MASSACHUSETTS

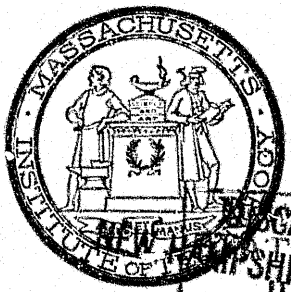
INSTITUTE OF TECHNOLOGY.

ANNUAL REPORT

OF THE

PRESIDENT AND TREASURER,

DECEMBER 9, 1896.



JOHN WILSON AND SON.
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creasing; and must soon be met if this useful and promising branch of our work is to have an adequate development. The first floor of the present Architectural building is devoted to recitation and lecture rooms; and these it was not proposed to disturb. The fifth and uppermost floor, which is at present devoted to life class-work, and to freehand and water-color drawing, it was proposed to continue in its present use.

Turning now to the Walker Building, let us inquire what could have been done there for the expansion of the Departments of Chemistry and Physics, at present occupying the whole of that building except the few rooms reserved for instruction in modern languages and mathematics. The withdrawal of general chemistry would have left the laboratory (90 × 40 ft.) on the Newbury Street side of the fourth story to be occupied by the laboratories of analytical chemistry and organic chemistry, each of which has outgrown its existing quarters; while the present lecture room of general chemistry would become available for uses which the Executive Committee did not deem it important to determine in advance. The needs of the two departments are so great that even the apportionment of this space would still leave much to be desired. This should not, however, make us indifferent to the measure of relief which would be afforded.

Turning now to the Rogers Building, I ask the attention of the Corporation to the great advantage, both scholarly, social, and sanitary, which the withdrawal of the Biological Department would afford. The laboratory now occupied by that department extends ninety feet across the whole width of the building on its Newbury Street end, and is thirty feet in depth; this it was proposed to make a general reading-room for the students of the Institute, with the Librarian's office at one end. Such a reading-room, especially if reached by new staircases at the rear of the building, above the present entrance into the basement, and warmed and lighted during the evening, for study or for quiet conversation, would constitute

an addition of inexpressible value to the present accommodations for our students. To many, the opportunity for passing their evenings in a large, well-lighted, well-furnished and well-ventilated room would not only facilitate their progress as scholars, but would afford a very valuable means of bringing them into better social relations than they now enjoy at the Institute. Such a room would also, upon occasion, be used for gatherings of students or for receptions by the President and members of the Faculty, and would constitute an important addition to our resources on commencement and other gala days. The present library would naturally become a much needed Faculty room.

Such was the pleasant dream in which the Executive Committee and the Faculty indulged themselves until rudely awakened by the impossibility of securing the necessary funds under the painful industrial and commercial conditions prevailing the past season. Is it too much to hope that those who have again and again come forward to the support of the Institute in its times of need and trial, will not long allow the school to suffer from accommodations so painfully cramped? I have here upon the table the plans which I have referred to as prepared by the Executive Committee last spring. It may interest the members of the Corporation to examine them; and any information which may be desired regarding the uses of the several portions of the building will be cheerfully given. I would say, in closing, that the Executive Committee received propositions from responsible builders which would have brought the entire cost of the building to about a hundred thousand dollars.

When it was at last reluctantly admitted that it was impossible to undertake the construction of a building which should be available for any part of the present school year, it became absolutely necessary to make a certain degree of provision for the Chemical Department. The situation was this: every desk in the laboratory of organic chemistry was occupied, while the in-coming fourth-year class was to be considerably larger. Many of the needs of the Institute were

urgent and pressing; but this seemed the most imperative. In consequence, all the changes made were to meet this single exigency. The William Ripley Nichols Chemical Library, which has for thirteen years been on the fourth floor of the Walker Building, was removed to Rooms 39 A and B, on the third floor. Here, the space formerly occupied by Dr. Drown for his private study and laboratory, and a part of the space occupied heretofore for molecular-weight determinations, was fitted up for a library. Not only are the present collections agreeably and conveniently placed here, with an effective installation of electric lights; but the additional room will provide for their normal increase through some years to come. A portion of the former room 39 A has been retained as a laboratory of molecular-weight determinations.

The space thus made vacant on the fourth floor has been utilized, through the removal of some partitions and the erection of others, for enlarging the laboratory of organic chemistry by the addition of eight students' desks, with convenient hoods and other fittings. The remainder has been divided into two laboratories, a small one for an instructor's use, and a larger one which will be occupied by Professor Noyes for organic and physical-chemical research.

The Graduating Class.

The school year of 1895–96 closed on the 9th of June, according to the new calendar of which I spoke in my last report. The graduating exercises will hereafter come always in June, the introduction of several holidays having the effect to bring commencement between the 3d and 11th of that month. The class of 1896 was the largest in the history of the school, numbering 188. Of these 25 graduated in Civil Engineering, 34 in Mechanical Engineering, 10 in Mining Engineering, 24 in Architecture, 16 in Chemistry, 48 in Electrical Engineering, 3 in Physics, 3 in Biology, 7 in Chemical Engineering, 4 in Sanitary Engineering, 3 in Geology, 5 in Naval Architecture, while 7 graduated from the

Department of General Studies. Of the Bachelors of 1895, three — Messrs. Frank Augustus Bourne, Herbert William Chamberlain, and George Defren — received the degree of Master of Science, on the completion of an additional year of successful study, the first two in Architecture, the last in Chemistry.

The Entering Class.

The registration of this year, as by the Catalogue now in press, amounts to 1,198 against 1,187 twelve months ago. It appears, therefore, that in the number of students this year the school has held its own.

Year.	No. of Students.	Year.	No. of Students.
1865–66	72	1881–82	302
1866–67	137	1882–83	368
1867–68	167	1883–84	443
1868–69	172	1884–85	579
1869–70	206	1885–86	609
1870–71	224	1886–87	637
1871–72	261	1887–88	720
1872–73	348	1888–89	827
1873–74	276	1889–90	909
1874–75	248	1890–91	937
1875–76	255	1891–92	1,011
1876–77	215	1892–93	1,060
1877–78	194	1893–94	1,157
1878–79	188	1894–95	1,183
1879–80	203	1895–96	1,187
1880–81	253	1896–97	1,198

Students by Classes.

The aggregate number of students for 1896–97 is divided among the several classes as follows: —

Graduate students, candidates for advanced degrees	11
Regular students, Fourth Year	194
" " Third "	198
" " Second "	182
" " First "	286
Special students	327
Total	1,198

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

Class.	Regular.	Special.	Total.
Graduates of the M. I. T.	11		11
Fourth Year	194	64	258
Third Year	198	92	290
Second Year	182	125	307
First Year	286	46	332
Total	871	327	1,198

Statistics of Examinations.

Of the 1,198 students of the present year, 440 were not connected with the school in 1895–96. Of these, 263 were admitted as regular students of the first year upon the basis of their entrance examinations. The 177 remaining comprise (1) those who had previously been connected with the Institute, and have resumed their places in the school; (2) those who were admitted provisionally without examination; (3) those who were admitted by examination as special students; (4) those who were admitted on the presentation of diplomas or certificates from other institutions of college grade. In addition to the 263 who were thus admitted to the Institute on examination, and have taken their place in the school, 66 were admitted on examination, but have not entered the school. The number of this last class, always large, has this year been increased even over that of last year by the continued depression in business.

In the case of the 263 persons who were admitted on examination, and have joined the school, the results of the examinations, embracing both those of June and those of September, were as follows: —

Admitted clear	183
" on one condition	43
" on two conditions	23
" on more than two conditions	14
	263

Thirty-nine applicants were rejected.

Examinations at Distant Points.

In addition to the entrance examinations held at Boston in June and September, examinations were conducted in June at Albany, Atlanta, Buffalo, Chicago, Cincinnati, Cleveland, Detroit, Easthampton (Mass.), Exeter (N. H.), Lawrenceville (N. J.), Los Angeles, Louisville, New York, Philadelphia, Pittsburgh, Portland (Maine), Portland (Oregon), Pottstown (Pa.), St. Paul, Seattle, Washington.

Residence of Students.

States.	Candidates for Advanced Degrees.	Fourth Year.	Third Year.	Second Year.	First Year.	All Regular Students.	Special Students.	Total.
Alabama	..	..	..	..	1	1	..	1
Arkansas	..	..	..	..	1	1	..	1
California	..	1	3	1	1	6	3	9
Colorado	..	..	1	3	..	4	3	7
Connecticut	..	6	5	2	5	11	6	24
Delaware	..	1	..	1	1	3	2	5
Dist. of Columbia	..	..	3	2	6	11	6	17
Georgia	..	..	..	1	1	2	1	3
Idaho	..	..	..	1	..	1	..	1
Illinois	..	12	2	6	12	32	13	45
Indiana	..	..	..	1	1	2	1	3
Iowa	..	1	..	4	1	6	8	14
Kansas	..	..	2	..	..	2	1	3
Kentucky	..	3	2	3	2	10	2	12
Maine	..	3	4	5	8	20	7	27
Maryland	..	2	2	2	3	9	..	9
Massachusetts	11	119	130	106	179	545	185	730
Michigan	..	1	2	2	1	6	..	6
Minnesota	..	3	..	1	..	4	3	7
Missouri	..	1	..	2	4	7	4	11
Montana	..	..	..	..	1	1	2	3
Nebraska	..	..	1	..	..	1	1	2
New Hampshire	..	3	6	3	6	18	8	26
New Jersey	..	1	3	3	3	10	3	13
New York	..	12	13	7	15	47	22	69
North Carolina	..	..	..	..	1	1	..	1
Ohio	..	6	6	3	5	20	8	28
Oregon	..	..	..	1	2	3	1	4
Pennsylvania	..	7	4	6	12	29	13	42
Rhode Island	..	6	2	4	3	15	5	20
South Carolina	..	1	..	..	3	4	2	6
Tennessee	..	..	1	..	..	1	..	1
Texas	..	..	1	..	1	2	..	2
Utah	..	..	..	1	..	1	1	2
Vermont	..	1	..	2	2	5	2	7
Virginia	..	..	2	1	..	3	..	3
Washington	..	..	..	..	2	2	3	5
West Virginia	..	..	..	..	1	1	1	2
Wisconsin	..	..	1	1	1	3	3	6
Wyoming	..	..	..	..	..	..	1	1
Foreign Countries.								
Chile	..	..	..	..	..	..	1	1
Cuba	..	..	..	1	..	1	1	2
England	..	..	..	2	..	2	..	2
France	..	..	..	..	1	1	..	1
Japan	..	1	1	..	..	2	..	2
Mexico	..	..	..	1	..	1	2	3
New Brunswick	..	..	..	2	..	2	..	2
Nova Scotia	..	1	..	..	..	1	..	1
Ontario	..	2	..	..	..	2	..	2
Quebec	..	..	1	..	..	1	1	2
Turkey	..	..	..	1	..	1	..	1
Venezuela	..	..	..	..	..	..	1	1
Total	11	194	198	182	286	871	327	1198

Thirty-nine States of the Union, besides the District of Columbia, are represented on our list of students. Of the total number of 1,198, 730 are from Massachusetts, or 60.9 per cent. of the whole; 104 are from other New England States; 364 are from outside New England. Of these, 20 are from foreign countries.

