ANNUAL REPORT

OF THE

PRESIDENT AND TREASURER

OF THE

MASSACHUSETTS

INSTITUTE OF TECHNOLOGY,

DEC. 11, 1889.

BOSTON:
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24 FRANKLIN STREET.
1890.

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To the Corporation of the Massachusetts Institute of Technology:

The present situation of the Institute of Technology is one which awakens in the minds of its friends mingled feelings of rejoicing and of apprehension. On the one hand, we have passed through another year of the highest prosperity, as regards the current work of the school. There has been a great gain in attendance, even over the large numbers of previous years, so that we have now nine hundred scholars, fully told. Those who have thus come to us from all parts of the country, and even from foreign lands, have been found better prepared than ever before to take up their work here with success. The instructing staff has been strengthened; a new building of the highest type has been erected, giving us engineering laboratories of extraordinary extent and completeness; and additional apparatus and machinery have been supplied, in the last twelve months, to an extent which might serve as the total equipment of many a school of applied science. The courses have been broadened, while opportunities for selection of studies and for a higher specialization of technical work have been afforded in greater measure. The spirit of the school has risen, alike among pupils and teachers; the sphere of its influence has widened; the prestige of its diploma is markedly increasing from year to year. So that it may safely be said that never did the Institute of Technology so fully justify its foundation and all the disinterested efforts which have been put forth for its maintenance and enlargement, as to-day; nor were its means of usefulness ever so great.

On the other hand, it is a source of deep regret, and, as I said, of grave apprehension, that the school, at the end of twenty-four years, is still, after all that has most generously been contributed towards its immediate needs by its many friends, virtually unendowed; and is thus without the resources which are needed to secure it from the occurrence of evil fortune directed against itself, or from the effects of financial disaster in the community which it was specially intended to serve. Of the $203,500 which was absorbed during the past year by the current expenses of the school, not less than $158,000, or seventy-eight per cent, was provided by the fees of students; while but little more than $25,000 was derived from the income of invested funds. Such a dependence of a college of the first rank upon tuition fees is altogether unknown among the educational institutions of the United States, and is itself a source of acute danger. A school that is doing the work which the Institute of Technology is carrying forward, amid general approval and with increasing success, ought not to be left in such a questionable and even perilous position. Many institutions, with only one half or one third our number of students, have twice or thrice the amount of our permanent funds.

Had we remained a small school, as we were ten years ago, we should now be moderately well endowed. The great, I might say the overwhelming, increase in attendance upon our courses has not been of our own seeking. It has come as the proper result of the wisdom of the founders of the Institute, and of the energy and self-sacrifice with which its work has been carried on from humble beginnings. The vast majority of those who have resorted to our halls and laboratories have come to us because they thought to find here something which they could not look for elsewhere. In most cases they would not have gone to institutions of a different character had we denied them admission. The needs of the Institute have become so

great, because it was itself so much needed. The very success with which it has fulfilled its part in the educational system of the country has been the cause of its own urgent necessities. Our problem now is to make good what has been so well done; to secure in permanence what we have so fortunately gained. The Institute of Technology needs two millions of dollars to place it on an assured foundation; and it would even then be less fully endowed, relatively to its work and to its needs, than are most of the colleges of the country.

But it is not alone for the permanent endowment of the Institute that additional funds are immediately required. The current expenses of the school are now only met by economies which prevent the proper expansion of its activity over the whole field of its possible usefulness. The salaries we pay our professors and other members of the corps of instruction are cruelly inadequate to the service they render. From lack of means we have to deny ourselves many opportunities for undertaking work which is greatly needed by the community. In the department of Industrial Chemistry alone we ought to be able to expend ten thousand dollars a year more than we now have for that purpose; and could we do so, the return to the people of Massachusetts and New England in the enhanced productiveness of their industries, within a few years, could not fail to be an hundred-fold. In many other departments we are only awaiting assurance of pecuniary support, to undertake work of instruction and of research which would be of great advantage to the Commonwealth and the country.

Doubtless our poverty was, for a while, a good thing, just as straitness of means is generally fortunate for a young man; but the full time has come when the Institute of Technology, having now an honorable history, a distinct constituency, a settled purpose, a well-outlined field of work, a Corporation sympathetic with that purpose and

mission, a Faculty able, devoted, and thoroughly organized to make use of all the means that may be placed at their disposal, may rightfully appeal to the friends of scientific education, and even more emphatically to all who are interested in the industrial development of the country, to give money without grudging, without stinting, and without fear, to enable this school at once to do its whole work in the largest, boldest, strongest manner possible.

THE NEW ENGINEERING BUILDING.

Six years ago, the painfully crowded condition of the Rogers Building led the Corporation of the Institute, even though the financial means for the purpose were not at the time forthcoming, to undertake the construction of the building which stands on the corner of Clarendon and Boylston Streets, since then known as the New Building. The large expense attendant on its erection and equipment, amounting to more than $200,000, was unhesitatingly incurred by the Corporation, in the belief that the same causes which were bringing students to our doors in such rapidly increasing numbers, could not fail to furnish, sooner or later, the resources necessary to provide for their instruction. Probably the Corporation would not have been so confident in this matter, had the Institute had its seat in another place. But the splendid record of Boston's munificence and the frequent experience of the generosity of the special friends of the Institute inspired the Corporation with the courage required for making so large a draft upon the future.

The debts of 1883 are now all discharged, thanks to the bounty of our fellow-citizens and to the Legislature of the Commonwealth. But the problem of that time has again recurred, in crowded halls and laboratories; and, since May of last year, the Executive Committee have been busily concerned with the question what should be done,

not only to provide accommodation for the students actually at our doors, but also to make room for further growth.

By authority of the Corporation, the Executive Committee, in May and June of 1888, purchased 19,240 square feet of land on Trinity Place, opposite the extension of the Museum of Fine Arts, at a cost of $76,315.69; and here, in May of the present year, the erection of a new building was begun.

The question, what kind of a structure should be undertaken, was made, of course, largely to depend on the prior question, what departments of the school should be in view in drawing the plans. Regarding this there could not long be doubt. The department of Mechanical Engineering had, owing to its remarkable growth, alike in the number of students and in the apparatus and machinery required for instruction, become greatly crowded, even before the increase of last year. The prospect of a still further addition to the body of students taking this course, together with the desire of Prof. Lanza to add largely to his equipment, pointed out this as eminently the department to be provided for in the new structure. In the basement of the Rogers Building it could never grow beyond its present limits; and, no matter what departments might move out of the rooms on the floors above, the space thus to be cleared could not answer the special purposes of the mechanical engineering laboratories. Moreover, the Rogers Building was not constructed with reference to the use of heavy machinery or to the employment of power; and great inconvenience has been occasioned, in the past, by the jarring and shaking of its floors and walls. It was therefore the first point settled, in the deliberations over the proposed building, that the Mechanical Engineering department should go there.

This having been determined upon, it seemed most fit that the Civil Engineering department should go to that

building, also, as having much in common with the department of Mechanical Engineering.

The building, as contemplated in the plans drawn within the Institute, and as now virtually completed, at a cost of about $110,000, including equipment and new apparatus, occupies an area upon the ground of 52 feet by 148 feet, and contains six stories, apportioned as follows: —

The two lower floors are entirely devoted to the engineering laboratories; the next two above are allotted to drawing rooms and recitation rooms for the Mechanical Engineering department; while the two upper floors are mainly devoted to drawing rooms and recitation rooms for the Civil Engineering department.

The building was designed with special reference to the uses to which it is to be devoted. It is, in its general plan, an example of what may be called modern mill architecture, although, in order to fulfil the requirements of the laboratories, the foundations, and also the beams, columns, and walls of the lower stories, have been made of extraordinary strength, far beyond the requirements of a factory. The steam used for heating, and also that used for power, is obtained from the boilers in the basement of the Rogers Building, whence it is brought, through a six-inch pipe, laid under the street, a distance of about one thousand feet.

The heating system, which was designed by Mr. Woodbridge, our instructor in heating and ventilation, is partly indirect and partly direct, the ventilation being produced by a Sturtevant blower, acting in connection with the indirect portion of the heating system.

It will be noticed that the laboratories have been spoken of as the engineering laboratories, instead of being called, as formerly, the laboratories of applied mechanics and of mechanical engineering. This change of name is merely a consequence of the natural development of all the engineering departments of the school, as will be made plain by the following considerations: —

First. The subjects of mechanism, thermo-dynamics, and steam engineering, which were formerly regarded as exclusively mechanical engineering studies, now form an essential part of the courses of mechanical engineering, electrical engineering, chemical engineering, and of two of the options of mining engineering; while mechanism has also been introduced into the course of civil engineering. These subjects may, therefore, be said to be general engineering subjects.

Second. The work in hydraulics and hydraulic motors, formerly given to the mechanical engineering students by instructors in their own department, is now to be conducted by Prof. Porter, of the Civil Engineering department, this being a step in the line of the modern idea of specialization, causing all work upon any one subject to be given by one and the same instructor to all students, whatever their course.

Third. These laboratories are really an aggregation of the following, viz.: —

(*a.*) A laboratory for testing the strength of materials.

(*b.*) A steam laboratory.

(*c.*) An hydraulic laboratory.

(*d.*) A laboratory for a great variety of engineering tests and experiments, not yet sufficiently differentiated to be characterized and classified.

Next, as to the general arrangement of the laboratories, and the additional facilities and apparatus provided.

The floor space of the laboratories has been increased from 5,550 square feet, as in the Rogers Building, to about 13,900 square feet, thus rendering it possible to carry on the work with the 190 students, who are to be accommodated in these laboratories during the second term of the present school year, and also providing for a certain amount of future growth.

