAGGAR, JR.

DEPARTMENT OF NAVAL ARCHITECTURE.

With the revival of activity in shipbuilding in this country it might be expected that the sizes of classes in the Department of Naval Architecture would increase correspondingly. This is to be desired, for, as in other departments of the Institute, there has been a greater demand for graduates than could be supplied. In general the facilities of the Department are sufficient for any increase that may be anticipated. There are, however, certain needs that have already been presented and which become more pressing. In particular the space assigned to the Department library has become insufficient and even after discarding books of doubtful utility it has become impossible to find room on the shelves for the books already in the library. The policy has been to purchase all books that appear valuable, and to keep up duplicate sets of certain proceedings of societies; this policy has been possible through the liberality of a friend who has also aided the Department in other ways. The library has also benefited from gifts from private libraries. In this connection it may be proper to call attention again to the need for a room for keeping drawings and instruments which we are unable now to guard and care for as we should.

During the past year the work of the Institute for the Navy Department received practical appreciation, through the request of the Acting Engineer-in-Chief that a Course parallel to the Course for Naval Constructors should be offered for Naval Engineers. Such a course was laid out to the satisfaction of the officer named. Afterwards, following an opinion of the Attorney General, and Engineer-in-Chief

was appointed who, after reviewing the situation, decided to establish a graduate course for naval engineers at the Naval Academy, it being in his opinion of importance to maintain a close association of such a course with the Navy Department.

From the inception of the Course for Naval Constructors, there have been many applications for foreign students to take that or a similar Course at the Institute. Citizens of the United States who have completed our regular Course in Naval Architecture, or who have the equivalent preparation, may take a graduate course in Naval Architecture with special attention to warship design and electricity, and thus accomplish such a purpose. A few students have taken advantage of this opportunity, being accommodated in the drawing room provided for the naval officers who are detailed for instruction, and using the confidential information provided the Institute by the Navy Department. Such a method is not now available for aliens, and while we have had foreign students in the regular Course for Naval Architects, we have been unable to provide for applicants to take naval construction. It has from the first been considered desirable to provide for such students and now it appears possible to do so, which is the more fortunate as there are three students from a foreign country who desire such instruction. It may be interesting to note that two naval engineers from a foreign country have taken instruction at the Institute with special attention to marine steam turbines, and that a third officer has joined the Institute this year.

For several years courses of lectures have been given to students in Naval Architecture by men eminent in the profession, and last spring a course was given by M. Bertin, Chief Constructor (Retired) of the French Navy. It is hoped that a course of like importance can be arranged this year.

One of the most important and least known problems in

ship propulsion is the interaction of the propeller and the hull. The propeller from choice and necessity is placed directly astern in the wake of the ship and has a distinct advantage from that location. On the other hand the location of the propeller so near the hull serves as a drag and increases the power beyond what would be required to tow the ship. One of the most approved ways of investigating this matter is by aid of a large model which can be navigated and tested in the open water. Through private generosity the Department is able to undertake such an investigation extending over several years, and it is expected that valuable information will be obtained, and that the work will also serve as a stimulus of interest among the students of the Department. This model can also be used for investigation of problems in steering and manœuvring.

C. H. PEABODY.

DEPARTMENT OF MATHEMATICS.

There have been no very important changes in the work or personnel of the Mathematical Department during the year covered by this report. Professor Woods is spending the present year on leave of absence in Europe, and is now engaged in mathematical work in Paris. The temporary vacancy has been filled by the reappointment of Dr. Nels J. Lennes, who was instructor in the Department in 1907–1908. We are this fall using Woods and Bailey's Course in Mathematics for the first time with third-year students. With increasing experience in the use of the new text as a whole, better adaptation to our needs and conditions naturally result. Among the large number of students entering this fall from other colleges it has been necessary to make special provision for only five who were prepared for second-year mathematics except in the elements of calculus. Men from

other colleges who have had differential equations are expected in general to be able to make up by themselves the small amount of that work now given in our second year.

The attention of the Department has been further occupied with considerations of the best plan for student conferences, or rather of the best means of securing personal acquaintance with the individual student as early as practicable in the term. Sometimes this depends on one or more personal conferences, but it must always depend very much on keeping the size of our sections relatively small. The present term the average size of sections is eighteen in third-year mathematics, nineteen in other subjects.

H. W. TYLER.

DEPARTMENT OF DRAWING AND DESCRIPTIVE GEOMETRY.

The changes in the arrangement of the large drawing-room, 43 Rogers, authorized in the spring, were made during the summer. The room is now divided into four class rooms, and each is provided with an excellent slate blackboard, and the usual equipment for lectures and individual instruction.

Each room is in charge of an instructor. By the old system class-room work was taken by groups sometimes containing as many as ninety students each. The size of the room prevented effective teaching from the blackboard. Several instructors assisted the students individually, but the instructors were without definite authority or responsibility. The size of the divisions interfered with satisfactory discipline as well as with concentration on the part of the student.

Under the present arrangement, the work in the drawing-room is given to groups including not more than forty men each, and some of the groups contain but twenty men. Each

instructor meets the same students throughout the term, and has definite authority and responsibility.

To secure consistent results in teaching, especially in Descriptive Geometry, it is believed that the first presentation of at least portions of the subject should be the same for all members of the class. This need is met by lectures given by Professor Adams in Huntington Hall.

In Mechanical Drawing, and parts of the Descriptive Geometry, lectures are given to the smaller groups by the instructors in charge, and at all times troublesome details can be explained, as appears preferable, either from the blackboard or individually.

The advantages derived from the changes in the method of instruction have already become apparent.

Professor Adams has completed the writing on Warped Surface, and this part of his Descriptive Geometry is now in type. The pressure of class work will prevent the completion of the final drawings, but it is expected that the completed work will be ready for use at the beginning of next year.

There is a portion of the instruction in Freehand Drawing which seems to call for special mention. It is the work of Mr. W. Felton Brown in connection with the restoration of the old frieze in Huntington Hall, which was destroyed some nine years ago when the hall was repainted. Mr. Brown has not attempted the exact duplication of any of the previous work, but has endeavored to keep the spirit of the old decoration. This work has been assigned as a regular part of the instruction in Freehand Drawing to fifth-year students in the Architectural Department. They have been encouraged to make original designs, and have been held responsible for all the work from the preliminary sketch to the completed painting. The paintings were made on canvas stretched on frames, so shaped, that they could be fitted into the wall spaces left between the columns. It was thus comparatively easy to do this work entirely in the

drawing-room and have it installed in place in a very short time, the general appearance being the same as if they had been painted upon the wall surface.

The first seven panels over the stage (including the seal of the Institute) were put in place on class-day 1907. The cost of the materials used in this work was defrayed by contributions from the graduating class of 1907. The next year four larger panels were added, completing the frieze on the south wall of Huntington Hall. They were unveiled on class-day 1908, the cost of materials in this case being borne by the alumni members of the class of 1895. Last year twelve panels were completed and placed on the wall on class-day 1909. The cost of materials last year was defrayed by a special appropriation made by the Executive Committee of the Corporation. Through the able criticism and instruction of Mr. Brown all these panels have been kept in harmony with the general scheme of decoration of the hall. During the present year Mr. Brown will probably have the fifth-year students add four more panels, which will complete the frieze.

These decorations, which have been obtained by the Institute at so little cost, give a notable illustration of the practical value of the instruction in Freehand Drawing given to the architects. This course of instruction is under the direction of Professor Charles L. Adams. He has always been ably assisted in this work by Mr. Brown, and the particular portion of the instruction to which I have just referred has been entirely under Mr. Brown's charge.

The only new appointment in the Department this year is that of Mr. Frank M. Gracey, a graduate of the Normal Art School in Boston, as instructor in Freehand Drawing for the first-year class.

ALFRED E. BURTON.

DEPARTMENT OF MECHANIC ARTS.

The total number of students receiving instruction in the Mechanical Laboratories is two hundred and eighty-three. Some of these attend in more than one class, the numbers attending in the several subjects being as follows:—

Subjects.	*Course.*	*Students.*
Carpentry and Wood Turning	II.	54
Joinery and Pattern Work	VI.	31
Forging	II. and XIII.	65
Metal Turning	VI., VIII., and X.	49
Foundry Work	II. and XIII.	89
Machine Tool Work	II. and XIII.	60
Total in all classes		348
Students attending work in two or more classes and counted more than once		65
Total number of students		283

The total number of students attending last year was two hundred and seventy-one. The number of excuses granted to students, entering from mechanics arts high schools, in Joinery, Wood Turning, and Forging, is still on the increase and the instruction in Wood Working is being rearranged to include as much Pattern Making as possible.