A table showing the number of students in each year, from 1890, coming from each State or Territory, and from each foreign country, may not be without interest and instruction:—

States.	1890.	1891.	1892.	1893.	1894.	1895.	1896.
Alabama	..	2	4	2	1	..	1
Arkansas	3	3	2	1	..	..	1
California	14	19	14	15	9	8	9
Colorado	4	7	7	5	8	7	7
Connecticut	31	30	27	30	29	27	24
Delaware	1	..	2	4	3	5	5
Dist. of Columbia	7	4	4	7	12	16	17
Florida	3	3	4	3	2	1	..
Georgia	2	2	3	3	2	2	3
Idaho	..	1	1	1	..	1	1
Illinois	34	32	40	39	36	42	45
Indiana	6	3	5	6	3	2	3
Iowa	9	10	10	13	10	12	14
Kansas	2	2	1	1	4	4	3
Kentucky	4	8	7	11	12	11	12
Louisiana	8	5	2	3	3	2	..
Maine	29	27	39	36	38	38	27
Maryland	7	7	6	4	4	9	9
Massachusetts	517	565	603	665	707	721	730
Michigan	16	13	10	7	8	7	6
Minnesota	12	13	13	11	9	5	7
Missouri	8	12	13	17	14	9	11
Montana	1	..	..	2	2	1	3
Nebraska	1	1	4	3	4	2	2
Nevada	1	3	3	2	2	..	..
New Hampshire	23	24	29	32	27	30	26
New Jersey	11	16	11	6	5	5	13
New Mexico	..	1	2	2	1	1	..
New York	40	40	50	52	59	64	69
North Carolina	1	1	1	..	..	..	1
Ohio	33	33	39	45	50	57	28
Oregon	1	1	2	1	1	1	4
Pennsylvania	22	26	25	31	37	36	42
Rhode Island	21	26	24	33	25	21	20
South Carolina	2	4	1	3	3	5	6
South Dakota	..	..	..	..	..	..	..
Tennessee	3	4	1	1	1	1	1
Texas	1	2	5	6	6	3	2
Utah	..	..	1	2	2	5	2
Vermont	4	5	4	5	3	5	7
Virginia	5	6	4	3	2	5	3
Washington	2	3	3	1	3	1	5
West Virginia	2	2	2	1	1	3	2
Wisconsin	10	7	5	11	6	7	6
Wyoming	..	..	..	..	..	..	1
Foreign Countries.							
Argentine Rep.	2	..	..	..	..	..	..
Belgium	..	..	1	1	1	..	..
Brazil	2	4	..	..	1	1	..
Bulgaria	1	1	1	1	..	..	..
Central America	..	1	1	1	..	1	..
Chile	..	..	..	..	1	1	1
Colombia	..	2	..	..	..	..	..
Cuba	..	..	..	1	1	3	2
England	2	1	1	1	..	2	2
France	1	1	1	1	..	..	1
Germany	..	..	..	2	1	..	..
Guatemala	..	..	1	..	..	..	..
Hawaiian Islands	4	4	2	2	..	..	..
Holland	..	2	2	2	2	..	..
Ireland	1	..	..	1	1	..	..
Japan	4	3	1	1	1	2	2
Mexico	1	1	1	1	1	1	3
New Brunswick	1	2	1	1	1	1	2
New South Wales	..	1	1	1	1	1	..
Nova Scotia	2	1	..	..	1	2	1
Ontario	1	2	2	4	4	2	2
Peru	3	1	..	..	..	..	..
Porto Rico	2	1	..	1	1	1	..
Quebec	4	4	5	5	2	2	2
Scotland	3	2	1	2	1	..	..
Spain	..	..	1	1	1	1	..
Trinidad	1	1	..	..	..	..	..
Turkey	1	2	1	..	1	3	1
Venezuela	.	1	..	1	1	1	1
Total	937	1011	1060	1157	1183	1187	1198

Residence of Massachusetts Students.

It has been said that 60.9 per cent. of our students are from Massachusetts. All the counties of the State send students to the Institute. One hundred and twenty-two cities and towns are borne on the lists. The first column of the following table shows the number of cities and towns in each county sending pupils; the second column gives the aggregate number from each county. It appears that Suffolk sends two hundred and thirty-five, and Middlesex two hundred and twenty-five pupils; Essex comes third, with seventy-nine; Norfolk, fourth, with sixty-seven.

County.	No. of Towns.	No. of Students.	County.	No. of Towns.	No. of Students.
Barnstable . . .	5	7	Hampshire . . .	2	2
Berkshire . . .	6	13	Middlesex . . .	32	225
Bristol	6	33	Nantucket . . .	1	1
Dukes	1	1	Norfolk	15	67
Essex	21	79	Plymouth . . .	12	29
Franklin . . .	2	2	Suffolk	3	235
Hampden . . .	4	10	Worcester . . .	12	26
			Total	122	730

The following is a list of the towns, forty-two in number, which send four or more students to the Institute: —

Boston . . .	228	Waltham . .	9	Lawrence . .	5
Newton . .	44	Reading . .	8	Natick . . .	5
Cambridge .	30	Taunton . .	8	Springfield .	5
Brookline . .	21	Gloucester .	7	Wakefield .	5
Newburyport	20	Melrose . .	7	Watertown .	5
Somerville .	19	Worcester .	7	Wellesley . .	5
Malden . .	16	Chelsea . .	6	Woburn . .	5
Hyde Park .	14	Concord . .	6	Essex . . .	4
New Bedford	12	Framingham .	6	Mansfield . .	4
Lowell . . .	11	Weston . .	6	Milton . . .	4
Brockton . .	10	Arlington . .	5	Pittsfield . .	4
Lynn . . .	10	Belmont . .	5	Plymouth . .	4
Salem . . .	10	Fall River .	5	Randolph . .	4
Medford . .	9	Fitchburg . .	5	Winchester .	4

The following table exhibits for ten years 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 whose names appear 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.
1887–88	720	396	324	229	95
1888–89	827	465	362	245	117
1889–90	909	557	352	255	97
1890–91	937	572	365	234	131
1891–92	1,011	624	387	258	129
1892–93	1,060	618	442	303	139
1893–94	1,157	701	456	301	155
1894–95	1,183	768	415	271	144
1895–96	1,187	778	409	266	143
1896–97	1,198	758	440	263	177

Ages of Students on Entrance.

The next table exhibits the ages of our students upon entrance, after taking out those who are repeating the first year, and eleven persons of unusual ages. These deductions

Period of Life.	1895–6.		1896–7.	
	Half-year Groups.	Yearly Groups.	Half-year Groups.	Yearly Groups.
16 to 16½ years . . .	5	—	2	—
16½ to 17 " . . .	4	9	3	5
17 to 17½ " . . .	28	—	19	—
17½ to 18 " . . .	23	51	40	59
18 to 18½ " . . .	38	—	52	—
18½ to 19 " . . .	49	87	44	96
19 to 19½ " . . .	42	—	41	—
19½ to 20 " . . .	23	65	28	69
20 to 20½ " . . .	19	—	23	—
20½ to 21 " . . .	16	35	9	32
21 to 22 " . . .	11	11	11	11
	258	258	272	272

leave two hundred and seventy-two as the number of students whose ages have been made the subject of computation. The results appear in the table above in comparison with the corresponding results of 1895–96.

From the foregoing, it appears that the average age on entrance is eighteen years and eleven months.

In this connection I present the ages, at graduation, of the class leaving us in June. The one hundred and eighty-eight members of the class were distributed among the different periods of life as follows: —

Between	20	and	20½	2
"	20½	"	21	7
"	21	"	21½	11
"	21½	"	22	18
"	22	"	23	51
"	23	"	24	48
"	24 and over			51
	Total			188

The special students this year constitute twenty-seven per cent of the whole body, as against twenty-eight per cent last year, and twenty-nine per cent the year before.

Graduates of Other Colleges.

The number of students who are graduates of this and other institutions is eighty. Of these, eleven are our own graduates, candidates for advanced degrees; sixty-nine are graduates of other institutions, pursuing courses of study with us, either as regular or as special students. Fourteen are graduates of Harvard University; five of Amherst College; four of Yale University; three each of Brown University, Georgetown University, Smith College, and Wellesley College; two each of Iowa State College, Johns Hopkins University, and Princeton University; while the following institutions are represented on our list by a single graduate each: Universities of California, Chicago, Michigan, Minnesota, Rochester, Santiago, Vermont; Cornell, Drake, Indianapolis,

and Norwich Universities; Boston, Carleton, Central Turkey, Colorado, Dartmouth, Dickinson, Hampden-Sidney, Middlebury, St. Johns, Trinity, Tufts, Williams Colleges; Colegio de Carreras; Throop Institute; U. S. Artillery School; and Virginia Polytechnic Institute.

The graduates of the Institute who are candidates for advanced degrees are Messrs. Charles William Berry, of the class of '95, the holder of the Swett Fellowship, in Physics, George Vincent Wendell, of the class of '92, the holder of the Savage Fellowship, in Physics, both studying abroad; Miss Margaret Eliot Dodd, of the class of '92, Mr. Simeon Curtis Keith, Jr., of the class of '93, Mr. George Linder Bixby, of the class of '95, Messrs. Henry Cummings, Jr., Ralph Coolidge Henry, Herbert Edwards Smith, Albert Ernest Smyser, James Smith Smyser, William Henry Whitten, Jr., all of the class of '96. Of the seventy-one graduate students not candidates for advanced degrees thirty-two are regular students, — viz., twelve in the fourth year, thirteen in the third year, six in the second year, one in the first year. Of the thirty-one graduates who are regular students in the three upper classes, one takes both Mechanical and Electrical Engineering; one takes both Mechanical and Chemical Engineering; eight take Civil Engineering; two, Mechanical Engineering; one, Mining Engineering; five, Architecture; one, Chemistry; eleven, Electrical Engineering; and one, Chemical Engineering.