By way of new apparatus the most important addition is that of a 150-horse-power triple-expansion engine, of the Reynolds-Corliss type, with cylinders 9 inches, 16 inches, and 24 inches, by 30-inch stroke, built specially for the Institute by Messrs. E. P. Allis & Co., of Milwaukee, Wis. It is so constructed that it can be run either single, compound, or triple, and with every possible variety of combinations of the cylinders.

The fact that this is the first triple-expansion engine of a practical size that has ever been arranged for experimental purposes, will enable this laboratory to take a leading position in experimental investigations in steam engineering, and to perform such work for the triple-expansion engine as was done in 1874 by the United States naval engineers for the compound engine, and also to extend to the triple engine the line of research followed out by Hirn, Hallauer, and others, with simple engines.

The next most important addition is that of an hydraulic tank, 5 feet in diameter and 27 feet high, and a stand-pipe 10 inches in diameter and about 85 feet high, which renders possible the development of a large amount of experimental work upon the flow of water through orifices and mouth-pieces and in pipes. Besides these, there are added some other pieces of apparatus, among which may be mentioned a complete set of Westinghouse air-brake apparatus, and a machine for testing the effect of repeated bending upon the elasticity of iron and steel.

Of the drawing room floors the lowest contains a drawing room for the second-year class in mechanical engineering, extending from the front of the building a distance of ninety-six feet towards the rear, while the next floor above contains an equally large drawing room for the third and fourth years' classes in mechanical engineering. The drawing room floor space is thus 9,600 square feet, as against 7,170 square feet, as in the Rogers Building. The remaining portions of these floors are occupied by five

recitation rooms, the largest of which will accommodate sixty students.

The two upper floors are, as has been said, mainly devoted to drawing rooms and recitation rooms for the Civil Engineering department ; on the lower of these two floors, however, a room, 40 feet by 24 feet, is set apart to contain the engineering library and reading room, which will be formed by combining the libraries of mechanical and of civil engineering, comprising together about 1,600 volumes. The engineering library will be in regular receipt of a very large number of engineering journals and periodicals from many countries.

THE GRADUATING CLASS.

The last school year closed fortunately. The class of 1889 graduated on the 28th of May. Of the eighty students of the fourth year, who were candidates for the degree of Bachelor of Science, seventy-five were admitted to that grade by your authority, upon the recommendation of the Faculty.

THE NEW YEAR.

The opening of the academic year 1889–90 witnessed a still further addition to our lists. The number of students in the School of Industrial Science, as by the Catalogue recently issued, is 909, against 827 reported last year, an increase of 82.

The following table exhibits the number of students in the School of Industrial Science each year, from the opening of the Institute to the present time :—

Year.	No. of Students.
1865–66	72
1866–67	137
1867–68	167
1868–69	172
1869–70	206
1870–71	224
1871–72	261
1872–73	348
1873–74	276
1874–75	248
1875–76	255
1876–77	215
1877–78	194
1878–79	188
1879–80	203
1880–81	253
1881–82	302
1882–83	368
1883–84	443
1884–85	579
1885–86	609
1886–87	637
1887–88	720
1888–89	827
1889–90	909

STUDENTS BY CLASSES.

The aggregate number of students for 1889–90 is divided among the several classes as follows: —

Graduate students, candidates for advanced degrees	3
Regular students, Fourth Year	110
" " Third Year	130
" " Second Year	148
" " First Year	261
Special students	257
Total	909

Assigning the special students to classes according to the predominant studies pursued by them, we reach the following statement of the division of the whole body among the several years: —

Class.	Regular.	Special.	Total.
Graduates of the M. I. T.	3	5	8
Fourth Year	110	25	135
Third Year	130	38	168
Second Year	148	129	277
First Year	261	60	321
	652	257	909

STATISTICS OF EXAMINATIONS.

Of the 909 students of the present year, 352 were not connected with the school in 1888–89.

Twelve had been connected with the Institute at some previous time, and returned to resume their places in the school; 17 were admitted provisionally, without examination; 50 were admitted on the presentation of diplomas from other institutions.

Excluding from consideration those who were admitted but have not, in fact, entered the school, the following was the result of the examinations held: —

Admitted clear		189
" on one condition	44	
" " two conditions	25	
" " three "	11	
" " more than three conditions	4	
	—	84
Rejected		60
		333

EXAMINATIONS AT DISTANT POINTS.

In addition to the entrance examinations held in Boston in June and September, 1888, examinations were also conducted, in June, at Chicago, Cincinnati, Kansas City, New York, Philadelphia, Pittsburg, San Francisco, St. Louis, St. Paul, and Washington.

Thirty-five States of the Union, besides the District of Columbia, are represented on our lists of students; of the total number of 909, including special students, 533 are from Massachusetts, or 58.6 per cent of the whole; 114 are from other New England States; 262 from outside New England, of whom 22 are from foreign countries.

The following table shows the number of students of each specified class for each State or foreign country: —

State.	Candidates for Advanced Degrees.	Fourth Year.	Third Year.	Second Year.	First Year.	All Regular Students.	Special Students.	Total.
Alabama							1	1
Arkansas				2		2		2
California		2		3	1	6	4	10
Colorado				2	1	3	3	6
Connecticut		3	9	4	10	26	10	36
Dist. Columbia			1	1		2	7	9
Florida			1		1	2		2
Georgia				1		1		1
Illinois		4	7	8	8	27	6	33
Indiana			1			1	2	3
Iowa		1		1	1	3	1	4
Kentucky		2		1	1	4		4
Louisiana				1	2	3	1	4
Maine		1	4	3	11	19	11	30
Maryland		1		1	1	3	1	4
Massachusetts.	2	66	73	84	160	385	148	533
Michigan			3	2	3	8	5	13
Minnesota		2		3	3	8	2	10
Missouri				1	2	3	5	8
Nebraska		1				1		1
N. Hampshire.		5	3	4	4	16	5	21
New Jersey		2		2	6	10	3	13
New York		2	8	2	6	18	7	25
No. Carolina				1		1	1	2
Ohio		5	3	3	12	23	12	35
Oregon			1		1	2		2
Pennsylvania	1	1	2	2	8	14	9	23
Rhode Island		6	3	3	7	19	3	22
So. Carolina		1				1		1
South Dakota		1				1		1
Tennessee			1	2		3	2	5
Vermont			1			1	3	4
Virginia				1	2	5	1	6
Washington			1	1		2		2
West Virginia					1	1	1	2
Wisconsin		2	2	3	2	9	1	9
Foreign Countries.								
Brazil				1		1	1	2
Bulgaria				1		1		1
Colombia					1	1		1
France					1	1		1
Guatemala				1		1		1
Hawaian Isl'ds				1		1		1
Ireland			1			1		1
Japan					1	1		1
Mexico					1	1		1
N. Brunswick				1		1		1
Nova Scotia					2	2		2
Peru							1	1
Porto Rico			1		1	2		2
Prov. Ontario		1				1		1
Prov. Quebec			1			1		1
Scotland				1		1		1
Trinidad							1	1
Turkey			1	1		2		2
	3	110	130	148	261	652	257	909

RESIDENCE OF MASSACHUSETTS STUDENTS.

It has been said that 58.6 per cent of our students are from Massachusetts. All the counties of the State, except the small counties of Dukes and Nantucket, send students to the Institute. Ninety-seven cities and towns are reported on the lists. The first column of the following table shows the number of cities and towns in each county sending pupils to the Institute; the second column gives the aggregate number from each county. It appears that

Suffolk sends us 197 pupils; Middlesex comes next, with 160; Essex third, with 50; Norfolk fourth, with 43.

County.	No. of Towns.	No. of Students.	County.	No. of Towns.	No. of Students.
Barnstable . .	2	4	Hampden . .	4	11
Berkshire . . .	2	2	Middlesex . .	28	160
Bristol	6	22	Norfolk . . .	16	43
Essex	14	50	Plymouth . .	10	20
Franklin . . .	1	2	Suffolk . . .	3	197
Hampshire . .	1	2	Worcester . .	10	20
	26	82	Total . . .	97	533

The following is a list of the towns, twenty-five in number, which send four or more scholars to the Institute: —

Boston 180	Lynn 9	Melrose . . . 6
Newton . . . 33	Salem 8	New Bedford . . 5
Cambridge . . . 24	Taunton . . . 8	Belmont . . . 4
Chelsea 16	Waltham . . . 8	Dedham . . . 4
Brookline . . . 14	Fall River . . . 7	Gloucester . . . 4
Lowell 13	Fitchburg . . . 7	Holyoke . . . 4
Newburyport . . 11	Framingham . . 6	Medford . . . 4
Somerville . . . 11	Lawrence . . . 6	Winchester . . 4
Malden 10		

PROPORTION OF OLD AND OF NEW STUDENTS.

The following table exhibits, for each year since 1882, the distribution of the total number of students among two classes: first, those students whose names are found upon the Catalogue of the year preceding; and secondly, those students whose names appear as new names upon the Catalogue of the year to which the statement relates: —

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.
1882–83	368	173	195	114	81
1883–84	443	231	212	140	72
1884–85	579	311	268	186	82
1885–86	609	369	240	177	63
1886–87	637	379	258	190	68
1887–88	720	396	324	229	95
1888–89	827	465	362	245	117
1889–90	909	557	352	255*	97

It appears from the foregoing that the number of students remaining over has been increased by 92, while the number registered for the first time is smaller by 10, making the net gain, as previously stated, 82.

AGES OF STUDENTS ON ENTRANCE.

The next table exhibits the ages of our students upon entrance. The regular students of the first-year class number 261. From these we should except 6 cases of students of unusual ages. These deductions leave 256 as the number of students whose ages have been made the subject of computation.

The results appear in the following table, in comparison with the corresponding results for 1888–89: —

* In addition, 6 students are repeating the first year.