Summer School.—The attendance in the Summer School was forty-eight, an increase of two over last year. The numbers attending the several classes were:—

Wood Work	9
Forging	7
Chipping and Filing	3
Machine Tool Work	29
Total	48

The large attendance in Machine Tool Work continues, due to the desire of many students to anticipate their Mechanic

Arts of the senior year to obtain more time for thesis or other departmental or allied work.

Increased Space.—A part of the room vacated by the Technology Union has been utilized for a Pipe Fitting Laboratory and for the installation of an equipment of pneumatic hammers, drills, and riveting tools, transferred from the Department of Naval Architecture. The Chicago Pneumatic Tool Co., the donors of most of the pneumatic tools, have loaned the Institute a 9″ x 9″ belt-driven air compressor. The entire equipment was used for instruction during the latter part of last year and instruction in the use of pneumatic tools is now given in connection with the work in Chipping and Filing. It is desired to utilize the greater part of the remaining space for a general lecture room, where illustrated lectures may be given in direct connection with the mechanic arts work. Such lectures would describe and illustrate processes and methods of doing work which cannot be carried out with our limited equipment.

Electric Lighting.—A new electric lighting plant is now installed to furnish current for lighting and power for the Gymnasium and the Mechanical Laboratories. A Sturtevant 25 K.W. direct connected unit supplies the current and the exhaust steam is used for heating. The new system is very much superior to the old and is very much appreciated.

Equipment.—In addition to the pneumatic tools mentioned above there have been installed in the machine-tool laboratory, a scleroscope for determining the relative hardness of metals, a case of machinist's tools from the Browne and Sharpe Manufacturing Co., and a set of electric pyrometers is soon expected to arrive for use in connection with the hardening equipment and melting furnaces. A new Reed engine lathe has replaced one of the old engine lathes. It was hoped to install an automatic screw machine but a sufficient reduction in price could not be obtained to enable the purchase to be made within the available appropriation.

In addition to this screw machine, which would permit instruction in the operation of automatic machinery, a small radial drill and an additional milling machine are needed. Six engine lathes and five speed lathes purchased in 1876 should be replaced by new tools.

The equipment in the wood working laboratory remains unchanged, some of this, in use since 1877, should be renewed and a few large lathes and a surface planer should be added. The forging laboratory equipment is nearly worn out. It has been put in good repair and its renewal is not advisable on account of its fixed character unless the laboratory is to remain in its present location for a long time. Only the necessary repairs have been made on the foundry equipment thus far. The question of new equipment and the obtaining of much needed additional room for development is now being considered. It was deemed best not to install a larger cupola furnace in the present contracted space.

Building.—The building is in fair condition. A new skylight has replaced the old leaky one over the cupola room. The floors in the machine and wood turning laboratories are too unsteady for good work and new ones are advisable.

Instructing Staff.—There have been many changes. Mr. Theodore B. Merrick, now over seventy-five years of age, was retired on October 1st, by the Carnegie Foundation, after twenty-five years of successful service as Instructor in Wood Work and Foundry Work. Mr. Albert L. Moulton, Assistant in Wood Work, resigned to accept a position at the Mechanic Arts High School, Boston. Mr. Alfred R. Hunter, Assistant in Chipping and Filing, resigned to accept a promising business opening. Mr. Ernest Curley, Assistant in Machine Tool Work, also resigned. The following new appointments have been made: Mr. Jeremiah F. O'Neil, Instructor in Wood Work; Mr. Arthur B. English, Assistant in Machine Tool Work; and Mr. Samuel W. Rounds, Assistant in Wood Work and Foundry Work.

Mr. O'Neil has been connected with manual training work

for the last twenty-three years. After graduating from one of the Boston public grammar schools he took charge of the tool-room of our Mechanical Laboratories, where, during his successful four years' service, he obtained considerable experience in machine work, becoming so attached to the work that he served his time as a machinist and worked several years as a journeyman. During this period of twelve years he employed his evenings in study and attending evening schools in drawing and high school subjects. In 1889 he accepted a position as Instructor in Manual Training and Laboratory Assistant in Physics at the St. Paul's School of Concord, N.H., where he remained four years, resigning to spend a year in study at the Institute, where he took advanced work in mechanic arts, descriptive geometry, and English. On completion of this course he served two years as Assistant in Wood Work and Foundry Work, resigning to accept the position of Sub Master in Manual Training at the Malden High School, which he has successfully filled during the last five years. He has entered into his chosen work with enthusiasm and has utilized his summer vacations in study at summer schools and in obtaining practical experience in pattern and foundry work.

Mr. English has served his time as a machinist and has worked ten years as a journeyman, most of the time as a die maker. He comes to us with the purpose of obtaining experience in teaching.

Mr. Rounds is a graduate of a Roxbury grammar school and has taken courses in mathematics and drawing in correspondence schools. He has worked as a journeyman pattern maker and has had several years' experience in machine shops, in the foundry, and as draftsman. He is very much interested in manual training and comes to us to obtain experience in teaching.

Mr. R. H. Smith, Instructor in Machine Tool Work, has for several years been engaged in the preparation of a textbook on machine work, prepared for the students in techni-

cal, manual training, and trade schools. It is to be published in three parts, the first two of which are now in press. It is expected that this text-book will be a great help to the students and that it will enable more and better work to be done.

PETER SCHWAMB.

DEPARTMENT OF ENGLISH.

The work of the English Department has been continued during the past year on the lines which have been indicated in former reports. The conference system is made a most important feature of the instruction, and gives most satisfactory results. The co-operation with other Departments goes on, and has been especially improved by the working out of a more careful method of handling the reports of the electrical engineers. In the teaching of First Year English a new feature has been introduced. For the first five weeks the freshmen have been given an introduction to the regular work in composition by being put through a course of reasoning and the simpler logical forms. While no attempt was possible at a course in logic which could even aim at anything like completeness, the students have been shown how to test the validity of their thoughts and conclusions, in order in the first place that they might do more in the way of thinking for themselves, and in the second that they might better estimate the value of the statements and conclusions which they will later use as material for theme-work. A pamphlet prepared in the Department was used as a text-book, and by frequent Department Conferences the instructors have been able to try the experiment with something like unanimity of plan and method. The results, so far as can be decided at once, have been good.

To the instructing staff has been added David Carb, A.B.

ARLO BATES.

DEPARTMENT OF HISTORY AND POLITICAL SCIENCE.

The course on the History of European Civilization and Art at present given to the students of the Department of Architecture in their fourth year will in 1910–11 and thereafter be given during the third year, and a new course, in part identical with that now given to graduate students, will henceforth be given in the fourth year. These two courses will in reality form a single continuous course, intended to afford a general survey of the development and principal phases of European civilization and art down to the close of the Italian Renaissance. By the use of a syllabus containing extensive summaries it is hoped that it may be possible to maintain the sense of historical continuity and relation while concentrating the lectures and topical reading mainly upon the Classical, the Gothic, and the Italian Renaissance periods. A special collection of several thousand photographs and lantern slides of works of sculpture, painting, and the industrial arts, has been formed for the illustration of these courses and the very large general collection of slides belonging to the Department of Architecture is also freely drawn upon. In addition to technical courses on the History of Architecture and of Ornament the students of Course IV. will thus be given a survey of the chief schools and the great masterpieces of European art studied in relation to the historical development and the political and social conditions which produce them. No other school of architecture, so far as I am aware, includes in its regular course so broad or so thorough an historical survey.

Upon the general foundation thus established it is hoped that henceforth the graduate courses in history and art offered to fifth-year students may advantageously be devoted to special topics, to be selected from time to time, such, for example, as Byzantine history and art; the institutions and

art of Venice; Rome as the centre of European civilization and art at the beginning of the sixteenth century; the civilization and art of the French renaissance; etc. In nearly all of these fields the superb collections of the Boston Museum of Fine Arts and of Fenway Court afford a supply of original illustrative material probably superior to that accessible to students in any other American city.

THIRD YEAR OPTIONS IN GENERAL STUDIES.