Women as Students at the Institute.

The number of women pursuing courses with us is seventy-one. Of these, eight are graduates of colleges. Of the total number, one is a candidate for an advanced degree; two are regular students of the fourth year; four, of the third year; five, of the second year; five, of the first year. Fifty-four are special students. Of the eleven regular students of the upper classes, four take Course IV., Architecture; three, Course V., Chemistry; two, Course VII., Biology; two, Course VIII., Physics. Of the special students, thirty-four devote them-

selves to Biology, eight to Chemistry, six to Architecture, two to General Studies, one to Physics, one to Geology, one to Mathematics, and one to Drawing.

THE COURSES OF INSTRUCTION.

The following table presents the numbers of the regular students in the second, third, and fourth years, by courses.

Year.	Civil Engineering.	Mechanical Engineering.	Mining Engineering and Metallurgy.	Architecture.	Chemistry.	Electrical Engineering.	Biology.	Physics.	General Course.	Chemical Engineering.	Sanitary Engineering.	Geology.	Naval Architecture.	Total.
4th Year Class	29	41	7	18	22	40	2	4	7	13	4	..	8	194*
3d " "	31	46	8	28	22	34	2	5	4	7	3	..	9	198*
2d " "	39	36	9	19	22	32	3	2	..	14	1	..	8	182*
Total . .	99	123	24	65	66	106	7	11	11	34	8	0	25	574*

The following table shows the figures of the total line in the foregoing table, in comparison with the corresponding figures for the next ten preceding years: —

Year.	Civil Engineering.	Mechanical Engineering.	Mining Engineering and Metallurgy.	Architecture.	Chemistry.	Electrical Engineering.	Biology.	Physics.	General Course.	Chemical Engineering.	Sanitary Engineering.	Geology.	Naval Architecture.	Total.
1886 . . .	45	75	19	13	24	52	4	2	8	..	..	..	..	242
1887 . . .	50	89	16	18	23	61	5	6	14	..	..	..	..	282
1888 . . .	71	100	12	21	28	74	4	5	12	11	..	..	..	338
1889 . . .	79	99	14	30	29	91	9	5	12	14	6	..	..	388
1890 . . .	79	95	18	27	27	105	11	4	13	18	7	3	..	407
1891 . . .	81	104	17	33	23	108	11	5	19	28	9	3	..	441
1892 . . .	76	106	19	37	35	112	9	5	16	34	5	3	..	457
1893 . . .	78	97	22	50	39	141	4	10	19	31	10	2	8	511
1894 . . .	88	111	19	48	50	137	5	9	19	35	13	2	20	556*
1895 . . .	88	118	25	67	59	126	7	11	14	25	10	3	22	575
1896 . . .	99	117	24	65	66	106	7	11	11	34	8	..	25	573

* Deducting those counted twice.

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 or Biology.	Physics.	General Course.	Chemical Engineering.	Sanitary Engineering.	Geology.	Naval Architecture.	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	5	1	3	..	..	..	..	..	..	..	..	..	19
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
1890	25	27	3	5	13	..	18	3	2	6	..	..	..	..	102
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	25	34	10	24	16	..	48	3	3	7	7	4	3	5	188*
Total	319	366	145	109	176	1	286	29	23	60	49	17	7	10	1,594
Deduct names counted twice															10
Net total															1,584

* Deducting names counted twice.

The following table shows, by classes and by courses, the number of regular students who have registered themselves

as electing to distribute the required studies and exercises over the period of five years.

Year.	Total.	Course.												
		I.	II.	III.	IV.	V.	VI.	VII.	VIII.	IX.	X.	XI.	XII.	XIII.
1st . .	3	..	..	..	..	..	..	..	..	..	..	..	..	..
2d . .	10	4	1	..	1	1	2	..	..	..	..	..	..	1
3d . .	11	2	4	1	1	1	..	..	1	..	..	..	..	1
4th . .	12	..	2	..	1	..	7	..	1	..	..	..	..	1
5th . .	6	..	..	1	..	1	1	..	1	1	..	..	..	1
	42	6	7	2	3	3	10	..	3	1	..	..	..	4

Classification of Special Students.

Our special students can, of course, not be classified systematically; but the following table exhibits the number of such students pursuing each particular branch of study: —

Applied Mechanics . . .	65	History	78
Architecture	55	Language	161
Biology	51	Mathematics	162
Chemistry	127	Mechanical Engineering .	79
Civil Engineering . . .	39	Mining Engineering . .	11
Drawing	157	Physics	145
Electrical Engineering . .	30	Political Science	69
English	104	Shopwork	75
Geology	27		

The following is the number of students, either regular or special, pursuing certain leading branches of study, in each of the four years, as follows: —

	First Year.	Second Year.	Third Year.	Fourth Year.	Total.
Mathematics . . .	336	237	131	64	768
Chemistry	382	81	67	63	593
English	306	256	12	13	587
French	192	75	57	7	331
Physics	..	265	236	170	671
German	73	197	151	3	424
Shopwork	19	115	67	72	273

The most noticeable feature of the foregoing tables is the large falling-off in the number of students taking mathematics, especially in the third and fourth years. Last year the total number of students in this department was 881; this year it is only 768. Last year the number of students of the third and fourth years together taking mathematics was 285; this year it is only 195. The chief reason for this is found in the increased requirements in mathematics, at entrance. I ought to add that, while there has thus been a reduction in the total number of students taking mathematics, owing to the increase in entrance requirements, the number of students taking advanced mathematics has steadily advanced during the few years; and still further progress may be anticipated. In the other departments named, the number of students holds its own, as in the case of the modern languages, or shows an increase, as in the case of chemistry, physics, or shop-work.

Changes in the Faculty and the Corps of Instruction.

The year has fortunately passed without the loss of any member of the Faculty from any cause. Professor Holman's health most unfortunately remains such as wholly to incapacitate him for work with his classes. The affliction which has been so heroically borne by this ripe scholar and gifted teacher is a source of sorrow to all his associates in the Faculty and in the corps of instruction, as it must be to all his former pupils and his many friends. Even infirmity and confinement have not sufficed to fetter his masterly hand; and the last two years of sickness and pain have witnessed the preparation of several important professional treatises.

Within the Faculty several promotions have been made. The following associate professors have been raised to the rank of full professors, namely: Peter Schwamb, S.B., to be Professor of Mechanism and Director of the Workshops; C. Frank Allen, S.B., to be Professor of Railroad Engineer-

ing; Alfred E. Burton, S.B., to be Professor of Topographical Engineering; Dwight Porter, Ph.B., to be Professor of Hydraulic Engineering. Assistant Professor Linus Faunce, S.B., has been promoted to Associate Professor of Drawing. The Faculty has been reinforced by the following promotions from the corps of instructors, namely: George H. Barton, S.B., to be Assistant Professor of Geology; William H. Lawrence, S.B., to be Assistant Professor of Architecture; Arthur G. Robbins, S.B., to be Assistant Professor of Highway Engineering; Joseph J. Skinner, Ph.D., to be Assistant Professor of Mathematics.

The following is the academic and professional history of the several members of the Faculty who have received promotions during the year and of the new instructors appointed:

Professor Allen was graduated from the Institute in 1872 in Civil Engineering. For five years he was engaged in the active practice of his profession, on the Water Works and Sewerage of Providence, R. I., the Water Works of Newton, and the Sewerage of Boston. He then went west, and for ten years was occupied in various capacities on the Atchison, Topeka and Santa Fé Railway in Kansas, Colorado, and New Mexico, and was for a time in the employ of the Mexican Central Railway. He also engaged in some private practice during this period, and was for a time Chief Engineer of the Las Vegas (N. Mex.) Water Works. In 1887 he returned to Boston to accept the position of Assistant Professor of Railroad Engineering at the Institute, and in 1889 was made Associate Professor. Professor Allen is a member of the American Society of Civil Engineers, a Director of the Massachusetts Highway Association, and Secretary of the Society for the Promotion of Engineering Education, besides being a member of other scientific bodies.

Professor Peter Schwamb was graduated in 1878 from the Institute of Technology in the department of Mechanical Engineering. In 1879 he was draughtsman for the Howe Scale Co., Rutland, Vt.; from 1880 to 1883, draughtsman for the Hinck-

ley Locomotive Co., Boston. In 1883 he became Instructor in Mechanical Engineering in the Institute of Technology; from 1884 to 1888 he was Assistant Professor of Mechanism; in 1888 he was appointed Associate Professor of Mechanism. He has been Director of the Workshops since 1883.

Professor Burton was graduated from the Civil Engineering Department of Bowdoin College in 1878, and for a year or more thereafter practised as a land surveyor in Maine. In 1879 he entered the service of the Coast Survey, where he remained for three years, first as topographical draughtsman, and then as topographer. In 1882 he accepted the position of Instructor in Civil Engineering at the Institute. In 1884 he was made Assistant Professor, and in 1889 Associate Professor of Topographical Engineering. Professor Burton was in 1895 appointed by Governor Greenhalge a member of the Massachusetts Topographical Survey Commission, a position which he still holds.

Professor Porter was graduated from the Sheffield Scientific School of Yale University in 1880, and at once entered the service of the government as an expert in the water power investigation of the Tenth Census. He was engaged upon this work for four years, and published numerous reports on the Hydrography and Water Power of various portions of the country. He came to the Institute in 1883, and served for a short time as Instructor in Mathematics, but later became Instructor in Civil Engineering. In 1887 he was appointed Assistant Professor of Hydraulic and Sanitary Engineering, and in 1890 Associate Professor. Professor Porter has delivered lectures on sanitary subjects at the Pratt Institute of Brooklyn and at the School of Sociology at Hartford, and, in addition to his work at the Institute, has been consulted as an expert in a great variety of matters relating to Hydraulic and Sanitary Engineering, among which may be mentioned the investigation of the sanitary condition of tenement houses in Boston, which he undertook in 1886, and the question of damming the Charles River, which came up so prominently last year. Professor Porter is a member of the American

Society of Civil Engineers, as well as of various other technical associations.