Period of Life.	1888-89		1889-90.	
	Half-Year Groups.	Yearly Groups.	Half-Year Groups.	Yearly Groups.
16 to 16½ years	3	..	1	..
16½ to 17 years	10	13	9	10
17 to 17½ years	23	..	26	..
17½ to 18 years	43	66	49	75
18 to 18½ years	53	..	58	..
18½ to 19 years	39	92	43	101
19 to 19½ years	25	..	30	..
19½ to 20 years	19	44	10	40
20 to 20½ years	16	..	12	..
20½ to 21 years	6	22	10	22
21 to 22 years	9	9	7	7
	246	246	255	255

From the foregoing tables it appears that the average age of the 255 students taken for this comparison, the present year, is 222.4 months, or 18 years 6 months and 12 days. This compares with the corresponding figures relating to previous entering classes as follows: —

	Av. Age in Months.
Class of 1889	218.53
Class of 1890	219.91
Class of 1891	221.55
Class of 1892	223.50
Class of 1893	222.40

In this connection it may be interesting to note the ages at graduation of the class leaving us in May. The 75 members of the class were distributed among the several periods of life, as follows: —

Under 20	2	Between 22 and 23	19
Between 20 and 20½	5	" 23 and 24	6
" 20½ and 21	12	" 24 and over	8
" 21 and 21½	12		—
" 21½ and 22	11		75

PROPORTION OF REGULAR AND OF SPECIAL STUDENTS.

The following table exhibits both the absolute number of regular and of special students, as by the Catalogue of each successive year since 1882, and the proportion existing between these two classes: —

Year.	No. of Regular Students.	No. of Special Students.	Total No. of Students.	Percentage.	
				Regular.	Special.
				Per cent.	Per cent.
1882–83	219	149	368	60	40
1883–84	272	171	443	61	39
1884–85	368	211	579	64	36
1885–86	415	194	609	68	32
1886–87	442	195	637	69	31
1887–88	520	200	720	72	28
1888–89	590	237	827	71	29
1889–90	652	257	909	72	28

WOMEN AS STUDENTS IN THE INSTITUTE.

The number of women pursuing courses with us last year was 33; this year it is the same. Of this number, 7 are graduates of colleges. Of the total number, 5 are regular students of the fourth year; 2 of the third year; 3 of the second year; 23 are special students. Of the 10 regular students of the upper classes, 1 takes Course IV., architecture; 4 Course V., chemistry; 4 Course VII., natural history; 1 Course IX., the general course. Of the special students, 9 devote themselves chiefly to chemistry and physics; 9 chiefly to biology and allied subjects; 4 to mathematics; and 1 to architecture.

GRADUATES OF OTHER COLLEGES.

Fifty graduates of institutions conferring degrees are included in our list of students for the present year. Of these, 8 are our own graduates, of whom 3 are pursuing studies as candidates for advanced degrees. Forty-three

* Including one who is also a graduate of the Institute of Technology.

are graduates of other institutions, pursuing courses of study with us, either as regular or as special students. Of these, 10 are graduates of Harvard University, 5 each of Brown University and Yale University, 4 of Boston University, 3 of Amherst College, while one comes from each of the following institutions: University of Minnesota, Oregon State University, Oberlin College, Hobart, Bowdoin, Rutgers, Boston College, Swarthmore, Pennsylvania State College, Bryn Mawr, United States Military Academy, Holy Cross College, Trinity, Robert College, Georgetown College, and Vassar.

Of the 47, not candidates for advanced degrees here, 8 are regular students of the fourth year, — 2 in civil engineering, 3 in mechanical engineering, 1 in architecture, and 2 in electrical engineering; 7 are regular students in the third year, — 3 in civil engineering, 3 in electrical engineering, 1 in chemical engineering; 8 are regular students in the second year, — 2 in civil engineering, 1 in mechanical engineering, and 5 in electrical engineering; the remaining 24 are special students.

THE COURSES OF INSTRUCTION.

The following table presents the number of students in each of the regular courses. It will be seen that this statement relates to the second, third, and fourth years, choice of courses being made only at the end of the first year: —

Year.	Civil Engineering.	Mechanical Engineering.	Mining Engineering and Metallurgy.	Architecture.	Chemistry.	Electrical Engineering.	Natural History.	Physics.	General Course.	Chemical Engineering.	Sanitary Engineering.	Total.
4th Year Class . .	26	33	4	5	13	19	3	2	5	..	..	110
3d " " . .	24	37	3	9	11	29	2	2	2	11	..	130
2d " " . .	29	29	7	16	5	43	4	1	5	3	6	148
Total . . .	79	99	14	30	29	91	9	5	12	14	6	388

The following table exhibits the number of persons who have graduated within each of the several courses, at each succeeding year since the first diplomas were conferred:—

Year.	Civil Engineering.	Mechanical Engineering.	Mining Engineering.	Architecture.	Chemistry.	Metallurgy.	Electrical Engineering.	Natural History.	Physics.	General Courses.	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	6	6	1	1	..	..	..	1	2	27
1876	12	9	7	..	5	1	..	2	3	4	43
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	4	1	3	..	..	..	..	..	18
1884	5	6	13	..	12	..	..	..	..	..	36
1885	4	6	8	2	4	..	2	..	..	1	27
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	15	23	5	3	8	..	17	1	1	2	75
Total,	158	162	111	30	96	1	54	11	9	24	656
Deduct names counted twice											2
Net total											654

The special students in the School of Industrial Science cannot be classified systematically; but the following table exhibits the number of special students pursuing each particular branch of study:—

NUMBER OF SPECIAL STUDENTS ATTENDING EXERCISES IN THE FOLLOWING DEPARTMENTS OF STUDY OR PRACTICE.

Architecture	66	Literature	28
Applied Mechanics	31	Mathematics	130
Astronomy	18	Mechanism	38
Biology	17	Mechanics and Acoustics	6
Blowpipe Analysis	6	Mechanical Engineering	11
Chemistry	75	Metallurgy	11
Civil Engineering	16	Military Drill	12
Climatology	3	Mining	3
Commercial Geography	6	Organic Chemistry	8
Drawing	42	Physics	111
Descriptive Geometry	63	Physiology	5
Electricity	2	Political Economy	60
English	14	Political Science	4
French	34	R. R. Management	10
Geology, etc.	21	Spanish	1
German	100	Shop-work	55
Heating and Ventilation	3	Surveying	24
History	14	Theoretical Chemistry	12
Industrial Chemistry	8	Zoölogy	9

Total number of entries, by special students	1,077
Total number of special students	257
Average number of entries	4.2

It may be of interest to note the number of students, either regular or special, pursuing certain leading branches of study, in each of the four years, which are as follows :—

Studies.	First Year.	Second Year.	Third Year.	Fourth Year.	Total.
Mathematics	315	249	140	27	731
Chemistry	306	60	31	28	425
English	272	208	106	8	594
French	258	19	18	6	301
Physics	..	231	160	21	412
German	51	190	131	13	385
Shop-work	..	114	59	43	216

THE CORPS OF INSTRUCTORS.

The Catalogue for 1889-90 shows the number of instructors of all grades, excluding instructors and assistants in the shops, and excluding, also, those persons who are announced as lecturers for the year only, to be 85, against 79 last year.

The following table shows the number of teachers of each recognized grade, exclusive of the department of Mechanic Arts, in each year since 1882:—

Year.	Professors.	Associate Professors.	Assistant Professors.	Instructors.	Assistants.	Total.
1882–83	16	..	3	10	11	40
1883–84	15	..	8	15	10	48
1884–85	14	3	11	15	14	57
1885–86	14	6	7	17	18	62
1886–87	12	7	6	27	17	69
1887–88	13	6	9	30	17	75
1888–89	12	7	10	32	18	79
1889–90	10	12	5	34	23	84

In addition to the teachers thus reported for the present year, three instructors and three assistants are engaged in the shops.

CHANGES IN THE FACULTY AND THE CORPS OF INSTRUCTORS.

The changes occurring within the Faculty during the past year have been in number fewer than has been usual of late; yet those which have taken place are of much importance.

After twenty-three years of active service, in charge of the department of English and History, Prof. William P. Atkinson resigned his connection with the Institute of Technology, at the close of the school year 1888–89. A member of the original staff of the Institute, Prof. Atkinson has been the teacher of every student who has gradu-

ated from the school. His genial ways and cordial, unaffected interest in young men have to an unusual degree made his pupils his friends. At the beginning, no member of the Faculty had a heartier faith than he in the kind of education which the Institute had undertaken to provide; and his pride in the school and his devotion to its interests continued unabated to the end. Prof. Atkinson's lectures were always interesting, and, to students of a decided turn to political and historical study, they were highly suggestive and inspiring.

The following resolution was adopted by the Executive Committee, Feb. 5, 1889: "That, in accepting the resignation of Prof. Atkinson, the Executive Committee desire to convey to him their high appreciation of the disinterested and faithful service he has performed for the Institute during the twenty-three years of his connection with it." No appointment has yet been made to the chair vacated by Prof. Atkinson. The classes hitherto taught by him have been assigned temporarily to Profs. Levermore and Dewey, or have been assumed by Dr. Benjamin Rand, of Harvard University, under an appointment for the present year.

The chair of Modern Languages, made vacant by the death of Prof. Otis, has been filled by the appointment of Dr. Alphonse van Daell, late Director of Modern Languages in the public school system of Boston. Dr. van Daell, a native of Belgium, studied at the College of Saint Servais, in Liège, graduating B. A. in 1864. He subsequently pursued his studies at Louvain, passing examinations in Philosophy and Letters. In 1868 he took the degree Docteur en Droit, at the University of Liège; and in the two following years attended lectures in Paris, Bonn, and Berlin. He came to America in 1873, and taught in private schools until 1876. He was then called to the chair of Modern Languages in Kentucky College, where he remained until 1879, when he moved to Philadelphia, and taught for several years thereafter in private

schools. In 1885 he became instructor in Haverford College, and lecturer in the University of Pennsylvania, which positions he resigned, in 1886, to accept the Directorship of Modern Languages in the Boston High and Latin Schools.