The number of students electing these options during the past two years, and for the first term of the current year, is shown by the following figures furnished by the Registrar:—

FIRST TERM.	1907–08.	1908–09.	1909–10.
ECONOMICS.			
Economic History	15	29	37
ENGLISH.			
Advanced English Composition	15	17	16
English Literature of 18th Century	15	6	10
The English Bible	3	10	12
MODERN LANGUAGES.			
French III.A (advanced)	11	7	9
French Colloquium	17	17	8
German III.A (advanced)	16	21	9
German Colloquium	26	16	16
Spanish	14		
HISTORY AND POLITICAL SCIENCE.			
Colonial Systems	7	20	20
International Law	48	87	101
History of Science	43	42	31

SECOND TERM.	1907–08.	1908–09.
ECONOMICS.		
Railroad Economics	13	31
Banking and Finance	75	89
Labor Problems	9	15
Organization of Industry	17	
ENGLISH.		
English Literature of 19th Century	13	11
Argumentation and Debate	14	16
MODERN LANGUAGES.		
French III.A (advanced)	10	11
French Colloquium	16	11
German III.A (advanced)	7	13
German Colloquium	10	18
Spanish	10	
HISTORY AND POLITICAL SCIENCE.		
Municipal Government	50	45
European Civilization and Art	9	19
History of Science	20	15

Various individuals are likely to draw varying conclusions from this table; but it may warrant one suggestion upon which a considerable number of persons are, perhaps, likely to agree, and that is the desirability, in a school of the character of the Massachusetts Institute of Technology, of introducing a required course in the history of science. In an institution of such high standing in the teaching of pure and applied science, it seems almost imperative to include, for all students, the study of the history of science, in order that every graduate should possess an outline knowledge of the general field itself and also understand the relation of his own branch of the subject to all science and all sciences.

CHARLES F. A. CURRIER.

DEPARTMENT OF MODERN LANGUAGES.

Since my last report, the requirements in Modern Languages have been further diminished by the dropping of Spanish from the Course in Naval Architecture, and of French or German, at the option of the student, from the Courses in Mining and Architecture. In only six of the fourteen undergraduate Courses are students now required to qualify both in Intermediate French and in Intermediate German. These Courses are Biology, Physics, Chemistry, Chemical Engineering, Geology and Electrochemistry.

The year 1906–1907 was the last in which elementary French and elementary German were offered and announced in the Programme of the Institute. Since then, however, elementary German has been offered each year by vote of the Faculty, and this year Elementary French has been likewise offered.

The several courses in modern languages, with the number of students (including listeners) that attend them, and the size of the sections, are shown by the following table:—

Subject.	Sections.	Students.	Average size of Sections.
Italian	1	8	8
French I.	1	16	16
French II.	10	150	15
French III.A	1	8	8
French III.B	2	25	12.5
French Colloquium	1	12	12
German I.	3	62	20.6
German II.	10	158	15.8
German III.A	1	12	12
German III.B	2	40	20
German Colloquium	1	26	26
Spanish I.	1	14	14
Spanish II.	1	4	4
Spanish III.	1	2	2
	36	537	14.9

Number of students taking French	211
Number of students taking German	298
Number of students taking Spanish	20
Number of students taking Italian	8

The size of the average section a little less than fifteen students) is no smaller than it need be to admit of proper attention to individual students. There are three sections numbering twenty or more students, and there is one numbering twenty-six.

For the assistance and encouragement of backward students, hours of conference have been arranged for French I. and French II., and for German I. and German II.—three for French, and five for German, per week. The attendance at these conferences—which have now been held for several terms experimentally—is satisfactory, and seems to justify their continuation.

Most of the students at the Institute have either passed off Modern Languages at entrance, or met the requirements therein by the end of the first year. A certain portion of them, wishing to have a command of a modern language on graduation, and realizing that they cannot have it unless they in the meantime keep up their practice of the language,

try to do so by taking one of the advanced courses. In many cases these students have not the time to take a whole course, and apply for admission as partial students or as listeners. It seems that there should be a course especially designed to meet their cases. Such a course, to consist of one exercise a week—without preparation—is under consideration by the Faculty.

A course of fifteen lectures in French on the subject of Gothic Architecture, intended especially for architectural students, is given for the first time by an instructor of my Department—Mr. Dike. I regard this course as pertaining to the Architectural rather than to the Modern Language Department.

The amount of summer reading in modern languages that has been done since such reading was instituted in 1906 is shown by the following table:

	1906.	1907.	1908.	1909
Number of students reporting	348	395	361	354
Number of foreign books read	43	50	60	55
Number to every ten students reporting . . .	1.23	1.27	1.66	1.55

This table shows that, of the books read, from one to two in every ten is a foreign one, and that the proportion has increased from 1.23 in 1906 to 1.55 in 1909. This showing is the more significant and gratifying when it is considered that the number of students taking modern languages has decreased during these years from about seven hundred in 1906 to about five hundred in 1909, and that the reading of foreign books counts for no more in the credit given the student than the same amount of reading in English.

The more pressing needs of the Department were set forth in my report of last year. One of these—the reduction of the size of the average section to fifteen students—has been met. The others are receiving the attention of a committee appointed last year by the Faculty to look into the working of my Department. I would emphasize especially the following recommendations:

1. Change of time distribution from three hours of classroom work and six of preparation, to four hours of classroom work and five of preparation, per week.

2. Oral tests at the entrance examinations in modern languages.

Both of these innovations are necessary to secure for the student a working knowledge of the language, or a fair appreciation of its genius and spirit. The second is desirable, moreover, as an encouragement and stimulation to preparatory schools in the preparation of students for the Institute.

JOHN BIGELOW, JR.

The Society of Arts.

Meetings of the Society of Arts have been held twice each month during December, January, February and March, with one meeting in April and one extra meeting in February. All of these meetings, with but one exception, have been held in Huntington Hall and the attendance has been very gratifying. With the exception of the meeting on March 25th, when a violent storm prevented a large attendance, two hundred has been the least number present and at the largest meeting nearly seven hundred were present.

The topics and speakers were as follows:—

December.	"Charles River Basin Improvements." By Messrs Youngman and Miller.
	"Modern Methods of Illumination." By Dr. Louis Bell.
January.	"The Corrosion of Iron." By Dr. William H. Walker.
	"The Future of Electricity." By Dr. Steinmetz.
	"The Messina Earthquake." By Dr. Jaggar.
February.	"Evolution of Organic." By Dr. Sedgwick.
	"Evolution of Inorganic." By Dr. Lowell.
	"The Gas Engine." By Dr. Charles E. Lucke.
March.	"Detection of Salting in Mine Examinations." By Mr. Harrison W. DuBois.
	"The Carnegie Institution of Washington and its Work." By Dr. Woodward.
April.	"Solar Cyclones and Magnetic Fields." Dr. George E. Hale.

The activities of the Society in the past year have resulted in the gain of sixty new members, corresponding to an increase of nearly fifteen per cent. in the membership.

The Technology Quarterly having been discontinued with the December number, it was necessary for the Society to make an independent publication of its proceedings. Bulletins have been published each month from December to

April inclusive. A stenographer has been present at the recent lectures and a good abstract has been obtained in cases where the speaker did not have a manuscript. The cost of the Bulletins has been about $2 per page for issuing 1,000. There has been a demand for extra Bulletins and many complimentary letters in regard to them and to the renewed activity of the Society have been received.

At a recent meeting of the Executive Committee it was voted that the Secretary prepare a card index of all present and past members and this has been undertaken. The list of present members is complete and the list of past members well under way.

The expenses of the Society for the past year are as follows:—

Printing Bulletins and Miscellaneous	$340
Secretary	200
Lectures and entertainment of speakers	150
Postage and mailing Bulletins	160
Clerical work	90
Stationery and Bulletin envelopes	47
Total	$987
There have been received for dues	862
Appropriation	500
	$1,362
	987
Unexpended balance	$375

There are at present three hundred and thirty members, a net increase of about fifteen per cent. over last year. Of the older members many will doubtless be found to be eligible to life membership on completion of the card index, but there appears every reason to believe that the dues for the coming year will amount to nearly $1,000. Half as many new members as were obtained during the past year would offset all transfers to the life membership group.