Professor Faunce, a graduate of the Institute in 1877, and subsequently engaged in the engineering department of the New York & New England Railroad, was appointed Assistant Professor of Drawing in 1884, and placed in charge of the drawing of the first-year, and of the second-year Descriptive Geometry.

Professor Robbins was graduated from the Institute in 1886, and has since that time been engaged continuously in teaching, first as Assistant, and then as Instructor in Civil Engineering. For several years past he has had charge, under the general direction of Professor Allen, of the instruction in Highway Engineering.

Professor Barton was graduated in the department of Mining Engineering and Geology in 1880. After spending a year as Assistant in Drawing, he went to the Hawaiian Islands as Assistant on the Government Survey, where he remained two years. He was then called to return to the Institute as Assistant in Geology, and, while occupying this position, devoted his time to work in Mineralogy, Structural Geology, and Blowpipe Analysis. In 1886 he was appointed Instructor in Determinative Mineralogy; in 1892 Instructor in Geology. He has given the instruction in the Blowpipe Laboratory and in Micro-Lithology, and has taught Structural Geology to the students in the department of Civil Engineering. For nine years he has given lecture-room and field instruction in Mineralogy or Geology to large classes in the "Teachers' School of Science" of the Boston Society of Natural History. He has also extended his studies of geologic phenomena by travel, and by his original investigations when employed by the United States Geological Survey. During the past summer he was a member of the party which made a special study of the glaciers and other features of the Umanak district in Greenland.

Professor Lawrence was graduated from the Institute in 1891, and was at once made Instructor in Architecture. His

active interest, the accuracy of his work, and his ability as a teacher have been highly appreciated.

Dr. Skinner, a graduate of the Sheffield Scientific School of New Haven, was appointed Instructor in Mathematics in 1885.

While no vacancy has occurred in the Faculty of the Institute, the corps of instructors has lost one of its oldest members, — Mr. James Hugh Stanwood, for eight years Assistant or Instructor in Civil Engineering, who died May 24th last, after a lingering illness. Mr. Stanwood was born in 1860 in Brunswick, Maine, and after receiving his earlier education in the public schools of Portland, entered in 1879 the office of Edward C. Jordan, at Portland, where he was engaged for over a year. He was afterwards in the office of the City Engineer of Portland, in the employ of the Maine Central Railroad and in other engineering work. He entered the Institute in 1883, and graduated four years later, having worked during the summer vacations with the Maine Central Railroad. Immediately after graduating, he entered the office of the Philadelphia Bridge Works, where he remained for over a year as Assistant to the Designing Engineer. In 1888 he returned to the Institute, where he has since remained. Mr. Stanwood was extremely faithful in the discharge of his duties, and his associates and former students remember him with affection and respect.

Mr. Henry Nash Dickinson, who has been Instructor in English at the Institute from 1891 to 1896, has resigned to engage in secondary teaching at Norfolk, Conn. Mr. Edward Robinson, of the class of '91, formerly Instructor in Mechanical Drawing and Descriptive Geometry, has accepted an appointment for similar work at the new Clarkson School of Technology, Potsdam, N. Y. Mr. Simeon C. Keith, Jr., of the class of '93, is now occupied with various commercial interests connected with Bacteriology, but is continuing his studies as a candidate for the Master's degree. Mr. Joseph P. Lyon, Instructor in Civil Engineering, has resigned during the year, to enter professional practice. Mr. Henry E.

Crampton, Instructor in Biology, has also terminated his connection with the Institute, receiving an appointment as University Fellow at Columbia University.

The following gentlemen, Assistants of last year in the several departments named, have been appointed Instructors: George B. Haven, S.B., '94, and Alexander W. Moseley, S.B., '91, in Mechanical Engineering; Frank P. McKibben, S.B., '94, in Civil Engineering; James F. Norris, Ph.D., in Organic Chemistry; Joseph W. Phelan, S.B., '94, in General Chemistry; Samuel C. Prescott, S.B., '94, in Biology. William J. Drisko, S.B., '95, in Physics; Arthur W. Weysse, Harvard A.B., '91, A.M., '92, Ph.D., '94, has been appointed Instructor in Biology. He studied in 1894–95 at the Universities of Leipsic and Berlin; in 1895–96 at Paris and in the Zoölogical Station at Naples. He has been Assistant in Zoölogy at Radcliffe and in Botany at Harvard, and has published several papers on zoölogical subjects.

The following named Assistants have been appointed for the current year: Reuben E. Bakenhus, S.B., '96, Minor S. Jameson, S.B., '96, Charles M. Spofford, S.B., '93, and Harold C. Stevens, S.B., '96, in Civil Engineering; Amadeus W. Grabau, S.B., '96, in Geology; Leonard H. Goodhue, S.B., '96, in Analytical Chemistry; Harrison W. Hayward, S.B., '96, in Industrial Chemistry; Albert J. Wells, S.B., '96, in Mechanical Drawing; Edward M. Bragg, S.B., '96, and Frank B. Masters, S.B., '95, in Mechanical Engineering; William L. Root, S.B., '96, in Oil and Gas Analysis; George K. Burgess, S.B., '96, William D. Coolidge, S.B., '96, and Ralph R. Lawrence, S.B., '95, in Physics; Clarence W. Perley, S.B., '96, in Biology.

Statistics of the Corps of Instructors.

The Catalogue of 1896–97 shows the number of instructors of all grades to be one hundred and twenty-seven, inclusive of those concerned with the mechanic arts, but exclusive of those who are announced as lecturers for the year only. The addi-

tion of these raises the total to one hundred and fifty-three. The following table shows the distribution among the several classes of instructors, in comparison with last year: —

	1895–96	1896–97
Professors	19	23
Associate Professors	10	7
Assistant Professors	18	21
Instructors	53	52
Assistants	21	24
Lecturers	26	26
Total	147	153

The Library.

The accessions during the year were 4,433, which may be classified as follows: —

By purchase	1,647
" binding	580
" gift	2,206
Total	4,433

After deducting from the above the number of books, pamphlets, etc., reported lost, worn out, or removed from the shelves for other causes, the net accessions during the year are found to amount to 4,411. The following table shows the net accessions of books, pamphlets, and maps to each of the libraries of the Institute, together with the cost of those purchased by the departments. The table also shows the total number of volumes, and of pamphlets and maps taken together, in each library, September 30, 1896. To a certain extent the pamphlets are counted twice, for, according to the custom established in previous reports, a collection of pamphlets bound together in one volume is counted as one in the enumeration of the volumes, while at the same time each pamphlet in the volume is counted as one in the list of pamphlets.

TABLE SHOWING THE NET ACCESSIONS FOR THE YEAR 1895–96, WITH THE COST OF THE SAME AND THE TOTAL CONTENTS OF THE LIBRARIES OF THE INSTITUTE ON SEPTEMBER 30, 1896.

LIBRARIES.	Vols. added.	Pamph. added.	Maps added.	Cost (Dept.)	Total Vols.	Total Pamph. and Maps.
General	422	277		$ 340.44	4,654	3,112
Engineering	621	90	329	1,023.53	6,671	3,121
Mining	168	28		180.38	1,686	303
Architectural	232	10		294.61	1,879	181
Chemical	336	51		450.66	6,565	1,437
Biological	134	20		201.38	1,802	351
Physical	587	24		643.24	5,385	656
Economics and History	616	132	6	619.45	7,973	2,975
English	170			160.42	2,184	36
Geological	94	20	37	103.90	1,667	761
Margaret Cheney Room	7				575	13
Totals	3,387	652	372	$4,018.01	41,041	12,946

The above table shows that at the end of the academic year there was a total of 41,041 volumes in the libraries, and that there were also 12,946 pamphlets and maps, making a grand total of 53,947.

During the year there were 1,178 orders sent out for the purchase of books. Ninety orders were returned to heads of departments as duplicates; of these five were reordered; 1122 volumes were bound; 412 stamped on the back with the shelf number and the initials of the Institute. The total cost of binding was $1,263.42. To the main catalogue 2,561 cards have been added, and a slightly larger number, in the aggregate, to the catalogues of the departmental libraries. The total number of cards now in the main catalogue is 37,432.

Two hundred and thirty-nine books were received for inspection, of which ninety-nine were purchased. It has not been possible to keep a record of the number of books borrowed, except in the Chemical Library, and from this one there were taken out for use at home more than 1,030 books during the nine months from January 1st to September 30th.

The Institute has been so fortunate as to receive during the year gifts amounting to 2,206 books, pamphlets, and maps. Among the most noteworthy of these may be mentioned, — thirteen volumes by bequest from the estate of the late S. R. Urbino, including Brehm's Thierleben, six volumes; a complete set of the Encyclopedie-Roret, 143 volumes, from Mr. George L. Roberts; from the U. S. Coast and Geodetic Survey, 252 charts, completing our set; 119 volumes of architectural books from Mrs. Henry Draper, including Van Ysendyck, Documents Classés de l'Art dans les Pays-Bas, five volumes; Histoire de l'Art pendant la Renaissance en Italie, three volumes; Dieulafoy, L'Art Antique de la Perse, five volumes; Havard, La France Artistique et Monumentale six volumes; Gotch, Architecture of the Renaissance in England, two volumes; the first twelve volumes of the Architectural Association Sketch-book; and Van Stegmann and Geymüller, Die Architektur der Renaissance in Toscana, a beautiful work, of which thirty-six parts have been issued.

The assistants in charge of the Chemical and Physical Libraries have been instructed during the year by the Librarian in the art of cataloguing books; and they now write all the catalogue cards for their respective libraries. This plan was found to be so successful and to increase so much the general efficiency of the library service, that it is being extended to the Engineering Library. The Librarian is still obliged, however, to write the catalogue cards for the other eight libraries of the Institute, besides doing an immense amount of other purely clerical and more or less mechanical work, from which it is desirable that he should be relieved as soon as arrangements to that end can be made.

Advanced Degrees.