Dr. van Daell's works are: —

(1.) A Monograph on the Study of Modern Languages.

(2.) La Parole Française, a practical introduction for the oral use of the French language.

(3.) Das Deutsche Buch, a similar work in German.

(4.) *Leander's* Träumereien, edited and annotated.

(5.) *Heine's* Harzreise, edited and annotated.

(6.) *Les Mémoires du duc de Saint Simon*, edited and annotated.

The appointment of Prof. van Daell of necessity terminated the provisional engagement of Mr W. C. Dreher, who had been employed for the year 1887–8 and a portion of the year preceding in the instruction of some of the classes relinquished by Prof. Otis.

In consideration of eighteen years of distinguished service in the department of Architectural Design, Associate Prof. Eugene Letang was granted, by the Executive Committee, a leave of absence for the school year 1889–90, which he will pass in Europe. Prof. Letang's classes will be taken, the current year, by Mr. C. Howard Walker, who has so long and with such eminent success taught interior decoration to our classes in architecture. Mr. Ross Turner having, also, gone abroad for the year, Mr. Walker has, in addition, assumed charge of the instruction in sketching and in water color.

The Executive Committee have been so fortunate as to be able to arrange for a course of lectures on Business Law during the second half of the present school year, from Prof. John C. Gray, of the Law School of Harvard University. Prof. Gray gave such a course in the Institute several years ago, to the great gratification of the whole

body of our students and with the best effect. Circumstances have prevented the continuance of that course in subsequent years; but Prof. Gray has consented to give these lectures the present year. The Executive Committee have nearly concluded arrangements through which a course of lectures on the Law of Business, extending through the entire year, will be regularly given hereafter by a distinguished member of the Boston bar.

Assistant Profs. Peabody, Allen, Burton, Dewey, and Levermore have been promoted to the grade of Associate Professor.

Dr. Howard V. Frost, whom we looked to see continue in charge of the Laboratory of General Chemistry, resigned, at the close of the school year, to become the head of the department of Chemical Instruction in the Brooklyn Collegiate and Polytechnic Institute. Dr. Frost's place, in charge of the Laboratory of General Chemistry, has been taken by Mr. Frederic L. Bardwell. Mr. Bardwell filled the position during the two years of Dr. Frost's absence, 1886–88, to the satisfaction of the department. This Laboratory now includes three hundred students. Mr. Bardwell is assisted the current year by Mr. Burns, instructor, and by three assistants.

Assistant Prof. Frederick W. Clark, who had for seven years been Prof. Richards' principal assistant in the department of Mining and Metallurgy, resigned that position at the close of the school year 1888–89, with a view to engaging in business. Prof. Clark has shown himself highly intelligent, active, and versatile, both in class-room instruction and in the work of the laboratory. He has borne a large part of the burden of the Summer School of Mining, and has labored in every way to advance the interests of the Institute.

To the position vacated by Prof. Clark, the Executive Committee appointed Dr. Heinrich O. Hofman, then a Professor in the Mining School of South Dakota. Prof.

Hofman, a native of Heidelberg, received his training at the Gymnasium of that city, and in 1871 entered the University, where he remained two years, pursuing the natural sciences. Thence he went to the Royal Prussian School of Mines, whence he graduated, both as mining engineer and as metallurgist, in 1877, entering the government service as chemist and assistant at the Lautenthal Smelting Works, in the Hartz Mountains. In 1881 Dr. Hofman came to America and engaged in metallurgical work, being employed in Pennsylvania, Missouri, Kansas, Colorado, and in Mexico. In 1885 he became private assistant to Prof. Richards at the Institute of Technology, and in 1886–87, by appointment of the Executive Committee, delivered a course of lectures to our students. In the autumn of 1887 he was appointed Professor of Metallurgy in the School of Mines in Dakota, where he remained until recalled to the Institute.

Shortly after the opening of the present school year, Mr. James P. Munroe, with a view to engaging in business, resigned the position of Secretary of the Faculty, which he had held with great acceptance. Mr. Munroe graduated in 1882 from the course in Mining Engineering. At the beginning of the next school year he became the assistant of Prof. Richards, then Secretary of the Faculty; and the following year became Registrar under the secretaryship of Prof. Wells. At the commencement of the school year 1884–85 Mr. Munroe assumed the duties of Secretary. During the great enlargement of the school which has since taken place, alike in the number of students, the introduction of new studies, the organization of new courses, and the multiform extension of the work of the Institute, Mr. Munroe has performed an important part. His quick intelligence, his wonderfully retentive memory, his scrupulous fidelity, his thorough knowledge alike of the present situation and of the traditions of the school, have qualified him to be an assistant and an ad-

viser on many questions of great consequence, as well as a faultless administrator in the regular routine of instruction and discipline.

Mr. Munroe's place has been taken for the current year by Dr. Harry W. Tyler, who returned from Germany in September to resume his relations to the school as Instructor in Mathematics. Greatly as his services were needed in that heavily burdened department, it was felt that the position of Secretary to the Faculty was one of such importance as to justify this sacrifice; and Dr. Tyler was accordingly prevailed upon to forego the resumption of his work as an instructor for at least a year, that the office of Secretary might suffer as little as possible through the resignation of Mr. Munroe.

Mr. Frank A. Moore, Junior Instructor in Architecture, having declined reappointment, Mr. Walter H. Kilham, of the Class of 1889, was appointed to his place.

The Assistants for the school year 1889-90 are as follows: Louis E. Levi, Edward C. Holton, William S. Davenport, in General Chemistry; Charles Ferry, James W. Loveland, and James P. Gilbert, in Analytical Chemistry; Frank H. Thorp, in Industrial Chemistry; George L. Heath, in Sanitary Chemistry; Bertrand R. T. Collins, Willard G. Bixby, Franklin W. Hobbs, Lewis H. Kunhardt, in Mechanical Engineering; James H. Stanwood, Frank H. Cilley, Alfred W. French, William E. Mott, in Civil Engineering; Edward Collins, Jr., and Frank A. Laws, in Physics; Arthur B. Frizell and Horace P. Edgett, in Mathematics; Amos E. Woodward, in Geology; Edward S. Hutchins and Frank E. Sanborn, in Descriptive Geometry.

In addition to the regular staff of instruction, the following gentlemen have been appointed lecturers for the current year: John C. Gray, A. M., LL. B., on Business Law; George W. Blodgett, S. B., on Applications of Electricity to Railway Working; Henry M. Howe, A. M.,

S. B., on Metallurgy; Charles W. Hinman, S. B., on the Manufacture of Illuminating Gas; Walter S. Allen, S. B., on the Manufacture of Fertilizers; David A. Gregg, on Pen and Ink Drawing; Anthony C. White, S. B., on the Distribution of Electricity for Commercial Purposes; Edward Blake, Ph. B., on the Construction and Applications of Electro-Motors; Edwin O. Jordan, S. B., on Biology.

Including these and the lecturers for the current year, we find the total number of persons engaged in the work of instruction to be 100, distributed among the several departments as follows:—

	Civil Engineering.	Mechanical Eng. and App. Mechanics.	Mining Engineering and Metallergy.	Architecture.	Chemistry.	Physics and Elect. Engineering.	Biology, Zoology, etc.	Mineralogy, Geology, and Geography.	English and Political Science.	Language.	Mathematics.	Drawing and Descrip. Geometry.	Mechanic Arts.	Military Tactics.
Professors.....(10)	1	1	1	1	1	1	....	1	....	1	2	....	....	....
Associate Professors.(12)	2	2	....	1	1	1	1	....	2	1	1	....	....	....
Assistant Professors.(5)	1	....	1	....	1	....	....	1	....	....	....	1	....	....
Instructors.....(37)	1	5	1	3	5	4	1	1	2	3	4	3	3	1
Assistants.....(26)	4	4	....	....	8	2	....	1	....	....	2	2	3	....
Total.....(90)	9	12	3	5	16	8	2	4	4	5	9	6	6	1
Lecturers.....(10)	....	....	1	2	2	3	1	....	1	....	....	....	....	....
Total.....(100)	9	12	4	7	18	11	3	4	5	5	9	6	6	1

SCHOLARSHIPS.

In addition to the ten free scholarships established in 1887, under the grant from the Commonwealth, ten more State scholarships were instituted on the same foundation, last year, making the final number of twenty. Thirteen

students are receiving aid this year, to the extent of a whole or a part of their tuition, from the Richard Perkins fund. The beneficiaries of the Sherwin, Joy, Farnesworth, Mirrless, and Milton (town) scholarships raise the total number to thirty-eight.

In December, 1888, the Trustees under the will of Mrs. Susan H. Swett made over to the Institute the sum of ten thousand dollars, to be set apart as a fund for maintaining a graduate scholarship. This addition to our means of encouraging advanced students at the Institute is most welcome, and cannot fail to be found of great advantage. The Swett scholarship has been awarded for the present year to Mr. Richard Lee Russel, a graduate of the last class from the department of Civil Engineering. With a view to still further promote advanced studies the Corporation have voted that hereafter the income of the James Savage fund shall be used for supporting a graduate scholarship, instead of two undergraduate scholarships, as in the past.

LIBRARIES.

Since the last annual report Mr. Clement W. Andrews has been appointed Librarian of the Institute. His work of cataloguing the several departmental libraries has been carried on through the year under many interruptions. It is hoped that it will be continued the present year to greater advantage. The several libraries have received accessions at about the usual rate, the most important relative gains being in the library of the Architectural department.

SUMMER SCHOOLS.