For the Executive Committee,

EDMUND H. HEWINS, *Chairman.*
WALTER S. LELAND, *Secretary.*

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MASSACHUSETTS INSTITUTE OF TECHNOLOGY

TREASURER'S REPORT

FOR THE YEAR ENDED SEPT. 30, 1909

Treasurer's Report.

To the Corporation of the
Massachusetts Institute of Technology:

I have the honor to submit herewith statements showing the financial condition of the Massachusetts Institute of Technology as of September 30, 1909, as well as the financial transactions during the fiscal year ended on that date.

These statements are presented in accordance with standard forms devised by The Carnegie Foundation for the Advancement of Teaching, for the purpose of making uniform, so far as practicable, the annual financial reports of universities, colleges and technological schools throughout the country.

These exhibits have been prepared by the Institute's auditors, Messrs. Harvey S. Chase & Company, of Boston, who have examined the Institute's accounts for the past year under the instructions of your auditing committee. This firm is now engaged in laying out the standard schedules for the Carnegie Foundation, and for this reason the accounts herein submitted are the first in the country to be published upon the standard forms of the Foundation. Particular attention is called to the balance sheet, Schedule B, in which a complete statement of the assets and liabilities of the Institute is exhibited. This balance sheet is explained briefly in the report of the accountants, which accompanies this statement.

The following gifts and legacies have been received during the year, and call for the sincere thanks of the Institute:—

GIFTS, BEQUESTS, ETC., 1908–1909.

Available for Current Expenses.

General.

M. I. T. Alumni Fund	$41,147.94

Special.

"A Friend of the Institute," for Sanitary Research Work	8,000.00
Dr. A. A. Noyes, for the Physico-Chemical Research Department	3,000.00
Dr. Charles G. Weld, for Naval Architectural Department	1,500.00

Charles W. Hubbard, for Research Work in Applied Chemistry (this is the second of three annual payments)		1,000.00
Conferences		500.00
Arthur Astor Cary		500.00
Saturday Club, for the purposes of the General Library		500.00
Guy Lowell, Travelling Scholarship in Architecture		500.00
Mrs. William B. Rogers, for Geological Department		296.83
Mrs. William B. Rogers, for periodicals		225.00
Mrs. Mary Pickering, toward repairs		87.50
Wheelwright Scientific School, for Applied Chemistry		50.00
Friend, for Naval Architectural Department		21.77
Levi L. Willcutt, for new books for Architectural Department		20.00
Total for current expenses		$57,349.04

For New Funds or Increases of Funds.

Gifts for Improvement Fund:		
Mr. and Mrs. Henry S. Grew	$5,000.00	
Mrs. E. M. Cary	5,000.00	
Mrs. W. H. Forbes	500.00	
Robert Treat Paine	100.00	
Wallace L. Pierce	100.00	10,700.00
John Felt Osgood Scholarship Fund		5,000.00
Gifts for Technology Union Building:		
A friend	$500.00	
A. T. Bradlee	250.00	
A. F. Bemis	250.00	
P. S. du Pont	250.00	
Frank L. Locke	250.00	
Charles A. Stone	250.00	
E. S. Webster	250.00	
John R. Freeman	150.00	
J. W. Rollins, Jr.	150.00	
Edward Cunningham	100.00	
Charles T. Main	100.00	
William L. Putnam	100.00	
John C. Runkle	100.00	
F. G. Stantial	100.00	
Dr. F. H. Williams	25.00	
William R. Greeley	14.00	2,839.00
		$75,888.04
Norton Grinding Co., Grinder for use of Machine Tool Laboratory, value		400.00
Morse Twist Drill and Machine Co., Gages for Machine Tool Laboratory, value		330.00
Professor C. L. Norton, Callender Recorder for the Physical Department, value		215.00
Gift of lathe and tools from A. J. Wilkinson & Co., value		200.00
Chicago Pneumatic Tool Co., Air Compressor for Mechanic Arts Department, value		191.00
		$77,224.04

The contributions of funds for current expenses of the Institute received through the Alumni Income Fund Committee

continue to be of great assistance. A substantial portion of these funds has been applied to permanent equipment. This amount, together with other outlays and special repairs, is sufficient to account for all of these contributions during the past year ($41,147.94), as follows:—

Additions to Technology Union (In excess of direct gifts)	$7,786.94
Salary increases	10,269.00
Electric light in Mechanical Laboratories	2,200.00
Changes in Gymnasium	1,300.00
Additional Mining Machinery	325.00
	$21,880.94
Other outlays and special repairs	19,267.00
	$41,147.94

The Walker Memorial Fund now amounts, with accrued interest, to $120,796.97.

I record the fact that losses by fires occurred in the Lowell building and in the Cabot house during the year. The first loss amounted to $3,080, and the second to $1,166. Both were fully covered by insurance.

Respectfully submitted,

FRANCIS R. HART,

Treasurer.

DECEMBER 6, 1909.

REPORT OF THE ACCOUNTANTS.

HARVEY S. CHASE & COMPANY,
Public Accountants and Auditors,
84 State Street, Boston.

NOVEMBER 30, 1909.

FRANCIS R. HART, ESQ.,

Treasurer Massachusetts Institute of Technology.

Dear Sir,—In accordance with your instructions we have prepared statements of the financial transactions of the Institute for the year ended September 30, 1909, and of its financial condition at the close of the fiscal year on that date.

These statements are exhibited upon schedules which follow, as closely as practicable, the forms provided by The Carnegie Foundation for the Advancement of Teaching for uniform financial reports for universities, colleges and technological schools throughout the country. These schedules comprise A, Summary of Income and Expense, showing the deficiency of income for the current year. This schedule is supported by A–1, giving classified details of the sources of income, and by A–2, a classified statement of the current expenses of the year. These schedules do not differ materially from the form in which the Treasurer's transactions of last year were exhibited, following the recommendations which we made at that time.

Schedule B is a Balance Sheet which exhibits the assets and the liabilities of the Institute at the close of the fiscal period. This balance sheet is separated into three parts: First, current assets and current liabilities, with the surplus of available assets; Second, investment assets and the endowments or funds liabilities, with the surplus of investments; Third, the educational plant assets taken at their book values, which, as we explained fully last year, are nominal amounts and do not represent the true values of the lands, buildings and

equipment of the Institute. Such true values cannot be set forth on the books until an appraisement of the properties is made. The offsetting account on the liability side represents the sum of bequests, gifts and endowments which have been invested in the educational plant by the corporation from time to time. As soon as practicable this total will be analyzed and the detailed funds from the beginning will be set up properly on the books and reported on the Balance Sheet. Schedule B is supported by subsidiary schedules C, D, E, etc., which set forth details of the corresponding items on the Balance Sheet.

It is evident from Schedule B that there was on September 30, 1909, a surplus of current assets over current liabilities amounting to $233,833.14. This surplus consists of investments which have been made during the past years out of gifts, bequests and legacies which have been presented to the Institute for general purposes and which could have been rightfully expended in those years for current expenses if the corporation had so determined. The corporation has acted conservatively in these matters, however, and considerable portions of these funds have been invested in securities or revenue-producing real estate and for that reason in spite of the deficiencies of revenue each year for a long series of years in the past, it now appears that there still remains this surplus of available assets from which similar deficiencies in the future may be met. It will be noted that a considerable part of this surplus consists of real estate with a book value of $176,917.32. (See balance sheet.) This surplus was disclosed only upon drawing off the Balance Sheet following the rearrangement of the methods and forms of accounting which has been going on during the past year under our supervision.

This rearrangement brought out the additional fact that there had been included in last year's (1907–08) statement of income some $6,875.00 of interest on securities which properly belonged in the following year (1908–09). This amount was included in the report of 1907–08 because the coupons had been clipped and entered to the credit of the Institute prior

to their due date, October 1st, whereas in previous years they had been entered as of October 1st, or later. This correction changed the revenue deficiency of last year from $23,131.91, as stated in last year's report, to $30,006.91, while the revenue deficiency of this year after making allowance for this correction appears as $29,819.51.

In accordance with the urgent request of The Carnegie Foundation, that all educational institutions establish a uniform closing date for their fiscal year, we suggest that the next fiscal period of the Institute be closed on June 30, 1910. The relatively quiet time during the summer vacation will then be available for closing the accounts and preparing the annual report each year. Complications concerning tuition fees in advance will also be eliminated.