During the past year, a measure which it is believed will have important scholarly results has been adopted by the Faculty after long and careful consideration. The situation out of which the new procedure arose may be illustrated as follows: A young man has graduated from the Institute, let us say, in Mechanical Engineering. His scholarly ambitions and his financial means concur to induce him to remain for an additional year of study. Should his plans embrace systematic, advanced work in the course from which he has graduated, as would be likely to be the case with a graduate in Chemistry or in Architecture, for example, he would naturally become a candidate for the degree of Master of Science. But it has been found in our experience that the larger proportion of the not large number of students thus able and desirous to pursue additional studies at the Institute, prefer to take the work belonging to some other course more or less closely allied to that from which they graduated. For example, a student having finished the Mechanical or Chemical Engineering course is likely to choose work in Electrical Engineering, to constitute at least the greater part of his additional year's work. Under the former rules of the Faculty, he might, at the end of a year of successful study, receive, not the Master's degree, but the Bachelor's degree in his new department. By the new rule it is rendered possible for a graduate in one department, subject to conditions established for the purpose of guarding the scholarly character of the higher degree, to obtain, not a second Bachelor's degree, but the degree of Master, while pursuing work mainly in another department from that in which he graduated. There is still required, however, in general a certain amount of strictly advanced work; while the thesis presented is expected to be of a higher order than would be exacted in the case of a first degree.

The consideration which chiefly moved the Faculty to make this important modification of the pre-existing require-

ments for the Master's degree was that a student who had successfully completed any one of the thorough courses of study at the Institute, and had taken his Bachelor's degree, would, as a matter of course, take up and carry on the fourth year's undergraduate work of another department in a stronger and more masterly way than would have been possible but for his previous training and preparation, and his maturer age. In other words, though the subjects studied in the additional year are to a considerable degree under-graduate studies to the men of that course, they become, in a certain and high sense, graduate studies to the graduate student, by reason of his superior age and qualifications. Certainly, no one can question that a man who has taken an additional year of study and has handsomely completed two courses at the Institute is a riper scholar and a better equipped professional man than if he had only completed a single course. Why, then, should he not receive an acknowledgment of this addition to his scholarly character and standing?

While for the foregoing reasons the requirements for the Master's degree are made more liberal than heretofore, the conditions imposed are, it is believed, such as will protect the degree against any tendencies to a real lowering of the standard. I am happy to be able to add that the more liberal provisions governing this matter have already resulted in a considerable increase in the number of applications for the Master's degree.

Double Degrees.

Another matter of much scholarly interest which has been dealt with by the Faculty during the past year, has been the question of students receiving the Bachelor's degree in two departments at the same time. This has been done, and the degrees conferred accordingly. But, while the Faculty are not disposed to take the position that in some cases this may not be done to the advantage of the student, they yet feel that there is danger of abuse arising from this source.

Since it is naturally regarded as a feather in a man's cap to take two degrees at once, there will always be some ground to fear that a student may attempt this, not for the sake of a larger knowledge and a broader culture, but for the distinction attending it, with the result either that he may fail in both courses, or, what is more probable, that he will get through all the studies and exercises of both courses, but without doing any part of the work very well. It does not need to be said that it is far better for a young man to take one course in a masterly way than to take two in a somewhat halting fashion, even though the actual requirements for the degree be met. At the same time, the Faculty are aware that cases occur where a student can do two courses at once and do them thoroughly; and even that the two may mutually support and supplement each other.

Under the foregoing circumstances, it seemed to the Faculty desirable to take the matter up for systematic regulation. The amendment of the Faculty rules which has been adopted is the result of much consideration given to this subject, and will, it is believed, prevent students from undertaking a double course unless the reasons therefor shall, in their individual cases, be strong and clear. The rule now reads as follows:—

"An applicant for the degree of Bachelor of Science in two courses at the same time must have made application for such candidacy not later than November 1st, next preceding his graduation. Such application shall be referred to a special committee of the Faculty to report as to the eligibility of the candidate, and, in case his application is approved, to have the oversight of all of his work for the remainder of the year, and to report to the Faculty, at the close of each term, as to the character of the work done. The committee shall decide as to the time and manner of carrying on the thesis-work required, and may in special cases recommend that the candidate be allowed to conduct the two theses at the same time."

Scholarships.

The scholarship resources of the Institute have been considerably enlarged. It will be remembered that the grant, in 1895, of $25,000 per year, for six years, by the General Court of Massachusetts, was accompanied by a special appropriation for ten free scholarships for six years, supplementing the twenty scholarships established by the Act of 1887. The demand for these scholarships had been so great that, without any initiative on the part of the Institute, an act was passed at the session of 1896, establishing forty permanent State scholarships, in place of the arrangement, in part permanent and in part temporary, stated above. Every senatorial district in the State is now permanently entitled to representation in the Institute; and it is hoped that the few districts which at present send no applicants may avail themselves of the benefits of this provision of the Commonwealth. By the will of Mrs. Ann White Vose, the Institute has received for the aid of needy and deserving students a sum amounting to about $50,000. Scholarship awards for the present year have amounted to nearly $14,000; and still it has hardly been possible to provide even for the urgent cases.

By the generosity and kindly interest of Mr. Charles H. Dalton, long a member and once Treasurer of the Institute of Technology, a fund of $5,000 has been established for the endowment of a graduate scholarship in Chemistry, the income to be used for the payment of fees of American male students, graduates of the Institute, who may wish to pursue advanced chemical study and research, especially applicable to textile industries.

In memory of the late William Hall Kerr, of the class of 1883, his widow, formerly, as Miss Alice M. Getchell, a special student at the Institute, has established a fund of $2,000, the income to be applied to the maintenance of a special library of machine design.

The Technology Club.

While the matter is not one which officially comes within the cognizance of the Corporation, I know the members will be glad to learn, if they have not been previously advised, of the formation of a social club, to be known as The Technology Club, constituted of such members of the Corporation, the Faculty and the corps of instructors, and of such past students of the Institute as may desire to join, together with a certain number of students elected from the several classes, and especially from the upper classes. The organization of the club was due to a feeling, long entertained, that opportunities for social intercourse, and for conference regarding matters of interest to the school, should, in some way, be provided. After full discussion the enterprise was launched last spring; Mr. James P. Munroe, long the Secretary of the Institute, was elected President; the house No. 71 Newbury St., directly opposite the vacant space between the Rogers Building and the Natural History Building, was rented for a term of years and fitted up simply but pleasantly for social uses. At the beginning of the present school year, the Club was opened, and has now been in full operation for nearly three months, apparently with the highest success, notwithstanding the fact that the fees are exceptionally low. Those who have charge of its fortunes have shown as much prudence as energy. They are thoroughly devoted to the interests of the Institute; and they are bent on making the Club a force for good in the development of the school.

Official Advisers.

In a previous report, I referred to the system of advisers to new students which had been adopted by the Faculty, not with any view to appointing guardians for the young men, or to taking any degree of responsibility whatever for their conduct and deportment, but simply as a means of introducing each student coming for the first time to the school to some

member of the Faculty or instructing staff who would hold himself under obligation to afford such information and advice as might be asked. As was stated in my former reference to this subject, it was not expected or desired that this system should amount to a very great deal. It could not do this without interfering with that responsibility for their own lives, that accountability as ordinary citizens of the community, which has been a fundamental principle in the government of the Institute. But it was believed when this step was taken that the appointment of official advisers, for the limited objects in view, would be useful and helpful to many new students, and that this advantage would be increased as the advisers assigned to the duty should have larger experience in dealing with young men in this way. These expectations have been justified by the result. There have been no drawbacks to the operation of this system, and its whole effect has been for good. It is believed that the influence upon the students of the school has been not inconsiderable.

The Y. M. C. Association.

I am happy to say that still further efforts are being made for the purpose of assisting the student, on newly coming to the Institute, to order his life in Boston to the best advantage; and, also, to improve the general social character of the school. The Young Men's Christian Association of the Institute has especially directed its energies to the first mentioned object. The Association issues a small manual, containing much information useful to the new-comer. It has recently, for the second time, held its annual reception for new students, whether of the first-year class or not, an occasion of much interest and doubtless of real practical influence for good. The present year the Association has made the important advance of taking an ordinary dwelling-house at the South End and making it a club-house, most of the rooms being occupied by the officers and other members of the Association, as their ordinary living-rooms, while the

public rooms are freely open to students. This certainly shows a most commendable spirit on the part of the young men concerned, who have as good an opportunity as they could possibly desire to exert an excellent influence upon the social life of the school. I do not see why several such centres of benevolent activity may not in time be established in different parts of the city where our students most congregate. One additional direction of effort by the Young Men's Christian Association is specially worthy of notice. This is the attempt to secure pleasant and wholesome homes for newcomers. The officers and the committees of the Association have taken a great deal of pains to secure information as to houses into which students may be introduced to the greatest advantage, and this information is freely communicated to all who care to avail themselves of it.

The Institute was represented at the annual meeting in Washington of the Association of American Agricultural Colleges and Experiment Stations by Professors Allen and Tyler. The principal matter affecting the interests of the Institute was the proposed establishment of Engineering Experiment Stations, corresponding to the Agricultural Experiment Stations established in 1887. The Faculty accepted the invitation of the College of New Jersey to send a delegate to the celebration of its one hundred and fiftieth anniversary, in October of the present year. The Institute was represented by the President on that very interesting occasion when the College of New Jersey became Princeton University.

Entrance Requirements.

Four years ago, the Catalogue contained the statement that the Faculty were considering the expediency of making a further advance in entrance requirements and that it was probable such a step would be taken at no distant date. This announcement was made for the purpose of giving the preparatory schools fair notice and enabling them to consider

the question with due deliberation. At the present time, the Faculty have the matter under active discussion; but no definite conclusion has been reached. Inasmuch as the question of entrance examinations is one which is at present undergoing very active agitation, and as the Institute of Technology has been somewhat misrepresented in the course of discussion, it seems to me desirable to state just what our position is upon this matter.

The arguments in favor of an advance in the entrance requirements are strong. It is unquestionable that we should do our work better if our students came to us with the amount of preparation contemplated, and that the high schools of the land ought to be so organized and officered that they could give this instruction without difficulty and without further delaying the preparation of their pupils for college. Just here, in the last point mentioned, lies the main difficulty and perplexity of the subject. Important as the Faculty of the Institute consider the additional preparation to be, they will be entirely unwilling to ask it, if, after much discussion and conference with the secondary schools, it shall appear that the effect of such increased requirements would be to increase appreciably the age of our students at entrance. That age, which is now about eighteen years and eight or nine months, is fully as high as is considered to be for the best scholarly development of the pupils. Such an average means that a large number enter at an age considerably greater.