The summer work in topography, geodesy, and geology, first planned and inaugurated in the summer of 1888, as stated in my last report, was again carried out, and with marked success, in the summer of 1889. The location

chosen for the work was the town of Schoharie, N. Y., and the instructors in attendance were Profs. Swain, Burton, and Niles, and Mr. Whipple of the Class of 1889, all of whom gave their time gratuitously. The school covered a period of between four and five weeks, of which time the greater part was devoted to topographical and geological work, including base line measurements, triangulation, work with the stadia, plane table and barometer, and the preparation of geological maps and sections, all under the direction of Profs. Burton and Niles. The latter portion of the time was devoted to the work of measuring the flow of the Schoharie Creek, under the direction of Prof. Swain. Eleven students were in attendance, all members of the present graduating class. They manifested interest and enthusiasm in the work, and the results of the course were all that could have been expected. The locality chosen was exceptionally favorable for topographical and geological study: It is expected that the school will be again carried on during the coming summer, the experience of the past two years having proved it to be a success in every particular, and to supply a want which could not otherwise be filled.

For the benefit of the students of the mining courses, a summer course in metallurgy was organized in June for the purpose of studying the iron blast furnace under as many conditions as possible. The class devoted the early part of their time to the anthracite furnaces of the Lehigh Valley. Here are to be found the best examples of furnaces designed for making iron with this densest of fuels. The construction of the furnaces, as well as the mode of running them, was studied to great advantage. At Bethlehem, the large plant of the Colebrook furnaces gave an opportunity for observing furnaces running on mixed coke and anthracite, mainly coke. At Steelton, the furnaces were run wholly with coke. Here the class were especially fortunate in having an opportunity to watch a furnace

recover from having been chilled by the Susquehanna flood. Finally, the students visited the magnificent plant of four great coke furnaces, now being erected by the Pennsylvania Steel Company, at Sparrow's Point, Md. Here were to be seen furnaces in four stages of construction, from the earliest to the point of being just ready to go into blast. Aside from the main object under consideration, the party also visited several steel works, iron mines, zinc works, and an anthracite mine; and they are much indebted for generous hospitality received to Mr. Fritz and Mr. Schropp, of Bethlehem; Mr. Thomas, of Hokendauqua; Mr. Goodwin, of the Lehigh Valley Railroad; Major Bent and Mr. Wood, of the Pennsylvania Steel Company; Mr. Eckley B. Coxe, of Drifton. The summer courses in mining and metallurgy will hereafter be arranged to take place on alternate years. The Faculty have not yet decided to make the course compulsory, since this would involve an expense which some of the students might not be able to bear.

Course I. *Civil Engineering.* — No changes of importance have been made in the studies in this course during the past year. The scheme of instruction, as now laid down, appears to be fully satisfactory, and it is not probable that any essential modifications will, for some time, be required. With regard to the assignment of the work of instruction, however, changes have been rendered necessary. The instruction in hydraulics, hitherto given by Prof. Swain, has been transferred to Prof. Porter, who has been relieved from some other work, and who will henceforth devote himself almost exclusively to sanitary and hydraulic engineering, giving the instruction in hydraulics to the students in mechanical and electrical engineering as well as to those in civil engineering. This change, as well as the increased number of students in the department, the large number of other students taking the course in surveying, and the accession of graduate students, has caused a great pressure on the accommodations of the

department and upon its corps of instructors, and has rendered imperative a considerable increase in the number of assistants, which is even now scarcely sufficient to do the work to the best advantage.

In connection with the work in hydraulics, a new and important feature will be the hydraulic laboratory in the engineering building. In designing this laboratory the purpose has been to provide facilities for making all the hydraulic tests and experiments which it is possible to carry on within doors and with small quantities of water. A wrought-iron tank, twenty-seven feet high and five feet in diameter, has already been built, and will be connected with pumps and with a stand-pipe and a supply pipe, both running to the top of the building, thereby rendering available a head of about eighty-five feet. The tank will be provided with apparatus of various kinds, and means will be afforded for measuring the flow through orifices and mouth-pieces, both free and submerged, over weirs and through pipes; and for studying the losses of head under various conditions, the distribution of velocity in pipes and jets, and other problems of interest. It is expected that as the laboratory grows there will be means for testing small motors and meters of various kinds, and for all other similar work. The Swain turbine, now in the mechanical engineering laboratory, will be used, as heretofore, in connection with the hydraulic work. The soil pipe, which serves as an overflow pipe from the stand-pipe and the supply pipe, is also to be provided with appropriate connections to render possible the carrying on of experiments upon the siphonage of traps, and other work relating to the plumbing and drainage of houses, a branch of experiment here attempted for the first time, I believe, in connection with work of instruction.

The instructors in this department are gradually getting their courses into print for the use of the students. During the past year Prof. Allen has had his notes on earth-

work and on railroad curves and location lithographed; and Prof. Swain is this year having almost his entire course on bridges and construction printed in the same manner, thereby much facilitating the work of instruction.

It is scarcely necessary to refer to the disadvantages under which the work of the department has of late been carried on, owing to the lack of needed room. The removal of the department to the engineering building at the close of the present term will afford a relief which has become imperative.

Mention should here be made of the fact that two of last year's graduates in this department, Messrs. S. H. Mildram and R. L. Russel, have returned this year to pursue advanced courses of study and research. Should the attendance of such students continue, it will be imperative to relieve Prof. Swain still further from some of the undergraduate work, by providing further assistants, in order that he may be able to devote more time to the conduct of his graduate classes. Until such provision can be made, it is not desired that the number of such students should be large, nor is it, indeed, expected that it ever will be; but the presence of a few earnest workers, pursuing advanced courses, cannot fail to exert a beneficial influence over the undergraduate students. It is further to be remarked that three graduates in mechanical engineering, Messrs. Cromwell, Davis, and Williston, have this year returned to take up studies in civil engineering. The outfit of the department has this year received no considerable additions beyond those referred to in connection with the hydraulic laboratory. The library, however, has been materially enriched by the addition of a large number of valuable books and pamphlets from the library of the late Edward S. Philbrick, generously presented to the department by Mrs. Philbrick.

Prof. Swain has continued his services as expert engineer to the Board of Railroad Commissioners of Massa-

chusetts, and has made numerous reports to the Board in that time upon the condition of the railroad bridges of the Commonwealth.

Course II. *Mechanical Engineering.* — The most important changes in this course have already been referred to in connection with the statements concerning the new engineering building.

In addition to the above, it may be noted that the publications issuing from the department during the past year are: —

1. A treatise on the "Thermodynamics of the Steam Engine," by Associate Prof. Peabody.

2. A paper on the "Flow of Steam through Orifices," presented to the American Society of Mechanical Engineers by Associate Prof. Peabody, embodying the results of the thesis of Mr. L. H. Kunhardt of the Class of '89.

3. A paper on the "Errors of different Types of Calorimeters," presented to the American Society of Mechanical Engineers by Associate Prof. Peabody, embodying the results of the thesis of Mr. A. L. Williston, of the Class of '89.

During the year a short course of lectures on Naval Architecture was given by Naval Constructor J. J. Woodward, of the United States Navy, to the students taking the marine engineering option. It is hoped to have a somewhat longer course given upon this subject during the present year.

There have been presented to the department during the past year, —

1. A Stratton separator.

2. A set of Crosby safety valves, some of them sectioned, to serve for illustration.

3. A number of blue prints and drawings from different works.

At the middle of the present school year, Mr. S. G. Stephens severs his connection with the Institute in order

to go into business, and the drawing room is to be placed in charge of Instructor E. F. Miller.

Of the thirty-four fourth-year students taking this course, five take the locomotive, seven the marine, and twenty-one the mill option.

Course III. *Mining, Engineering, and Metallurgy.*— The recent large development of the engineering courses of the Institute has afforded a favorable opportunity for the further specialization of the course in mining in the directions of civil, mechanical, and electrical engineering.

The mining and metallurgical professions have in the past exacted greatly varying requirements from their followers, calling upon young men to fit themselves in many branches, such as civil engineering, mechanical engineering, chemistry, and geology. This variety has been called for, partly by the primitive conditions of the profession in this country, necessitating, for a given place, a wide range in attainment; partly also from the fact that our students have sought for variety in order that they might have a wider range of choice. The time for this more general mining course has now gone by. The demand at present plainly indicates that it is better for a young man to fit himself more thoroughly in fewer directions, deciding at the outset what line of work he wishes to pursue, and devoting himself to that.

The Faculty have been guided by the above considerations in planning the new mining schedules, and have laid out the mining and metallurgical courses under four different headings, two leading to mining and two to metallurgy.

The first course prepares a student to begin his work in line for promotion in any mining industry, — as a miner, a foreman, assistant manager, or manager of a mine. It fits him in geology, mining, milling, and in mechanical engineering adapted to mining.

The second course prepares a student to take position

in line for promotion in a surveyor's office in a mining district, as assistant surveyor, as surveyor of mines, as consulting mining engineer, as mine superintendent. It fits him in geology, mining, milling, and in civil engineering adapted to mining, construction of railroads, electric railroads, canals, roads, buildings, bridges, etc.

The third course fits a student to take position in line for promotion in a smelting works as a hand, as foreman, assistant superintendent, or superintendent, or he may enter the works through the chemical laboratory. It fits him in analytical chemistry, metallurgy, mathematics, and in mechanical engineering adapted to metallurgy.

The fourth course fits a student to take position in line for promotion in a smelting works as assistant chemist, as chemist, as furnace manager, as superintendent. It fits him in analytical and theoretical chemistry, in metallurgy, in electrometallurgy.

Course IV. *Architecture.* — In the Architectural department the strengthening of the two-years' partial course has worked very satisfactorily, and as already had the effect of bringing to the Institute an abler class of young men, as is shown by the improved work of this year. It has attracted draughtsmen who have been willing to leave good situations, confident that this course will make their future success more certain. These older and stronger men are exerting an excellent influence upon the department; and it is gratifying to report that, while only ten students entered last year, intending to pursue the regular course, this year there are nineteen.

Feeling that the four months' vacation made too long a break from regular work, Prof. Chandler, at the close of the last school year, requested such students as were not engaged in architects' offices to do a certain amount of specified work during the summer. This request was responded to by the students with great cordiality, and excellent results have been shown.