The schedules which follow are blank in some instances for the reason that it has been found impracticable to complete the rearrangement of the Institute's accounting methods during the past year. The work will be concluded this year and all schedules of the "Uniform" system should be filled satisfactorily in the next report.

Very respectfully,

HARVEY S. CHASE & COMPANY,

Public Accountants and Auditors.

Schedule A.*

SUMMARY OF INCOME AND EXPENSE.

FOR THE YEAR ENDING SEPTEMBER 30, 1909.

Income for the year, Schedule A–1	$545,974.84
Expense for the year, Schedule A–2	575,794.35
Deficiency of Income	$29,819.51

Schedule A–1.

INCOME.

INCOME FROM STUDENTS.			
Tuition fees, for year 1908–9		$325,434.25	
Entrance examination fees forfeited		135.00	
Laboratory materials, supplies, etc.		13,549.66	
Sales of lecture notes, etc.		2,076.63	$341,195.54
INCOME FROM ENDOWMENTS.			
From funds for general purposes		$34,529.52	
From funds for special purposes		50,584.08	
From investments of gifts, etc., in excess of funds		5,154.20	
		$90,267.80	
Less income added to funds	$8,251.86		
Less annuity to Samuel Dorr	1,000.00		
Less accrued interest	1,057.47	10,309.33	79,958.47
GRANTS BY NATION AND STATE.			
Annual grant from State of Massachusetts		$25,000.00	
United States grant of 1890		13,336.33	
United States grant of 1862		5,306.68	
State of Massachusetts for scholarships		4,000.00	47,643.01
			$468,797.02
Carried forward			

*Arranged in accordance with the "Uniform" schedules recommended by the Carnegie Foundation for the Advancement of Teaching.

Brought forward		$468,797.02
GIFTS BY INDIVIDUALS FOR CURRENT EXPENSES.		
General Purposes.		
M. I .T. Alumni Fund		41,147.94
Designated Purposes.		
For Sanitary Research Fund	$8,000.00	
Physico-Chemical Research Fund	3,000.00	
Naval Architectural Fund	1,521.77	
Applied Chemistry	1,050.00	
Salaries	1,000.00	
Library	725.00	
Travelling Scholarship	500.00	
Geological Department	296.83	
Repair Department	87.50	
Architectural Department	20.00	16,201.10
INCOME FROM OTHER SOURCES.		
Interest and discount	$2,760.08	
Rents, per Schedule F	10,840.00	
Sales of Electricity	1,613.47	
Applied Chemistry earnings	1,216.40	
Refunds to Physico-Chemical Reseach Fund	1,220.00	
Refunds to Rogers Scholarship Fund	722.50	
Letter Box rents	37.00	18,409.45
INCOME. SOCIETY OF ARTS. Dues		1,419.33
Total Income		$545,974.84

Schedule A–2.

EXPENSE.

SALARIES OF TEACHERS.		
Professors	$120,505.06	
Associate professors	44,580.00	
Assistant professors	56,192.54	$221,277.60
Instructors	$70,036.59	
Lecturers	9,720.00	
Librarians	1,750.00	
Assistants	33,316.75	114,823.34
WAGES ACCESSORY TO TEACHING.		
Clerks	$7,230.38	
Stenographers	4,373.47	11,603.85
		$347,704.79
Carried forward		

Brought forward		$347,704.79
ADMINISTRATION AND GENERAL EXPENSES.		
Salaries of officers	$21,833.29	
Salaries of assistants, stenographers, etc.	9,563.06	
Printing and advertising	10,878.13	
Purchase of books, supplies, etc.	50,817.63	
General Expense	17,676.91	110,769.02
OPERATION AND MAINTENANCE OF PLANT.		
Fuel, Gas, and Electricity	$25,476.90	
Mechanicians' wages	6,729.59	
Laborers' wages	42,589.54	
General repairs	8,413.77	
Department repairs	3,634.38	
Repair wages	2,691.00	
Physico-Chemical Research repairs	268.61	
Lunch-room repairs	140.09	89,943.88
REAL ESTATE EXPENSE		1,436.53
LUNCH ROOM (Technology Union)	$32,342.68	
Less Income	30,762.73	1,579.95
PREMIUMS CHARGED OFF, General Investments	$3,059.00	
Rogers Memorial Investments	542.00	3,601.00
INSURANCE		2,645.68
INTEREST on Temporary Loans		349.58
EXPENDITURES OF SPECIAL DEPARTMENT FUNDS (other than salaries and wages).		
Sanitary Research Fund	$4,695.31	
Applied Chemistry	1,449.68	
Physico-Chemical Research Fund	1,710.35	
Roentgen Ray Experiment Fund	76.06	
Margaret Cheney Reading Room Fund	264.82	
Naval Architectural (Weld) Fund	1,609.58	
Samuel Cabot Medal Fund	1.30	
Letter Box Fund	18.00	
Travelling Scholarship in Architecture	250.00	
Architectural Prizes	200.00	
Income Teachers' Fund	1,000.00	
Sundry Scholarships	1,800.00	
Austin Fund Scholarships	4,972.12	
	$18,047.22	
Less amounts paid from previous accumulations of funds' income	2,812.83	15,234.39
SOCIETY OF ARTS. Expenses		2,529.53
Total Expenses		$575,794.35

Schedule B.

MASSACHUSETTS INSTITUTE
TREASURER'S BALANCE SHEET.

1.

CURRENT ASSETS.

Cash on hand and in banks, available for general purposes, per Schedule C	$48,422.71
Notes Receivable, per Schedule D	12,920.50
Accounts Receivable, per Schedule E	1,833.47
Rents Receivable, less reserve, per Schedule F	4,500.00
Interest and dividends accrued (not established this year)	
Physico-Chemical Research Fund (excess expenditure)	69.77
Excess of investment assets. (Contra, below)	292,275.75
Total available assets	$360,022.20

2.

INVESTMENT ASSETS.

Securities, per Schedule H	$1,972,673.72
Real Estate, per Schedule I	176,917.39
Funds deposited in Savings Banks	6,397.45
Total investments	$2,155,988.56
Cash: In bank, against minor funds	7,484.31
In bank, against funds' incomes	22,349.50
Total investment assets	$2,185,822.37

3.

EDUCATIONAL PLANT ASSETS.

Lands, Buildings and Equipment. Nominal Values.

Total book value at beginning of year, per Schedule J	$1,683,995.39
Additions during year, per Schedule K	10,625.94
Total book value at end of the year, per Schedule J	$1,694,621.33

WALKER MEMORIAL. ASSETS.

Securities, per Schedule II	$116,173.30
Cash in bank (reserved for investment)	4,623.67
Total assets	$120,796.97

Schedule B.

OF TECHNOLOGY.

SEPTEMBER 30, 1909.

1.

CURRENT LIABILITIES.

Accounts Payable, per Schedule N	$7,962.69
Tuition fees in advance for year 1909–10	97,063.00
Students' deposits in advance, breakage and supplies	10,530.75
Students' deposits unclaimed, breakage and supplies	1,031.13
Students' examination fees	4,380.00
Technology Union receipts in advance	130.74
Locker deposits outstanding	1,090.75
State of Massachusetts. Annual grant, in advance	4,000.00
Total current liabilities	$126,189.06
Surplus of available assets over current liabilities	*233,833.14*
	$360,022.20

2.

ENDOWMENT FUNDS.

Funds for general purposes, per Schedule P	$756,850.21
Funds for designated purposes, per Schedule Q	1,106,862.60
Total invested funds	$1,863,712.81
Minor cash funds, per Schedule R	7,484.31
Funds' income balances, per Schedule R	22,349.50
Excess of investment assets, derived from unconditioned gifts and bequests invested during past years. Transferred to current assets. (Contra, above)	292,275.75
	$2,185,822.37

3.

EDUCATIONAL PLANT ENDOWMENTS AND CAPITAL ACCOUNTS.

Endowment for Electrical Engineering Building	$68,000.00
Other endowments, funds and capital (not yet analyzed into specific items)	1,626,621.33
	$1,694,621.33

WALKER MEMORIAL FUND.

Balance at beginning of year	$116,388.40
Net income for year, added to fund	4,408.57
	$120,796.97

Schedule C.

CASH RECEIPTS AND DISBURSEMENTS

FOR THE YEAR.

Total Cash Receipts	$830,312.53
Total Cash Disbursements	830,287.29
Excess of Receipts	$25.24
Cash Balance at beginning of year	82,854.95
Cash Balance at end of year	$82,880.19

CASH BALANCE

AT END OF YEAR.