Further to increase the average age on entrance, or further to procrastinate the entrance of men above the average age, would, in the opinion of the Faculty, be distinctly and highly objectionable. They believe that students should not be held back in the secondary schools after they have reached the degree of maturity necessary for taking our work, even if it be to give them still further high-school preparation. The average boy of nineteen years has outgrown the spirit of the secondary school. If compelled to stay longer, his mental growth is retarded or possibly encounters a permanent check. The pupil who is held back to finish his high-school course

until he is twenty, is probably not more but less fortunate than one who comes to us at eighteen, even with a somewhat less complete preparation. When a certain period has been reached, youth, with its pliability and adaptability, is of more value to a student of this school, at least, than a certain amount of additional knowledge and the mental training involved in the acquisition of that knowledge.

The question, therefore, whether the advance in entrance requirements at the Institute which has so long been under consideration shall soon be adopted, depends mainly upon the answer to the question whether the preparatory schools can so deal with the matter as to send us pupils, equally well trained and equipped in other respects, who shall bring with them the additional preparation required, at an age not appreciably greater than that of to-day. This is not on its face impossible. Better and higher results can often be reached without any greater strain and in no longer time, simply by a better arrangement and systematization of work; by omitting traditional topics which are of no real importance; and by reapportioning the time to be expended upon the different parts of a subject. To our inquiries many of the preparatory schools have returned cordial and encouraging answers. Their desire is to make the advance which has been suggested. On the other hand, it is necessary that we should proceed with great caution in the interest of less fortunate schools, which, with a smaller staff of teachers and fewer resources, have all they can do at present to meet our requirements. To demand of them more may mean either a mere cramming for our examination, which we should deprecate, or the introduction of an intermediate year at some academy or distant high school. This last would involve an expense which many students would not be able to bear, and would be, on many other accounts, far from desirable.

ENGLISH.

A new departure has been taken by the English Department in the matter of the teaching of composition. There

are students who have elsewhere covered the first-year requirements in rhetoric, or have even succeeded in passing the examinations at the Institute, yet who have serious faults in the mechanics of writing. To aid these men in overcoming their defects, and to insure that no graduate shall be unable to write clear and correct business English, the department has undertaken the special individual supervision of these students. The experiment is being tried of calling to account men who are noticeably unable to spell or to write with reasonable correctness, and of insisting that effort be made to correct these faults. In connection with this, the chemistry notebooks of first-year students are examined weekly by the English Department to secure their being written with care and accuracy. By the coöperation of the instructors of the Department of Architecture, arrangements have also been made to have the papers of these students criticised for the English. It may be added that the increasing responsiveness of students to the work in literature is especially gratifying, and can hardly fail to lead to increased efficiency in all the work of the English Department. The work has been taken up with very great zeal by Professor Bates and his accomplished assistants. The amount of labor which they have brought upon themselves has been very great; and I trust that the financial condition of the school will soon permit of a reinforcement of the staff in English, so that every student of the Institute may receive no inconsiderable amount of individual attention from the instructors in this department.

Mathematics. — Still further changes in the arrangement of the work of the Mathematical Department have resulted from the advance in entrance requirements, which took effect in 1894, and which has now enabled the class of '98 to complete integral calculus during its second year. The time thus set free in the first term of the third year has been used in part for differential equations. Students in Electrical Engineering now complete this subject in the first term of the third year, instead of in the final term of their course, as heretofore.

The students in Mechanical Engineering, Chemical Engineering, and Naval Architecture take a brief course in differential equations, of particular value for their subsequent work in mechanics. An elective course was given last year by Dr. Woods on the theory of functions, and has been succeeded this year by a course on the theory of surfaces, open to advanced students and members of the instructing staff. The resources of the department have been much enlarged by the purchase of models. The collection is now ample for our own needs, and is of great value for certain branches of advanced work. Professors Woods and Bailey have in preparation a text-book on analytic geometry which will be used by the first-year class during the second term.

Modern Languages. — The work of the Modern Language Department has been carried on by Professor van Daell and his associates during the past year successfully, but without any notable change, yet with that degree of progress which comes from continuous attention and experience. In one direction, however, the modern language work of the Institute shows a very gratifying gain. I shall, in the following pages, call attention to several instances where important departments of the school are giving their students of the upper classes considerable practice in the reading of journals and scientific papers in French and German. This has always been done as far as the time and strength of the instructing staff would allow; but the later developments of the school have allowed it to be carried on during the past two or three years to a much larger extent. Nothing could be more desirable, and I trust to be able to report further progress another year.

Military Science and Tactics. — The instruction in Military Science, both theoretical and practical, has been carried on most fortunately during the year, under the able and judicious direction of Captain Bigelow. The recent improvement in this service has been truly remarkable. The spirit of the department has steadily risen, the instruction has constantly

become more scientific, while the practical results, as seen in the armory drill, are better than ever before. In truth, Captain Bigelow's two years of service here have made a distinct contribution to the subject of military instruction in colleges, by demonstrating that, even with a closely limited amount of time devoted to a course, sound, substantial results, worthy to be compared with the best results of instruction in mathematics, in philosophy or natural science, in history or the classics, can be obtained through the full utilization of the resources available, and a judicious and energetic direction of the work. The number of students of the first year regularly belonging to the battalion is exactly three hundred. In addition to these, four students receive the theoretical instruction in Military Science without the drill, having been excused from the latter on examination. One student is taking the drill as an option, making the total number of students in the department three hundred and five. In the examination held for candidates for appointment to the grade of officer in the battalion, twenty schools were represented, and two organizations of the National Guard, one in Illinois and one in New Jersey. The total number of students offering themselves for examination was thirty-five. All but one or two were new students at the Institute.

History and Political Science. — In History, a constantly increasing use is made of specially prepared maps, charts, diagrams, etc., in all the courses. This is true to a very large extent in the subjects taken by all the students of the first and second years. To the preparation of such material Professor Currier and Mr. Sumner have given a great deal of attention; and the resources of the department have been very greatly increased thereby. Maps, charts, and diagrams of appropriate sizes are now available for the illustration of every subject covered in the several courses; and these are so placed in cases, constructed especially for the purpose, that they are readily available for use.

By every means, the instructors in this department are

striving to make the work in history more and more fruitful. It has long been one of the highly approved features of the Massachusetts Institute of Technology that its courses combine some measure of philosophical studies with the predominant scientific and technical exercises of the school. In this matter, the Institute has been a leader among the scientific and technical schools of our country; and this feature is one which, while it cannot be greatly extended in the time given to it, may yet be truly magnified through the improvement and enlargement of the courses thus given. I have great satisfaction in feeling that our work in history is being done in the most admirable spirit and with a high degree of intelligence. A very interesting suggestion has been made that it might be found possible to establish relations between this department of the Institute of Technology and the teachers of history in the schools of Boston and vicinity through which the latter might be enabled, by no undue effort or sacrifice of time, to pursue courses of study here, not merely in history but in the related subjects of economics, statistics, sociology, and government. That the teaching of history in our grammar and high schools greatly needs enrichment and inspiration will be readily admitted by all. Whether the Institute could in any important degree contribute to this branch of instruction, is a matter to which thought will be given in the immediate future.

The work in Political Economy for all the students of the third year is being better systematized by the publication of a weekly syllabus; there is, moreover, a constantly increasing oversight of the written work of the students as carried on throughout the term.

Shopwork. — As it is some years since I have made more than a passing allusion to our shops, it seems appropriate to state just where we stand in this matter at the present time. No great changes have taken place; but under the enlightened direction of Professor Schwamb there has been a steady movement towards larger and better work. The members of the Corporation are aware that our shops have, from the first,

been of the character of laboratories. The exercises taking place in them are intended to be as purely and as highly educational as those in the laboratory of chemistry or physics. In each of the shop courses the student completes, from working drawings, a systematic series of "pieces," or models, designed to cover progressively the principles to be taught and to give practice in the use of the different tools or machines. So far as practicable, the models are useful objects; but in no case is the prime, I may even say, the sole object of the course, namely, instruction, sacrificed or subordinated to considerations of immediate utility. Our shops are not factories, but laboratories. It is not the thing made, but the training, the discipline, the practice, which the student obtains in the making, which forms the object in view.

Seven shop courses are recognized upon our schedules, namely, carpentry and wood-turning, pattern-work, foundry-work, forging, chipping and filing, metal-turning, machine-tool work. Of these, the course in foundry-work is purely optional, not being required as an essential part of any course. It is, however, taken by a considerable class. The course in metal-turning is specially arranged for students in electrical and chemical engineering. The instruction is in light lathe-work, on iron and on brass.

The equipment of the several departments of the shops is as follows: The carpentry, wood-turning, and pattern-making departments contain forty carpenters' benches, two circular-saw benches, a swing-saw, two jig-saws, a buzz-planer, a mortising machine, thirty-six wood-lathes, a large pattern-maker's lathe, and thirty-six pattern-makers' benches. The foundry contains a cupola furnace, two brass furnaces, a core oven, and thirty-two moulders' benches. The forge-shop contains thirty-two forges, seven blacksmiths' vises, and one blacksmith's hand-drill. The machine-shop contains twenty-three engine-lathes, seventeen hand-lathes fitted with slide-rests, two machine-drills, three planers, a shaping-machine, two universal milling-machines, furnished with spiral and gear-cutting attachments, a universal grinding-machine, a cutter

and reamer-grinder, a twenty-four-inch standard measuring-machine, thirty-two vise-benches arranged for instruction in bench-work, and a fully equipped tool-room. A power-hammer will be added to the equipment of the forge-shop during this year.

The number of students who can be accommodated at a time in each class is as follows: carpentry, forty; wood-turning and pattern-making, thirty-six; foundry-work, thirty-two; forging and chipping and filing, thirty-two; machine-tool work, twenty-three when all students are upon lathe-work, thirty when their work can be varied.