To the regular studies will be added this year a course in acoustics. Iron and steel construction is also to be made an important course. Beginning with the nature of materials, the student is to apply the theory of his applied mechanics to practical construction, in designing roof trusses, floors, columns, etc. The library has been largely added to, and its usefulness greatly increased by more detailed indexing, and by better facilities for reading. The department has been much benefited indirectly by the Rotch scholarship. The trustees of this fund have loaned to us certain of the envois, which are hung on the walls of drawing rooms. These beautiful drawings of historical architecture, made by finished draughtsmen, serve as a further stimulus for our young men. The Architectural department will derive great advantage, beginning with the second term of the current year, from the removal of the Civil Engineering department to the Trinity Place building. The large drawing room now occupied by the second and third year students of the latter department will, after January, be assigned to the use of the architectural students.

Course V. *Chemistry.* — The present crowded condition of the organic laboratory may call for its enlargement in the near future. The addition of a special room for organic combustions would relieve the pressure now existing here.

The demand made upon the Institute for chemists of industrial works — in the lines of dyeing, metallurgy, fertilizers, etc. — is greater than we can supply.

The analysis of the waters of Massachusetts for the State Board of Health still continues. During the past year 1,700 samples have been analyzed, making in all, to Dec. 1, 1889, 5,400 complete sanitary examinations of the natural waters of the State. This important work, involving much original research into the sanitary aspects of the water supply of cities, has made the department of Sanitary

Chemistry additionally attractive to students of Course V., four of whom will do their thesis work in this department during the current year.

A course of laboratory instruction in textile coloring has been put in operation. This course has been taken by ten students during the past year. It will be still further perfected during the present year.

The laboratory practice in the preparation of chemicals has been so far extended in the industrial laboratory that a large proportion of the pure chemicals required in the various laboratories is now produced by the students.

Course VI. *Electrical Engineering.* **VIII.** *Physics.* — During the past year there has been a considerable increase in the number of students in the departments of Physics and Electrical Engineering, which has called for a correspondingly increased expenditure of time and labor in their instruction. Notwithstanding this fact, it is thought that the various courses have been more efficient than they were before. Several of the special courses of lectures or laboratory instruction have been extended or otherwise strengthened, and the average in excellence and in amount of work done by the more advanced students has materially improved. Several papers, embracing the results of original investigation, have been published, or are nearly ready for publication.

In consequence of the growth of the department, as well as the development of physical science in general, a large increase of apparatus for instruction and research has been necessary. This has been abundantly supplied. The new dynamo room, to which reference was made in my report for last year, with its independent engine, together with the dynamos and accessories given us by the Edison Company and the Thomson-Houston Electric Company, has made it possible to give far more efficient instruction than before regarding direct-current methods, while the 500-light Thomson-Houston alternating-current dynamo, pur-

chased by the Institute, has proved invaluable in the study of various problems arising in connection with the newer modes of the distribution of electricity.

The temporary loan of several electro-motors of large capacity by the Thomson-Houston Electric Company has further allowed us to introduce additional instruction in certain new and important methods of testing dynamos and motors. It is also a satisfaction that it has proved possible, without serious difficulty or expense, to remedy the trouble formerly experienced from the jarring of the floors and walls of the building caused by the machinery in the dynamo room. The building of a foundation wall for the shafting has largely reduced the vibration; and the addition of a few piers upon which to place the heavier dynamos will probably do away with it altogether.

It should further be remarked, in this connection, that the use of electricity in lighting the new engineering building will offer to our students an opportunity to study the working of a larger direct-current dynamo than any which we at present possess, since for this purpose a 500-light United States Company's dynamo is to be provided.

During the past year two entirely new physical courses have been instituted in connection with the department of mining. Both of these are unique in their character, and should prove of much value. The subject of heat measurements of various kinds, including the measurement of high temperatures, the determination of the calorific value of fuels, and similar important topics, is one of large practical importance, regarding which very little information is now accessible to the student. And this is true, to an even greater degree, of the applications of electro-metallurgy to chemical analysis, the reduction of ores and allied problems, in which even the methods are often still to be devised. Several years must necessarily elapse before these courses are fully developed.

Course VII. *Biology.* — The number of students in biology (22) is larger than ever before. More students, also, from other departments (26) are under instruction, chiefly in general and sanitary biology. Of the 22 students who make biology their specialty, 9 are regulars and 13 specials. Of the regulars, 4 intend to become physicians, and 4 teachers or professional biologists. Of the special students, 3 are college graduates fitting themselves here for particular lines of work, 6 are about to become regular students of biology, 2 are teachers preparing themselves for higher positions, and 2 intend soon to enter upon teaching or the medical profession.

By special arrangement with the State Board of Health, the biological work of the Lawrence Experiment Station has, for the past year, been carried on in the biological laboratory under the direction of Prof. Sedgwick. His chief assistant in this work has been Mr. Edwin O. Jordan, a graduate of this department of the Institute in the Class of 1888. The results of the year include interesting contributions to sanitary biology, and are soon to be published in a special report of the State Board of Health.

Dr. E. G. Gardiner, instructor in biology, a graduate of the Institute in the Class of 1882, who has had the more immediate charge of the classes in Zoölogy, Anatomy, and Embryology, acted as assistant during the summer, in the Marine Biological Laboratory at Wood's Holl, where he conducted investigations upon *Amaræcium*, one of the compound ascidians.

Mr. Alexander L. Kean, until very recently a special student in this department, has so far completed his studies of the Bermuda lily disease, begun and carried out during his connection with the laboratory, that an important paper from his pen will appear upon that subject in the January number of the *Botanical Gazette*.

The demand which has arisen for instruction and expert aid in sanitary biology has necessitated increased facilities

until it is believed that no college or science school in the land offers larger opportunities for work and investigation in this direction than does the Institute. The library, especially when re-enforced by the biological portion of the William Ripley Nichols library, is certainly unsurpassed.

An important gift to the biological department has been made during the year by Mr. James Means, whose generosity has made possible the purchase of an extremely useful collection of Mediterranean animals, preserved and identified at the celebrated Stazione Zoölogica in Naples.

Course IX. *General Studies.* — The resignation of Prof. Atkinson of course involves large changes in this department; but for the present year provisional arrangements only have been made, through the appointment of Dr. Rand, already spoken of. It is probable that next year's report will have to deal with an extensive reorganization of the general studies of the school.

Course X. *Chemical Engineering.* — The course in chemical engineering, in which instruction was introduced last year, has been still further developed. The department receives frequent calls for men trained in mechanical engineering, and at the same time acquainted with applied chemistry. On this point I will repeat a few lines from my report of last year: —

There are a great number of industries which require constructions, for specific chemical operations, which can best be built, or can only be built, by engineers having a knowledge of the chemical processes involved. This class of industries is constantly increasing, both in number and in importance. Heretofore, the required constructions have, generally speaking, been designed and work upon them has been supervised and conducted, either by chemists having an inadequate knowledge of engineering principles and unfamiliar with engineering, or even building, practice; or else by engineers whose designs were certain to be either more laborious and expensive than was neces-

sary, or less efficient than was desirable, because they did not thoroughly understand the objects in view, having no familiarity, or little familiarity, with the chemical conditions under which the processes of manufacture concerned must be carried on. It was to meet this demand for engineers having a good knowledge of general and applied chemistry, that the course in chemical engineering was established.

The instruction thus far given, while following mainly in the line of mechanical engineering, has included an extended study of industrial chemistry, with laboratory practice, in the third year.

The arrangement of the course of study has now been completed. A considerable portion of the time in the fourth year will be devoted to mechanical engineering and general applied chemistry, but a series of options has been introduced, designed to specialize the work more highly, either in the line of the textile industries, of furnace construction and regulation, or of the manufacture of organic products. A special course of lectures is to be given by Prof. Peabody, devoted to the discussion of chemical machinery from the engineering point of view. It is believed that this course will prove of the greatest value to the students in chemical engineering. It will deal with problems, some of which have not hitherto been dealt with in a systematic way for purposes of instruction, such as pumping machinery for gases and liquids, refrigerating machinery, filter presses and other forms of presses, methods for evaporation *in vacuo*, and other special problems with which the chemical engineer has to deal.

Course XI. *Sanitary Engineering.* — The establishment last year of Course X., in addition to the traditional nine courses at the Institute, has been followed this year by the inauguration of still another course, in sanitary engineering, to be known as Course XI. Six students of the present second year's class have enrolled themselves in this course.

The nature of the course is, perhaps, sufficiently indicated by its title, yet a somewhat detailed account of its character and of the causes which led to its adoption may be of interest.

The rapid advances in sanitary science and the increasing necessity for co-operation between the engineer, the chemist, and the biologist, in dealing with questions affecting the public health, appeared to render desirable a course which should afford students an opportunity to master so much of the subjects of chemistry and biology as should fit them properly to interpret the results of sanitary chemistry and sanitary biology, and to appreciate their bearing upon engineering problems.

The course of study is essentially one in civil engineering. It is not the object to make chemists or biologists; and the courses in chemistry and biology, though continuous, are very moderate in amount. But by giving the student a firmer grasp of these subjects, by teaching him to think in chemical or biological language, it is hoped to enable him to deal somewhat more intelligently with the questions which come within the province of the sanitary engineer.

The course differs from the regular course in civil engineering in the following particulars: —

(*a.*) There is a reduction in the time devoted to railroads and bridges, and an entire omission of the mechanical engineering subjects of mechanism, machinery, and motors, and of the subjects of astronomy, metallurgy of iron, and historical geology.

(*b.*) The time thus gained is devoted principally to courses in chemistry and biology. In the fourth year, a course of instruction is also given in heating and ventilation.

(*c.*) The entire instruction in sanitary and hydraulic engineering, now given in the course in civil engineering, a portion of which is there optional with other studies, is required in the course in sanitary engineering.