Cash on Deposit at banks:		
Old Colony Trust Company *	$70,772.27	
National Shawmut Bank, for general purposes,	1,382.97	$72,155.24
Cash at offices:		
For general purposes		10,724.95
Cash Balance, as above		$82,880.19

* For minor funds $7,484.31
For funds' incomes 22,349.50
For Walker Memorial Fund 4,623.67
For general purposes 36,314.79
$70,772.27

Schedule D.

NOTES RECEIVABLE.

Description of Notes and Security therefor, if any.	*Date of note.*	*Date when due.*	*Amount.*	*Rate of Interest.*
Advisory Council	5/28/08	5/28/09	$350.00	6%
Chapin mortgage (property in Nahant)	—	—	12,000.00	5%
Student's Note	10/2/93	—	125.00	6%
" "	10/1/94	—	125.00	"
" "	2/1/94	—	75.00	"
" "	2/1/95	—	75.00	"
" "	10/1/94	—	118.00	"
" "	10/2/93	—	52.50	"
Total			$12,920.50	

Schedule E.

ACCOUNTS RECEIVABLE.

For Tuition:		
7 Naval Officers for Summer School	$1,325.00	
4 Students	128.75	$1,453.75
Miscellaneous:		
Chemical Breakage, due from 97 students		379.72
		$1,833.47

Schedule F.

RENTS RECEIVABLE.

Arrears of Rents at beginning of year		$14,500.00
Rents due during year:		
Clarendon Street (Grundmann Studios)	$5,500.00	
Huntington Hall	3,500.00	
Cabot House	1,000.00	
Massachusetts Avenue property	840.00	10,840.00
Total		$25,340.00
Collections of Rents during year		10,840.00
Arrears of Rents at end of year		$14,500.00
Less: Reserve for doubtful accounts		10,000.00
		$4,500.00

Schedule G.

INTEREST AND DIVIDENDS ACCRUED ON SECURITIES.

Interest and Dividends accrued at beginning of year

Interest and Dividends earned during year

Total

Interest and Dividends received during year

Interest and Dividends accrued at end of year

(Not computed this year. Schedule is given in order to make a complete illustration of Carnegie Foundation's forms.)

Schedule H.

SECURITIES: BONDS, STOCKS, AND REAL ESTATE MORTGAGES.

INVESTMENTS, GENERAL.

Bonds.

$26,000.00	Am. Dock & Improvement Co. 5s	due	1921	$26,880.00	
105,000.00	American Tel. & Tel. Co. 4s	"	1929	104,700.00	
25,000.00	Atchison, Top. & St. Fé R.R. 4s	"	1995	25,000.00	
34,000.00	Baltimore & Ohio R.R. 3½s	"	1925	30,090.00	
4,000.00	Bur. & Mo. River (Neb.) R.R. 6s non-exempt	"	1918	4,000.00	
43,000.00	Chesapeake & Ohio R.R. 5s	"	1939	48,585.00	
38,000.00	Chicago, Burl. & Q. R.R. 4s	"	1958	38,096.00	
50,000.00	Chi. Junc. & Union S. Yds. 5s	"	1915	51,110.00	
50,000.00	Chi. Junc. & Union S. Yds. 4s	"	1940	49,250.00	
30,000.00	Chi., Mil. & St. Paul R.R. 7s	"	1910	30,227.00	
100,000.00	Chi. & W. Michigan R.R. 5s	"	1921	101,100.00	
17,000.00	Delaware & Hudson R.R. 4s Ref.,	"	1943	17,330.00	
3,000.00	Illinois Central R.R. 4s	"	1951	3,000.00	
120,000.00	Illinois Steel Co. non-conv. 5s	"	1913	119,586.25	
7,000.00	K. C., Clinton & Spgfld. R.R. 5s	"	1925	6,289.21	
50,000.00	K. C., Ft. Scott & Memphis R.R. 6s,	"	1928	56,426.00	
8,500.00	K. C., Mem. & Birmingham R.R. 4s,	"	1934	8,287.50	
50,000.00	Kansas City Stock Yards 5s	"	1910	50,000.00	
18,000.00	Kentucky Central Ry. Co. 4s	"	1987	17,910.00	
3,000.00	Lake Shore & Mich. Southern 4s	"	1928	3,000.00	
75,000.00	Lake Shore & Mich. Southern deb. 4s,	"	1931	75,000.00	
100,000.00	Long Island R.R. 4s	"	1949	96,137.50	
25,000.00	Mass. Elec. Co. notes 4½s	"	1910	24,500.00	
50,000.00	N. E. Tel. & Tel. Co. 4s	"	1930	50,420.00	
52,000.00	N. Y. C. & H. R. R.R. (L. S.) 3½s	"	1998	46,046.65	
36,000.00	N. Y. C. Equipment 5s	"	1919	34,740.00	
31,000.00	N. Y., N. H. & H. 6s	"	1948	35,484.00	
50,000.00	Northern Pac. Gt. Northern Joint 4s.	"	1921	48,500.00	
50,000.00	Oregon R.R. & Navigation Co. 4s	"	1946	51,080.00	
50,000.00	Oregon Short Line 4s	"	1929	48,500.00	
4,000.00	Ozark Equipment Co. 5s	"	1910	4,000.00	
50,000.00	Rio Grande & Western R.R. 4s	"	1939	49,180.00	
25,000.00	Southern Ry., St. Louis Div. 4s	"	1951	24,875.00	
5,000.00	Terminal Asso. St. Louis 4s	"	1953	5,000.00	
50,000.00	Union Pacific R.R. 4s	"	1947	51,554.00	
25,000.00	Wabash Equipment 4½s	"	1912	24,360.00	
19,000.00	Wabash Equipment 4½s	"	1916	18,259.00	
100,000.00	West End St. Ry. 4s	"	1917	101,470.00	$1,579,973.11

Stocks.

Shares.					
172	Boston & Albany R.R.	par	100	$34,456.50	
1	Boston Ground Rent Trust	"	1000	900.00	
64	Boston Real Estate Trust	"	1000	68,605.64	
80	Chi., Mil. & St. Paul R.R. Pf.	"	100	5,738.00	
2	Dwight Mfg. Co.	"	500	1,600.00	
27	Essex Company	"	50	3,780.00	
31	Great Falls Mfg. Co.	"	100	3,472.00	
56	Hamilton Woolen Co.	"	100	5,390.00	
17	Pepperell Mfg. Co.	"	100	2,789.50	126,731.64
	Carried forward				$1,706,704.75

	Brought forward				$1,706,704.75
INVESTMENTS W. B. ROGERS MEMORIAL FUND.					
			Bonds.		
$25,000.00	Atchison, Top. & St. Fé R.R. 4s . .	due	1995	$24,470.00	
6,000.00	Baltimore & Ohio R.R. 3½s	"	1925	5,310.00	
7,000.00	Chesapeake & Ohio R.R. 5s . . .	"	1939	7,911.00	
1,000.00	C., Burl. & Quincy 4% Gen'l Mtge.,	"	1958	1,000.00	
40,000.00	Chi. Junc. & Union S. Yds. 5s . . .	"	1915	41,292.00	
4,000.00	Cin., Ind., St. Louis & Chicago R.R. 6s	"	1920	4,000.00	
37,500.00	Detroit, G. Rapids & Western R.R. 4s,	"	1946	37,500.00	
35,000.00	Fort St. Union Depot 4½s	"	1941	34,825.00	
27,000.00	Kansas City Belt R.R. 6s	"	1916	27,750.00	
4,000.00	K. C., Ft. Scott & Gulf R.R. 5s . .	"	1911	4,000.00	
31,000.00	N. Y. C. & H. R. R.R. deb. 4s . . .	"	1934	30,225.00	
1,000.00	N. Y. Central Equipment 5s	"	1919	965.00	
3,200.00	Republican Valley R.R. 6s.	"	1919	3,200.00	
24,000.00	Rome, Watertown & Ogdensburg R.R. 5s	"	1922	25,560.00	
1,000.00	Wabash Equipment 4½s	"	1916	961.00	248,969.00
INVESTMENTS JOY SCHOLARSHIP FUND.					
Mass. Hospital Life Insurance Co.					5,000.00
Deposits in Savings Banks				$6,397.49	
INVESTMENTS SUSAN H. SWETT SCHOLARSHIP FUND.					
Mass. Hospital Life Insurance Co.					10,000.00
INVESTMENTS RICHARD LEE RUSSEL FELLOWSHIP FUND.					
$2,000.00	Conveyancers Title Ins. Co. Mort. 4½s . .		1913		2,000.00
	Totals, per balance sheet			$6,397.49	$1,972,673.75
INVESTMENTS WALKER MEMORIAL FUND.					
$30,000.00	Am. Tel. & Tel. Co. 4s	due	1929	$30,300.00	
10,000.00	Chicago, Burl. & Quincy R.R. 4s .	"	1958	10,000.00	
54,000.00	N. Y. C. & H. R. R.R. 3½s	"	1998	47,986.35	
14,000.00	Oregon Short Line 5s	"	1946	16,310.00	
5,000.00	St. Louis Iron Mt. 4s	"	1933	4,812.50	
7,000.00	Wabash Equipment 4½s	"	1916	6,764.45	$116,173.30

Schedule I.