The following table gives the total number of hours allotted to the different shopwork subjects: —

Subject.	Mechan. Eng.	Elect. Eng.	Physics.	Chemical Eng.	Naval Architect.	Special Class.
Carpentry and Wood Turning	60	60	60	60	..	135
Pattern Work	30	..	..	..	..	90
Foundry Work	30	..	..	..	..	45
Forging	110	..	..	45	110	135
Chipping and Filing	70	..	..	..	70	60
Metal Turning	...	30	..	30	..	..
Machine-Tool Work	150	..	..	..	120	120

The following table shows the number of students taking the different shopwork courses during the past three years, with the corresponding numbers for 1896–97 estimated on the basis of the first term's registration: —

Subject.	1893-94.	1894-95.	1895-96.	1896-97.
Carpentry and Wood Turning	138	133	124	138
Pattern Work	55	72	68	90
Foundry Work	28	36	38	40
Forging	85	66	78	110
Chipping and Filing	53	54	60	69
Metal Turning	96	59	61	66
Machine-Tool Work	49	52	48	59

Students taking chipping and filing are only counted in the third year's part of the course.

In addition to the foregoing, there is a special class comprising five professional teachers taking the course in pattern-work.

Summer Schools.

Mining. — The Summer School of Mining was held this year among the iron mines of Michigan, Wisconsin, and Minnesota. Visits to mines and to furnaces occur on alternate years. This was the year for the mines. The party consisted of Professors Richards and Hofman and ten students. The students were from the second, third, and fourth-year classes of the Mining Department. Through the generosity of Messrs. M. A. Hanna & Co., of Cleveland, the members of the party were transported upon the ore-boats of the Company from Ashtabula, Ohio, to Escanaba, Michigan, one of the ports of the iron mines, and back again. The work of inspection and study began at Ironwood, in the Gogebic district, with the great Norrie mine, after which followed the Aurora, the Tilden, and the Newport mines. The party next visited, in the Mesabi Range, the Mountain Iron mine, the Oliver, the Norman, and the Franklin mines. On the return by way of Duluth, the great ore docks were inspected. Finally the Chapin, the Pewabic, and the Aragon mines of the Menominee Range were visited. The students found a great deal of interest in these remarkable iron districts, not only in the geology of the deposits, which has been a great puzzle to the geologists, but in the mining methods which have been brought to their present state of perfection by close competition and by the use of the highest engineering skill. The students and professors met with the kindest reception everywhere.

Geodesy, Topography, and Hydraulic Engineering. — The Summer School for field work in Geodesy, Topography and Hydraulics, was held during the month of June at Machias, Maine, a new locality for this work. The instruction was in

charge of Professors Burton, Porter, and Robbins, assisted by Mr. H. K. Barrows, Assistant in Civil Engineering, and Mr. G. C. Whipple, a graduate from this department, and one of the inventors of the thermophone, referred to in my last report. Fourteen members of the third-year class were in attendance. A base-line was measured with the one hundred-meter tape, using the thermophone for the determination of the precise temperature of the tape. This work was similar to that of last summer, and the results were equally satisfactory. A system of triangulation was extended over the country in the vicinity of Machias, and connected with the triangulation points of the United States Coast Survey. A topographical survey of about two square miles was made with the plane table, on a scale of 1 to 5,000, with contours ten feet apart. Plane table surveys were also made of the river front, on scales of 1 to 1,000 and 1 to 10,000, with special reference to a study of the water-power. A feature of field instruction, which was introduced for the first time this year, was the study of tidal phenomena and the determination of a datum plane for elevations. Machias furnishes an excellent opportunity for the study of the tides, the range being over fifteen feet. A special form of tide gauge was devised by Professor Robbins for the work, and the plotted results prove the excellence of the design. The hydraulic work consisted in measurements of the flow of the Machias River, by floats and by meters, at a point a short distance above the village of Machias. The stream at this place is about one hundred and forty feet wide, and from twelve to fourteen feet deep. The flow through one of the mill flumes was also measured, using the current meters and the Darcy tube. The School was in every respect satisfactory and profitable. It will probably be carried on at the same place next year.

Architecture. — During the past year the department of Architecture has made an important extension of its work, taking the initiative by sending a group of its students abroad for the study of European architecture. Since 1893, when the first summer school was held at Chicago, the

serious study of the Colonial buildings of New England has given the classes opportunities for an intimate acquaintance with the peculiarities of our local architecture. The work thus conducted has been valuable; but it could not be expected to afford the student the broad knowledge of style which forms so important a part of thorough architectural training. The scheme of a tour in Europe was at once supported by the students with enthusiasm. Although a fee was necessarily charged, twenty students from the third and fourth years applied for admission. Applications from several students of other colleges had to be refused, in order to keep the school down to a practicable size. The class of twenty students, in charge of Professor Homer, who had as assistant Mr. F. M. Mann, S.M., '94, spent fifty days in England and France, touring on bicycles from London to Southampton, and through Normandy and Touraine to Paris. It was found that this way of travelling was particularly advantageous, as it did away with railway expenses, was entirely healthful, and afforded unusual opportunities for the study of local architecture. The large size of the class required careful preliminary arrangements. Maps were imported, routes decided upon, and hotel accommodations secured, before the expedition left America. General permission to photograph and draw was also obtained from the French government. The only difficulties encountered were those that arose from accidents to bicycles, and the temporary fatigue produced by the method of travelling, but nothing of a serious nature occurred at any time. The tour proved entirely successful, the eleven days in England and the thirty-nine days in France giving excellent opportunities for comparing examples of monumental and domestic architecture of the Romanesque, Gothic, and Renaissance styles of these countries. Pencil sketches and studies were made in each town visited, and a large number of photographs taken with the twelve cameras carried by instructors and students. The average necessary expense for the entire trip of seventy-six days proved to be $340.00. Omitting London and Paris, the

average necessary expense was $2.00 per day for England, and $1.90 for France. It is to be hoped that this successful precedent in the study of European architecture will be followed with good results in succeeding years.

Geology. — No summer school in Geology was held the past year, but during the semi-annual vacation the students in economic geology, under the guidance of Professor Crosby, made a ten days' excursion to Washington and the mining districts of eastern Pennsylvania. In Washington, attention was given chiefly to the important economic collections in the National Museum. The other points where special studies were made included the anthracite coal mines at Drifton, Pa., the slate quarries at Slatington, and the zinc and steel works at Bethlehem. Very profitable visits were also made to the Delaware Water Gap and the Cavern of Luray.

Summer Courses at the Institute.

The system of Summer Courses on which I have commented in the last two annual reports, has again been carried on in certain subjects, after the completion of the school year. The courses have generally lasted for five or six weeks, covering about the ground of the regular instruction of the year in the same subjects. A special committee of the Faculty under the chairmanship of Professor Crafts has had general charge of the arrangements. It has been previously remarked that only a considerable amount of experience in such a matter could enable us to decide whether this scheme would meet a real want. The experience of the last summer, in addition to that already acquired, seems to show that the courses offered have been, in number and variety, somewhat in excess of the needs of students, actual or prospective. At the same time, the attendance upon certain courses holds on well, and seems to indicate that these, at least, should be continued. The more successful courses of the present year were those in analytic geometry, analytical chemistry, organic analysis

and preparations, physical measurements, and machine-tool work.

Courses I. and XI., Civil and Sanitary Engineering. — No changes of importance have been made in the courses of study during the past year. During the coming year, 1897–98, some rearrangement of the work of the fourth year will be required, resulting from the transfer to the third year of the course in applied mechanics, hitherto given in the fourth year.

I have already spoken of the loss of the Civil Engineering Department through the death of Mr. Stanwood and the resignation of Mr. Lyon; Mr. H. K. Barrows, Assistant last year, also resigned to enter professional practice. The places thus left vacant have been filled, and one additional Assistant has been appointed, in view of the large increase in the work of the department.

In my last report, I referred to the desirability of our having a small building erected on firm ground in the neighboring country, equipped with the necessary means for pendulum and magnetic observations and for the ordinary observations of field astronomy. The funds required for the erection of such a building having been granted by the Corporation, the building will be erected and partially equipped during the present year, as soon as a suitable site can be secured. Our facilities for instruction in the line of geodesy and practical astronomy will thereby be greatly improved, and it is hoped that the means for properly equipping this building will soon be forthcoming.

Mention should here be made of the fact that during the past summer Professor Burton, on the invitation of Lieutenant R. E. Peary, U. S. N., organized a party for scientific research in western Greenland. The party comprised Professors Burton and Barton, and Mr. R. W. Porter, from the Institute of Technology, Mr. G. R. Putnam, Assistant in the U. S. Coast and Geodetic Survey, and Messrs. J. C. Phillips and A. M. Dodge, students in Harvard University. Starting early in July, this party was taken in Lieutenant Peary's steamer

"Hope" to Umanak Fjord, Greenland, where it was left for five weeks, while Lieutenant Peary proceeded farther north, calling for the party on his return. The most important results of this expedition are the measurements of glacial motion and temperature and the study of glacial action, by Professors Burton and Barton, and the pendulum and magnetic measurements made by Mr. Putnam, who was specially detailed by the U. S. Coast and Geodetic Survey to accompany this expedition. The party was in every way successful, meeting with no mishaps, and the results will prove of value to science.

The equipment of the department has been increased in various ways during the past year. A collection of twenty-six levels and eight transits was purchased from the Mexican Central Railway Co., some of which will be disposed of, while the remainder, when put in good condition, will render it unnecessary for the department to purchase for the use of students any further instruments of this character for a long time to come. Two mercurial barometers have also been procured for use in the summer school. In the hydraulic laboratory a new measuring-tank has been procured, six feet in diameter and ten feet high, a duplicate of the one already in use, giving greatly increased facilities for the accurate measurement of considerable volumes of water in experimental work. The introduction of this tank required considerable changes in piping, chutes, and valves, for directing and controlling the flow of water. Valuable experiments were made last year, as a part of the thesis work of students, with apparatus specially planned for the purpose, in determining the effect of irregular connections and on the loss of head at sudden enlargements of pipes. For the convenient use of the present hydraulic apparatus, it is important that there should be an enlargement of the reservoir in the concrete floor, to which all water discharged in experiments is conducted, and from which it is pumped, being thus used repeatedly. It is also desirable that we should have increased pumping facilities, and arrangements have just been made for procuring a powerful rotary pump.