In the second year, brief courses in organic chemistry and chemical analysis are introduced; in the third year, chemical analysis, water analysis, and biology; and in the fourth year, advanced analysis, chemistry, and biology of natural waters, and sanitary biology and bacteriology, take the place of certain purely engineering subjects.

LOWELL SCHOOL OF INDUSTRIAL DESIGN.

The Lowell School of Industrial Design has since my last report had a thoroughly successful year. The exhibition of the work of the pupils, made at the time of the annual graduating exercises of the School of Industrial Science, was highly creditable, a distinct improvement being manifested even over the admirable exhibit of 1888. Much of the best work of the year, however, could not be shown, owing to the fact that numerous designs for wall papers and for prints had been sold by the pupils to manufacturers.

Of the ten graduates of May, seven have already obtained situations in different mills. The session of 1889–90 began with fifty-three pupils, the maximum number allowed. Of these thirty-three were former pupils. Since the school began in October, six of the pupils have left the school to take situations in manufacturing establishments. According to our usage, the certificates of these students will be delivered to them in connection with the next graduating exercises, their work in the mills being accepted in substitution for the remaining work of their school course. A new feature of the work of the present year is the introduction of china painting, for which provision has been made by taking in a portion of the room formerly occupied by the drawing classes of the School of Mechanic Arts.

By the kindness of the owners of various mills in Lowell, Lawrence, and elsewhere, pupils have had opportunities to visit the weaving departments of those mills.

At the close of the last school year, Miss Delphina Weston, after a valued service of four years, resigned her position as assistant in the Lowell School, and Mrs. Minnie Gray was appointed to her place. Mr. Albert Bryant continues in charge of the weaving department of the school.

OBITUARY.

The Corporation has lost by death four valued members during the past year. Mr. James L. Little was one of the charter members of the Corporation, and even before that had been active among the projectors of the Institute of Technology. For many years he was most zealous and attentive to his duties as a Trustee. His courage and his faith in the future of the school were no small part of the force which kept it alive in the days of darkness and doubt which now seem so far back in the past. Of late years increasing infirmities have kept him from active participation in our affairs.

Mr. Edward S. Philbrick became a member of the Corporation in 1866, and from that time forward was among the most active of its supporters. He gave of his time and personal attention as much, perhaps, as any member of the Corporation, holding himself always subject to call whenever his professional assistance or his practical judgment was in request. He was chairman of the Building Committee having in charge the erection of the new building of 1883. At the time of his decease he was Chairman of the Visiting Committee of the Corporation on the department of Civil Engineering.

Mr. Charles L. Flint was elected to the Corporation in 1865, and served as a zealous and scrupulously attentive member during the remainder of his life. He was one of the Committee on the School of Industrial Science until that Committee was discontinued on the reorganization of the Corporation, when he became Chairman of the Visiting Committee on the department of Modern Languages. The

exceptional qualifications for public service which Mr. Flint exhibited during so many years as Secretary of the State Board of Agriculture, made him a valuable member of the Corporation of the Institute.

Were I to attempt an eulogy of Mr. Stanton Blake, the tender recollections of forty years of personal friendship would so mingle with the sense of the official loss sustained through his untimely death, as to make it difficult for me to choose my words on this occasion. But the qualities of head and of heart which united to make Mr. Blake the friend and staunch supporter of every good cause, are all too well known to this Board and too fresh in our remembrance to require panegyric here.

TREASURER'S REPORT.

STATEMENT OF THE TREASURER.

The Treasurer submits the annual statement of the financial affairs of the Institute for the year ending Sept. 30, 1889.

During the year the only change of importance in the investments has been the sale of $25,000 Gulf, Colorado and Santa Fé first mortgage 7s, and the purchase of the same amount of $25,000 Kansas City Belt Line 6s bonds for the account of the Wm. Barton Rogers Memorial Fund.

An estimated value of one-tenth undivided interest in estate 1004 Walnut Street, Philadelphia, bequeathed to the Institute by Robert E. Rogers, of Philadelphia, has been entered on the books at $2,500.00.

The income from general investments has been divided at the rate of $4\frac{696}{1000}$ per cent among the funds to which it belongs, and the balance of ten cents remaining after division carried to Profit and Loss.

Gifts and bequests have been received from —

State of Massachusetts	$100,000 00
Subscription of 1887	38,500 00
Estate of Mrs. Susan H. Swett to found Susan H. Swett Scholarship Fund	10,000 00
Mrs. Mary E. Atkins to found Farnsworth Scholarship Fund	5,000 00
Estate of Stanton Blake	5,000 00
" " Sidney Bartlett	10,000 00
Mrs. Wm. B. Rogers for periodicals	100 00
James Means for Biological Laboratory	200 00
Estate of William Perry, of Brockton, and used to defray current expenses	885 22
Alumni of Institute towards Wm. B. Rogers Scholarship Fund	1,000 00

Statement of Lewis William Tappan, Jr., Treasurer

RECEIPTS.

Augustus Lowell, Trustee		$2,500 00
" " "		2,200 00

APPLIED TO CURRENT EXPENSES.

From Income of Funds for Salaries. }		$4,113 70	
" " " " " Scholarships. }	A	3,376 80	
" " " " " General Purposes. }		5,175 95	
" Income Joy Fund, specially invested		200 00	
" " Wm. Barton Rogers Memorial Fund.	B	12,511 25	
" previous income Richard Perkins Scholarship Fund		19 13	
" James Henry Mirrlees Scholarship Fund		1 71	
" Students' Fees		158,026 50	
" Laboratory Breakage and Supplies		4,012 93	
" Sale of Printed Lecture Notes		1,799 63	
" State Agricultural Fund		5,504 42	
" Boston University		1,150 00	
" Rents. **Table I.**		6,427 50	
" Gifts		300 00	
" Estate of Wm. Perry of Brockton		885 22	
			$203,504 74

OTHER RECEIPTS.

From State of Massachusetts		$100,000 00	
" Subscription of 1887		38,500 00	
" Estate of Mrs. Susan H. Swett		10,000 00	
" Mrs. Mary E. Atkins		5,000 00	
" Estate of Sidney Bartlett		10,000 00	
" " " Stanton Blake		5,000 00	
" " " Robert E. Rogers		2,500 00	
" Alumni W. B. Rogers Scholarship		1,000 00	
" Interest on " "		204 26	
" Income James Savage Scholarship Fund, not used		99 88	
" Students' Notes Receivable	$1,245 00		
" loss by death and charged off	200 00		
		1,445 00	
" Sale of Gulf, Colorado and Santa Fé R. R. Bonds,		27,761 75	
" Burlington and Missouri R. R. Bonds drawn		3,000 00	
" Students' Deposit		50 00	
" Augustus Lowell, Trustee, L. S. D.		1,000 00	
" Shawmut Bank	$445 93		
" last Cash Balance	8,412 07		
		8,858 00	
			214,418 89

SUNDRIES.

From Income Wm. Barton Rogers M. F., credited to Advance Bonds Premiums		$1,111 86	
" Transferred from Advance Bonds Premiums. Contra		272 00	
" Advance for Accrued Interest credited to Advance Bonds Premiums		1 33	
" Balance of Profit and Loss used to reduce Gymnasium Account		33 19	
			1,418 38
			$419,342 01

of the Massachusetts Institute of Technology.

DISBURSEMENTS.

Lowell Courses		$2,500 00
Charles Kastner's Salary		2,200 00

EXPENSES.

Rents	$180 00	
Repairs	3,506 22	
Laboratory Supplies. **Table II.**	25,047 21	
Salaries. **Table III.**	137,472 83	
Printing and Advertising	2,068 28	
" Lecture Notes	1,657 62	
" Catalogue, 1888–89	1,179 97	
General Expenses. **Table V.**	8,217 19	
Fuel, Water, and Gas. **Table IV.**	8,363 99	
Interest. **Table VI.**	6,584 95	
Scholarships	3,625 00	
Society of Arts	175 06	
Physical Laboratory Improvement	2,827 86	
New Boiler	995 81	
Profit and Loss	1,569 56	
		$203,471 55
Balance		33 19
See below. Contra.		
		$203,504 74

PAYMENTS.

Lowell School of Design	$926 11	
Notes Payable	101,000 00	
Massachusetts Charitable Mechanic Association	4,000 00	
		105,926 11

PURCHASES.

Everett Mills, 17½ Shares, 50%	$875 00	
Kansas City Belt Line Bonds	28,500 00	
Policy Massachusetts Hospital Life Insurance Co.	10,000 00	
Burlington & Missouri R. R. Nebraska Bond	1,063 75	
		40,438 75

SUNDRIES.

$\frac{1}{10}$ Estate 1004 Walnut Street, Philadelphia	$2,500 00	
Building on Trinity Place	39,327 53	
Taxes on Trinity Place Land	638 39	
Joy Scholarship Fund	143 53	
Richard Perkins Scholarship Fund	19 13	
James Henry Mirrlees Scholarship Fund	1 71	
		42,630 29
Wm. Barton Rogers M. F. Advances Bonds Premium. Contra	$272 00	
		272 00
Cash Balance		26,570 12
		$419,342 01

A.

INCOME FROM GENERAL INVESTMENTS, AND APPLICATION THEREOF.

Applied to Salaries		$4,113 70	From Dividends, Old Boston Bank	$302 50
" " Scholarships		3,376 80	" State Tax returned, Old Boston Bank	86 09
" " General purposes		5,175 85	" Railroad Bonds	4,546 17
" " Profit and Loss		10	" Essex Co. Dividends	216 00
" " Increase of Funds		304 14	" Chicago, Burlington and Quincy Railroad Dividends	560 00
			" Cocheco Manufacturing Company Dividends,	240 00
			" Hamilton Woollen Company Dividends	300 00
			" Everett Mills Dividends	70 00
			" Joy Scholarship Fund	143 53
			" Rent, 1004 Walnut Street, Philadelphia	134 68
			" Wm. B. Rogers Memorial Fund over-invested, $7,284.50, @ 5%	364 22
			" Interest, Students' Notes Receivable	162 63
			" " Shawmut Bank	1,491 44
			" " on Uninvested Funds, @ $4\frac{000}{1000}$, being rate of earnings of funds invested	4,353 33
		$12,970 59		$12,970 59

B.