INVESTMENTS IN REAL ESTATE OTHER THAN EDUCATIONAL PLANT.

Description of Properties.	*Balance at beginning of year. Cost.*	*Balance at end of year. Cost.*
Clarendon St. Land and building, Grundmann Studios	$142,762.94	$142,762.94
930–934 Mass. Ave., Cambridge, Land and buildings	16,154.38	16,154.38
Edge Hill Road (Cabot House), Land and buildings, (not listed last year)		18,000.00
	$158,917.32	$176,917.32

Schedule J.

LANDS, BUILDINGS AND EQUIPMENT.

EDUCATIONAL PLANT.*

Land and Buildings, Book Values.

Rogers Building	$200,000.00
Walker Building	150,000.00
Engineering Building A, Trinity Place	90,000.00
Engineering Building B, " "	57,857.10
Engineering Building C, " "	47,561.08
Henry L. Pierce Building " "	154,297.05
Boiler and Power House " "	26,916.74
Technology Union " "	19,460.36
Lot Number 1 " "	76,315.69
Lot Number 2 " "	137,241.60
Lot Number 3 " "	282,286.35
Electrical Eng. Building, Aug. Lowell, Clarendon St.	121,790.93
Mechanic Arts Building, Garrison St.	30,000.00
Land, Garrison St.	50,840.00
Gymnasium Building	12,624.07
Athletic Field, Brookline	112,964.32
	$1,570,155.29

Equipment, Book Values.

In Engineering Building	16,555.24
In Electrical Engineering Building	87,282.24
In Mechanical Laboratories	20,628.56
Total Educational Plant, Book Values	$1,694,621.33

* The values of land, buildings and equipment under this head are nominal values which have been carried on the books at these figures for many years. A complete appraisal of all these properties will soon be made, and amounts closely in accord with the actual costs, or with the appraised values, will then be entered in the books.

Schedule K.

ADDITIONS TO LANDS, BUILDINGS AND EQUIPMENT.

Additions to Lands	$ 0.00
Additions to Buildings, Technology Union	9,000.00
Additions to Equipment, Technology Union	1,625.94
Total during year	$10,625.94

Schedule L.*

DEPRECIATION ON LANDS, BUILDINGS AND EQUIPMENT.

Depreciation written off to beginning of year, viz.:		
On Buildings		$
On Equipment		
		$
Appreciation of lands (if any)		
Total (net) at beginning of year		$
Depreciation written off during year, viz.:		
On Buildings	$	
On Equipment		
Total	$	
Appreciation of Lands		
Net Depreciation written off		
Depreciation written off to end of year		$

Schedule M.*

NOTES PAYABLE.

	Amount.	
Notes Payable:		
Temporary loans issued	$55,000.00	
Temporary loans paid	55,000.00	
Total Notes Payable outstanding		$ 0 00
Interest accrued		0.00
Total Notes Payable and Interest accrued thereon		$ 0.00

Schedule N.

ACCOUNTS PAYABLE.

M. I. T. Alumni Association	$632.52
Jas. G. Biddle	580.35
Town of Brookline	554.40
Hand Bros.	320.02
Haskins Mfg. Co.	315.00
General Elec. Co.	280.00
Holt & Bugbee Co.	231.36
Walworth Mfg. Co.	216.28
American Bank Note Co.	184.50
T. J. Johnson & Co.	182.45
A. J. Wilkinson & Co.	162.45
George F. Swain	153.10
Stark Tool Co.	152.80
Lemcke & Buechner	149.15
Henry Heil Chemical Co.	144.10
N. E. Tel. & Tel. Co.	143.60
Robert A. Boit & Co.	140.00
Geo. H. Ellis Co.	128.89
J. F. Donlan	123.56
Salt Lake Hardware Co.	120.00
J. Bishop & Co.	108.86
Thompson Balance Co.	108.45
172 sundry bills	2,904.26
	$8,036.10
Sundry debit balances, deducted	73.41
Total per balance sheet	$7,962.69

* Included in order to illustrate Carnegie Foundation's "Uniform" schedules. Schedule O is omitted. This schedule provides for mortgage liabilities of which the Institute has none.

Schedule P.

ENDOWMENT FUNDS FOR GENERAL PURPOSES.

Increases and Decreases of Funds for General Purposes.

Invested Funds.	*Funds Sept. 30, 1908.*	*Income and other increases of funds.*	*Expenditure and other decreases of funds.*	*Funds Sept. 30, 1909.*
George Robert Armstrong	$5,000.00	$218.00	$218.00	$5,000.00
Sidney Bartlett	10,000.00	436.00	436.00	10,000.00
Stanton Blake	5,000.00	218.00	218.00	5,000.00
Charles Choate	25,000.00	1,090.00	1,090.00	25,000.00
George B. Dorr	49,573.47	2,161.40	2,161.40	49,573.47
Martha Ann Edwards	30,000.00	1,308.00	1,308.00	30,000.00
James Fund	163,654.21	7,135.32	7,135.32	163,654.21
Katharine B. Lowell	5,000.00	218.00	218.00	5,000.00
Arthur T. Lyman	5,000.00	218.00	218.00	5,000.00
James McGregor	2,500.00	109.00	109.00	2,500.00
Nathaniel C. Nash	10,000.00	436.00	436.00	10,000.00
Richard Perkins	50,000.00	2,180.00	2,180.00	50,000.00
John W. and Belinda L. Randall	83,452.36	3,638.52	3,638.52	83,452.36
Robert E. Rogers	7,680.77	334.88	334.88	7,680.77
William Barton Rogers	250,225.00	9,665.56	9,665.56	250,225.00
Samuel E. Sawyer	4,764.40	207.72	207.72	4,764.40
Nathaniel Thayer	25,000.00	1,090.00	1,090.00	25,000.00
Albion K. P. Welch	5,000.00	218.00	218.00	5,000.00
Charles G. Weld	15,000.00	654.00	654.00	15,000.00
Alexander S. Wheeler	5,000.00	218.00	218.00	5,000.00
Income credited in 1907–08 belonging to 1908–09	—	2,775.12	2,775.12	
Totals	$756,850.21	$34,529.52	$34,529.52	$756,850.21

Schedule Q.

ENDOWMENT FUNDS FOR DESIGNATED PURPOSES.

Increases and Decreases of Funds for Designated Purposes.