INCOME FROM WILLIAM BARTON ROGERS MEMORIAL FUND, AND APPLICATION THEREOF.

Paid Massachusetts Institute of Technology 5% on Amount of Fund ($250,225)	$12,511 25	From Railroad Bonds	$13,107 33
Paid Massachusetts Institute of Technology 5% on Amount Borrowed (over-invested)	364 22	Chicago, Burlington & Quincy R. R. Dividends, 220 shares	880 00
Credited to Advance to Bonds Premiums	1,111 86		
	$13,987 33		$13,987 33

TABLE I. — Rents Received.

Huntington Hall for Lowell Lectures	$2,500 00	
Lowell School of Design	1,000 00	
Chauncy Hall School for Gymnasium	300 00	
State Board of Health for use of Laboratories	2,325 00	
Use of Lecture Rooms	52 50	
Green-house on Trinity Place	250 00	
		$6,427 50

TABLE II. — Department Supplies.

Chemical Department	$7,117 95	
Mining "	1,321 33	
Physical "	4,779 80	
Mechanical Engineering Department	1,147 72	
Applied Mechanics "	836 42	
Mechanic Arts "	1,413 98	
Civil Engineering "	1,515 28	
Biological "	1,661 98	
Geological "	105 20	
Architectural "	2,655 77	
Drawing "	112 96	
English "	1,413 67	
Periodicals	965 15	
		$25,047 21

TABLE III. — Salaries.

Paid for Instruction	$113,019 49	
" Administration	12,566 49	
" Labor	11,886 85	
		$137,472 83

TABLE IV. — Fuel, Water, and Gas.

Paid for Fuel	$5,625 34	
" Water	910 70	
" Gas	1,827 95	
		$8,363 99

TABLE V. — General Expense.

Insurance	$1,516 00	
Postage and Stationery	1,022 30	
Furniture	1,251 60	
Diplomas, Commissions, and Expense of Drills	304 90	
Entrance Examinations	644 50	
Paris Exposition	191 07	
Subscription to Technology Quarterly	150 00	
Gift to Technology Quarterly	500 00	
Electric Lighting	152 84	
Expressage	267 37	
Ice (Boston Ice Co.)	166 67	
Washing	244 65	
Damper Regulator (Locke Bros.)	185 00	
Covering Steam Pipes (Trainer & Co.)	235 48	
Oil for Engine	81 98	
Examining Elevator (Whittier Machine Co.)	24 00	
Paving Sidewalk and pointing around Chimney (R. S. Dewing)	40 35	
Carting away Rubbish, etc. (J. Gormley)	33 88	
Prints for Drawings (D. A. Gregg)	58 00	
Rent Union Safe Deposit Vaults	50 00	
Towels, etc. (C. F. Hovey & Co.)	78 23	
Paint, Varnish, etc. (J. A. & W. Bird & Co.)	332 18	
Pails, Brushes, etc.	163 14	
Reducing Valve (Mason Regulator Co.)	42 75	
Window Glass (Page, Harding & Co.)	74 70	
Office Supplies (Cyclostyle Paper, Ink, etc.)	140 57	
Printing Treasurer's Report	20 00	
Ventilation (W. H. Blake and others)	46 45	
Making Keys (T. Margeson)	21 50	
Check Books (J. Ottmann)	47 00	
Sundries	130 08	
		$8,217 19

TABLE VI. — Interest Paid.

Moses Williams, Trustee, on Mortgage	$620 14	
Alumni Association	58 33	
Shawmut Bank	553 15	
Augustus Lowell, Trustee	1,000 00	
On $92,702.92 Uninvested Funds	4,353 33	
		$6,584 95

INVESTMENTS.

BONDS.

INVESTMENT OF WM. BARTON ROGERS MEMORIAL FUND.

Cin., Ind., St. Louis, and Chicago R. R. 6s	$4,000 00	
Omaha & Southwestern R. R. 8s	7,000 00	
Mo. Valley, Blair R'y & Bridge R. R. 6s	20,000 00	
Saginaw & Western R. R. 6s	50,000 00	
Kansas City, Clinton & Springfield R. R. 5s	16,000 00	
Republican Valley R. R. 6s	5,400 00	
Kansas City, Emporia & Southern R. R. 7s	7,000 00	
Kansas City, Memphis & Birmingham R. R. 5s	1,905 00	
Grand Rapids, Newaygo & L. Shore R. R. 8s	34,000 00	
Burlington & Mo. River R. R. 4s	25,787 50	
Kansas City, Lawrence & Southern R. R. 6s	6,000 00	
Cowley, Sumner & Ft. Smith R. R. 7s	2,000 00	
Ottawa, Oswego & Fox River R. R. 8s	2,000 00	
Quincy & Warsaw R. R. 8s	4,000 00	
Lincoln & Northwestern R. R. 7s	1,000 00	
Atchison & Nebraska R. R. 7s	1,000 00	
Florence, Eldorado & Wt. Valley R. R. 7s	1,000 00	
Kansas City Belt Line 6s	25,000 00	
	$213,092 50	
220 shares Chi., Bur. & Quincy R. R.	22,000 00	
Advances to Premiums on Bonds $18,821 39		
" " " Stock 2,483 75		
	21,305 14	
		$256,397 64

INVESTMENT OF JOY SCHOLARSHIP FUND.

Mass. Hospital Life Insurance Co.	$5,000 00	
Deposits in Savings Bank	2,513 50	
		7,513 50

INVESTMENT OF MRS. SUSAN H. SWETT SCHOLARSHIP FUND.

Mass. Hospital Life Insurance Co.	10,000 00
Amount carried forward	$273,911 14

BALANCE.

FUNDS.

Wm. Barton Rogers Memorial Fund	$250,225 00
Joy Scholarship Fund, ...	7,513 50
Mrs. Susan H Swett Scholarship Fund	10,000 00
Amount carried forward	$267,738 50

OTHER PROPERTIES OF THE MASS. INSTITUTE OF TECHNOLOGY AS THE SAME APPEAR ON LEDGER.

BONDS.		
Amount brought forward		$273,911 14
Quincy & Palmyra R. R. 8s	$25,000 00	
Chicago, Burlington & Quincy R. R. 4s	5,100 00	
Burl. & Mo. River R. R. Land Grant 7s	15,000 00	
Burl. & Mo. River R. R., Nebraska, 6s	19,000 00	
		64,100 00
STOCKS.		
Chicago, Burl. & Quincy R. R., 140 shares	$14,000 00	
Old Boston National Bank, 55 shares	5,510 50	
Cocheco Manufacturing Co., 12 shares	6,000 00	
Everett Mills, 35 shares	3,150 00	
Hamilton Woollen Co., 50 shares	5,000 00	
Essex Co., 27 shares	4,050 00	
		37,710 50
SUNDRIES.		
Notes Receivable	$1,500 00	
Students' Notes Receivable	5,905 00	
Lowell School of Design	127 41	
Cash	26,570 12	
		34,102 53
REAL ESTATE.		
1-10 1004 Walnut St., Philadelphia	$2,500 00	
Rogers Building	315,726 88	
New building of 1883	190,492 44	
Mechanic Arts Building	52,416 49	
Land on Garrison St.	50,840 00	
Gymnasium	3,713 36	
Land on Trinity Place	76,315 69	
Building on Trinity Place	39,327 53	
		731,332 39
Mechanic Arts Equipment		20,628 56
		$1,161,785 12

BALANCE.– (Continued.)

Amount brought forward		$267,738 50
James Hayward, for Professorship of Civil Engineering	$18,800 00	
Nathaniel Thayer, for Professorship of Physics	25,000 00	
Wm. P. Mason, for Professorship of Geology,	18,800 00	
Henry B. Rogers, for Salaries of Professors, etc.	25,000 00	
		87,600 00
Thomas Sherwin Scholarship Fund	$5,000 00	
James Savage " "	10,744 64	
James Henry Mirrlees " "	2,623 76	
Wm. Barton Rogers " "	5,553 96	
Richard Perkins " "	51,745 57	
Farnsworth " "	5,000 00	
		80,667 93
INCOME OF THE FOLLOWING FUNDS IS USED FOR GENERAL PURPOSES OF THE INSTITUTE.		
Albion K. P. Welch Fund	$5,000 00	
McGregor "	2,500 00	
Nathaniel C. Nash "	10,000 00	
Robert E. Rogers "	6,690 29	
General "	36,028 00	
Richard Perkins "	50,000 00	
		110,218 29
Estate Stanton Blake	$5,000 00	
" Sidney Bartlett	10,000 00	
		15,000 00
Subscriptions of 1887	$87,500 00	
M. I. T. Stock Account	483,164 15	
		570,664 15
Income Joy Fund		200 00
Advances to Bond Premiums		9,146 25
DEBTS.		
Note Payable	$20,000 00	
Students' Deposits	550 00	
		20,550 00
		$1,161,785 12

E. & O. E.

LEWIS WM. TAPPAN, JR., *Treasurer.*

BOSTON, Dec. 2, 1889.

An examination of the accounts of the Treasurer of the Massachusetts Institute of Technology for the year ending Sept. 30, 1889, has been made, and they are found to be correctly cast, and with proper vouchers. The Ledger Balances agree with the Trial Balance. We have verified the evidences of personal property held by the Institute.

FREDERIC W. LINCOLN, } *Auditing*
PERCIVAL LOWELL, } *Committee.*