Invested Funds.	*Funds Sept. 30, 1908.*	*Income and other increases of funds.*	*Expenditure and other decreases of funds.*	*Funds Sept. 30, 1909.*
FUNDS FOR SALARIES.				
Sarah H. Forbes For General Salaries	$500.00	$21.80	$21.80	$500.00
George A. Gardner For General Salaries	20,000.00	872.00	872.00	20,000.00
James Hayward Professorship of Engineering	18,800.00	819.68	819.68	18,800.00
Wm. P. Mason Professorship of Geology	18,800.00	819.68	819.68	18,800.00
Henry B. Rogers General Salaries	25,000.00	1,090.00	1,090.00	25,000.00
Nathaniel Thayer Professorship of Physics	25,000.00	1,090.00	1,090.00	25,000.00
	$108,100.00	$4,713.16	$4,713.16	$108,100.00

Schedule Q, *Continued.*

FUNDS FOR SCHOLARSHIPS.				
Elisha Atkins	$5,000.00	$218.00	$200.00	$5,018.00
Billings Student Fund	50,000.00	2,180.00	2,000.00	50,180.00
Lucius Clapp	5,511.83	218.00	0.00	5,729.83
Dalton Graduate Chemical	5,419.37	218.00	500.00	5,137.37
Isaac W. Danforth	5,666.26	218.00	200.00	5,018.25
Ann White Dickinson	40,841.64	1,769.92	1,600.00	41,011.56
Farnsworth Scholarship	5,000.00	218.00	200.00	5,018.00
Charles Lewis Flint	5,347.51	218.00	200.00	5,365.51
T. Sterry Hunt	3,257.00	130.80	125.00	3,262.80
William F. Huntington	5,285.10	218.00	200.00	5,303.10
Joy Scholarship	11,570.47	445.77	400.00	11,616.24
Elisha Thatcher Loring	5,450.79	218.00	200.00	5,468.79
James H. Mirrlees	2,915.40	109.00	100.00	2,924.40
Nichols Scholarship	5,000.00	218.00	200.00	5,018.00
Charles C. Nichols	5,441.29	218.00	200.00	5,459.29
John Felt Osgood	0.00	5,109.00	0.00	5,109.00
Richard Perkins	53,471.43	2,256.94	2,100.00	53,628.37
Willard B. Perkins	6,583.25	287.03	0.00	6,870.28
William Barton Rogers	11,577.32	1,227.27	1,555.00	11,249.59
Richard Lee Russel	2,339.97	87.20	0.00	2,427.17
Henry Saltonstall	9,600.00	836.00	400.00	10,036.00
James Savage	14,617.61	436.00	500.00	14,553.61
Thomas Sherwin	5,050.00	218.00	200.00	5,068.00
Susan H. Swett	10,595.45	425.00	400.00	10,620.45
Susan Upham	1,312.68	43.60	50.00	1,306.28
Ann White Vose	60,984.61	2,629.66	2,400.00	61,214.27
	$337,838.98	$20,371.19	$13,930.00	$344,280.17
Less gifts, transfers, &c. incl'd above		6,122.50		
Income for year for Scholarships		$14,248.69		
FUNDS FOR LIBRARIES AND READING ROOM.				
Charles Lewis Flint	$5,000.00	$218.00	$218.00	$5,000.00
Wm. Hall Kerr	2,000.00	87.20	87.20	2,000.00
Arthur Rotch Architectural Library	5,000.00	218.00	218.00	5,000.00
Ednah Dow Cheney for Margaret Cheney Reading Room,	14,226.79	610.40	544.82	14,292.37
	$26,226.79	$1,133.60	$1,068.02	$26,292.37
FUNDS FOR PRIZES.				
Arthur Rotch Prize Fund in Architecture	$5,200.00	$218.00	$200.00	$5,218.00
Arthur Rotch "Special" Prize Fund in Architecture	5,200.00	218.00	0.00	5,418.00
	$10,400.00	$436.00	$200.00	$10,636.00
OTHER FUNDS.				
Edward Austin Fund	$360,000.00	$15,696.00	$15,696.00	$360,000.00
Edward Austin Income Reserve,	12,880.00	1,569.60	0.00	14,449.60
Bursar's Fund	6,000.00	494.73	325.00	6,169.73
Susan E. Dorr	19,288.48	1,840.98	840.98	20,288.48
Improvement Fund	0.00	10,700.00	0.00	10,700.00
Charlotte Billings Richardson (Industrial Chemistry)	37,378.78	1,629.71	1,629.71	37,378.78
Arthur Rotch Architectural Fund	25,000.00	1,090.00	1,090.00	25,000.00
The Saltonstall Fund	43,097.71	1,879.06	1,409.30	43,567.47
Teachers' Fund	100,000.00	4,360.00	4,360.00	100,000.00
	$603,644.97	$39,260.08	$25,350.99	$617,554.06
Less gifts, transfers, etc.		13,269.60	21,056.00	
Income for year for "other funds"		$25,990.48	$4,294.99	

Schedule Q, *Concluded.*

Recapitulation of Funds.

	At Beginning.	*Income.*	*Outgo.*	*At End.*
SPECIAL FUNDS.				
Funds for Salaries	$108,100.00	$4,713.16	$4,713.16	$108,100.00
Funds for Scholarships	337,838.98	14,248.69	13,930.00	344,280.17
Funds for Libraries and Reading Room	26,226.79	1,133.60	1,068.02	26,292.37
Funds for Prizes	10,400.00	436.00	200.00	10,636.00
Other Funds	603,644.97	25,990.48	4,294.99	617,554.06
Income credited in 1907–08 belonging to 1908–09		4,099.88	4,099.88	
Income from General Investments not credited to Funds		5,116.47	5,116.47	
Total Special Funds	$1,086,210.74			$1,106,862.60
GENERAL FUNDS.				
Per Schedule P	756,850.21	34,529.52	34,529.52	756,850.21
TOTAL INCOME per Schedule A-1		$90,267.80	$67,952.04	
TOTAL CAPITAL increases and decreases		19,392.10	21,056.00	
GRAND TOTALS	$1,843,060.95	$109,659.90	$89,008.04	$1,863,712.81

Schedule R.

INCREASES AND DECREASES OF MINOR CASH FUNDS.

	Funds Sept. 30, 1908.	*Income and other increases of funds.*	*Expenditure and other decreases of funds.*	*Funds Sept. 30, 1909.*
MINOR CASH FUNDS.				
Applied Chemistry	$0.00	$3,269.65	$3,202.93	$66.72
Samuel Cabot Medal Fund	100.92	0.00	1.30	99.62
Dormitory Fund	1,868.96	0.00	0.00	1,868.96
Letter Box Fund	61.25	37.00	93.00	5.25
M. I. T. Alumni Fund	3,811.41	41,147.94	41,147.94	3,811.41
Naval Architectural Fund (Weld),	87.81	1,521.77	1,609.58	0.00
Roentgen Ray Experiment Fund,	956.50	0.00	76.06	880.44
Sanitary Research Fund	705.22	8,000.00	8,703.31	1.91
Travelling Scholarship in Architecture	0.00	1,000.00	250.00	750.00
	$7,592.07	$54,976.36	$55,084.12	$7,484.31
Physico-Chemical Research Fund	*225.42	7,988.61	7,832.96	*69.77
	$7,366.65	$62,964.97	$62,917.08	$ 7,414.54

* Debit balance.

FUNDS' INCOME.				
Cash Accumulations:				
Edward Austin Fund Income,	$7,890.22	$14,126.40	$16,047.12	$5,969 50
Teachers' Fund Income	13,020.00	4,360.00	1,000.00	16,380.00
	$20,910.22	$18,486.40	$17,047.12	$22,349.50

REPORT OF AUDITING COMMITTEE.

BOSTON, Dec. 6, 1909.

To the Corporation of the
Massachusetts Institute of Technology:—

Your auditing committee report that Messrs. Harvey S. Chase & Company, public accountants, employed by this committee, have examined the accounts of the Treasurer of the MASSACHUSETTS INSTITUTE OF TECHNOLOGY for the year ended September 30, 1909, and have verified the cash at office and in banks, and their certificate is hereto annexed.

We have verified the list of securities held by the Institute.

CHARLES C. JACKSON,
JAMES P. TOLMAN,
WILLIAM L. PUTNAM,
} *Auditing Committee.*

AUDITORS' CERTIFICATE.

84 STATE STREET, BOSTON, Dec. 6, 1909.

To the Auditing Committee of the
Massachusetts Institute of Technology:—

We hereby certify that we have examined the books and have audited the accounts of the treasurer and of the bursar of the Massachusetts Institute of Technology for the fiscal year ended September 30, 1909. We have established the assets and liabilities of the Institute as set forth on the balance sheet included in our report to the treasurer, and have brought the ledger accounts into agreement therewith. We have found the books in excellent condition, and they have been accurately kept during the year. We have verified the vouchers for disbursements, have satisfied ourselves that all receipts of money had been acknowledged on the books and deposited in the banks, that the cash balances of the books on September 30, 1909, were actually available, and that these balances were correct. We have verified the details of the bookkeeping during the year, have rearranged the methods of accounting in various respects and have prepared the report of the treasurer upon schedules submitted herewith.

Very respectfully,

HARVEY S. CHASE & COMPANY,
Public Accountants and Auditors.