Mention should also be made of the fact that in the instruction of the Civil Engineering Department the use of lantern slides is being gradually introduced. During the past year over seven hundred slides were procured for use in various courses, principally relating to bridges and railroads. The only additional set of notes prepared by the instructors of this department during the past year is a new edition of Professor Porter's Notes on Stereotomy, for the use of the third-year students. Excursions have been made to several manufacturing establishments and other places of interest; and thanks are due to President Tuttle, of the Boston & Maine Railroad, W. H. Barnes, General Manager of the Boston & Albany Railroad, President C. P. Clark and General Superintendent E. G. Allen, of the New York, New Haven & Hartford Railroad, for courtesies extended to the classes. The department has also received during the past year a large number of blue-prints of various engineering works from city engineers, bridge companies, and other friends of the Institute.

In the present year there are forty students in the fourth year of the Courses in Civil and Sanitary Engineering; and the drawing-room is crowded to its utmost capacity. Four of these students are pursuing the Course in Sanitary Engineering and thirty-six that in Civil Engineering. Of the latter, twenty have elected the first, or general option, fifteen the second, or railroad option, and one, a special student, the third, or geodetic option.

Course II., Mechanical Engineering. — The following apparatus has been added to the laboratory, viz.: —

1. An Otto gas-engine of thirty-six horse-power capacity, with all the latest improvements.

2. An unusually complete and delicate apparatus for testing steam injectors, which was built and in service during the latter part of the last school year.

3. In place of the compound Marsh pump, of a capacity of eight hundred gallons per minute, which was loaned to the laboratory, and has now been returned to the makers,

a rotary pump has been added, of a capacity of one thousand gallons per minute, made by the Holyoke Machine Company.

4. A Buckeye steam-engine governor, arranged for experimental purposes.

5. A Rider hot-air engine has been presented to the laboratory by Mr. Fred A. Wilson, of the class of '91.

During the last school year, in the regular laboratory work, complete tests have been made of two large plants: one a fifty-hour test of the West End Street Railway Power Station at Sullivan Square, Charlestown, and one, another twenty-four-hour duty test of the triple engine of the Chestnut Hill Pumping Station.

The detailed results of the test of the latter plant made in May, 1895, by the students under the direction of Professor Miller, were published in No. IV. of the "Results of Tests made in the Engineering Laboratories," this being contained in the "Technology Quaterly" dated June–September, 1896. The results of other tests made in the Mechanical Engineering laboratory during the school year 1895–96, will appear in No. VI. of the "Results of Tests made in the Engineering Laboratories," contained in the "Technology Quarterly" for December, 1896.

There is great need of additional space, both in the laboratory and in the other rooms of the department.

This year, for the first time, the changes due to the increased requirements of admission affect the third-year class, and advantage has been taken of that fact to make a number of improvements in the course. Those which affect the third year, and which, therefore, take effect this year, are the following: —

1. A short course in elementary differential equations has been added.

2. A course has been added in industrial electricity and in electrical measurements.

3. Political economy is to be completed in the third year, instead of a portion being left for the fourth year, as heretofore.

4. A little additional time has been given to the third-year course in applied mechanics.

The following publications have been made by members of the department: —

1. A treatise on steam-boilers (now in press), by Professors Peabody and Miller.

2. A new edition of the "Notes on Dynamometers, Planimeters, Governors, and Fly-wheels," by Professor Lanza, has been printed.

It should also be noted that, during the last year, Professor Schwamb has been in charge of an extensive investigation of a matter of great public interest, on behalf of the Steam Users' Association.

APPLIED MECHANICS. — The following apparatus has been added to the laboratory; viz: —

1. An Olsen testing-machine, of one hundred thousand pounds' capacity, for tensile and compressive tests, capable of testing specimens five feet long and under.

2. A frame of two plate girders, together with a pair of large cast-iron skewbacks, previously in the laboratory, a set of steel rods, and other suitable apparatus, so far complete a machine of four hundred thousand pounds' capacity as to enable us, during the present school year, to make some tests of masonry arches of such sizes and proportions as are used in practice.

3. The machine for testing wire has been partly rebuilt, and very much improved.

In No. V. of the "Results of Tests made in the Engineering Laboratories," contained in the double number of the "Technology Quarterly" for June–September, 1896, are published the results of tests made in the course of the regular work of the laboratory, on the following subjects (the greater part having been made during the last school year): —

1. Tests of two series of bolted joints.

2. Tests of wrought-iron pipe of different sizes, used as columns; an investigation suggested by Mr. Hiram F. Mills of the Corporation, which we are still continuing.

3. Tests of spruce, and of Norway pine beams.

4. An extensive series of tests of the compressive strength of timber at right angles to the grain.

5. Torsional tests of shafting, mostly two inches in diameter.

6. Tests of the tensile strength of specimens of steel, and of iron wire, of manilla, of cotton, of hemp, and of sisal rope, and some tests of the strength of certain alloys.

7. Tests of the tensile and of the compressive strength of cement.

8. Torsional tests of wire, carried on in connection with tensile tests of the same wire.

Another investigation in which we are engaged in this laboratory, but of which no results have yet been published, is the strength, and behavior under load, of trusses built of 6-inch by 8-inch timber, with a variety of the framing joints commonly used in practice.

"Notes on Graphical Statics," by Professor Sondericker, has been printed for the use of the students.

A new and revised edition of the text-book on applied mechanics, by Professor Lanza, has been published.

Course III., Mining Engineering and Metallurgy. — The instructing staff of this department remains the same as last year. The largely increasing number of students rendered the addition of an Assistant highly desirable; but the Executive Committee found it possible to supply this want during a portion of the year only. A larger number of students are availing themselves of the advantages of the department than ever before. The numbers now reach a total of forty-one, distributed as follows: twenty-one in the second year, twelve in the third year, eight in the fourth year.

During the past summer Professor Hofman made an extended tour, including Omaha, Kansas City, the Black Hills of Dakota, Denver, Pueblo, and Leadville, with a view to obtaining the latest data upon the metallurgy of silver and lead. The results of his investigations will be embodied in a new edition of his "Metallurgy of Lead," a book which has already

been everywhere accepted as authority. Professor Lodge took the opportunity of the meeting of the American Institute of Mining Engineers, held in Colorado last September, to visit Denver, Pueblo, Leadville, Aspen, Cripple Creek, and other places in the state, to bring his knowledge up to date in matters of sampling, assaying, milling, and smelting of gold, silver, copper, and lead ores. Professor Richards is now embodying the notes obtained in his extended trip through the principal mining regions during the summer of 1895, and also the results of his experiments and investigations made in the Mining Laboratory, in a book upon Ore Dressing, which he hopes to send to press some time next summer. He has spared no pains or expense in bringing the science and theory abreast of modern practice.

A circular has been prepared for the Mining Department, giving the course of instruction; suggestions to students taking the course; the details of the laboratories of mining engineering and metallurgy, together with a statement of the general plan and management. The pamphlet includes a list of theses illustrative of subjects investigated by students during the last term of their course, and finally gives a list of graduates and former students who have been directly or indirectly benefited by the department in their present occupations. This list gives a good idea of the influence this department is exercising upon the mining and metallurgical interests of the United States. Although there has been so much depression in business the past year, all the members of the graduating class have found occupation in the line of their profession.

A new course of lectures in general metallurgy and non-ferrous metallurgy has just been established for students in Chemistry and Chemical Engineering. Formerly the students in these courses attended a portion of the lectures given in the Mining Course. The lectures on electro-metallurgy for students in Electrical Engineering given last year as an experiment, have been adopted as a regular part of that course. The library of the department has grown

to the limit of the present book-shelves; but there is still room for more book-cases. Our collections of ores and products completely fill the present cases. The department will be unable to add to them until additional space shall be provided. Professor Richards has written "The Cycle of the Plunger Jig," a study of the theory of jigging ores for the separation of the waste minerals, also a second paper on "Sorting before Sizing," which discusses the whole theory of separation of the fine slimes. Professors Richards and Hofman have each contributed articles to "The Mining Industry," the former on "Progress in Ore Dressing in 1895;" the latter, on "Recent Improvements in the Treatment of Argentiferous Lead Ores." Professor Hofman has contributed two papers to the American Institute of Mining Engineers: "Further Experiments for Determining the Fusibility of Fire Clays," and "The Equipment of Mining and Metallurgical Laboratories." Professor Lodge has contributed two papers to the American Institute of Mining Engineers: "Treatment of a Roasted Gold Ore by Means of Bromine," and "The Cyanide Process as Applied to the Concentrates from a Nova Scotia Gold Ore."

The following periodicals have been added to the files of the Mining Department: The American Manufacturer; Annales des Mines de Belgique; Cassier's Magazine; Compressed Air; Digest of Physical Tests; Engineering Magazine; Jernkontorets Annaler; Journal of the Canadian Mining Institute; Mining Journal of the Northwestern Mining Association; The Foundry; Transactions of the Institution of Mining and Metallurgy, London.

Course IV., Architecture. — Not much requires to be said respecting the Architectural Department, which continues its steady gain, both in the number of pupils and in the character of the work done, from year to year. The collections of the department have been enlarged by a considerable number of superb architectural casts, although these very important accessories of architectural designing and drawing rooms cannot be placed to the best advantage in the existing build-

ing. Some noble architectural photographs, the gift of Mrs. Henry Draper, have been hung upon the walls. The library has been further increased by purchase, and still more largely by gifts. The library is now one of singular richness, and leaves almost nothing to be desired; but the space allotted to it is so narrow that the large illustrated volumes, photographs, etc., cannot be taken down and used upon the tables with anything like the freedom which is desirable.

An exceedingly important addition has been made to our working plant through the purchase, by Professor Homer, in Paris and London, the last summer, of twenty-six hundred lantern slides, containing views of buildings and cities in western Europe, Russia, and the East. These modern views will admirably supplement the present collection, and will materially assist the illustration of lectures. The views of Spanish, Russian, Indian, and Chinese architecture are particularly valuable, including a large amount of material at present available in no other form. The first instalment has already been received from London, and the remainder is expected at an early date. The new electric lantern of the Architectural Department makes the use of the slides much more convenient and effective. The interest taken by the students in the lectures has manifestly increased with the enlarged use of this mode of illustration. Two prizes, each the income of a fund of $5,000, which were established by the will of Mr. Arthur Rotch, for so long a time chairman of the Visiting Committee on the Architectural Department, became available for the year closing in June last. The prize for the student graduating with the greatest distinction from the regular course in Architecture was awarded to Miss Esther Stone, of Providence, R. I. The prize for the special student completing his course with the highest standing, was awarded to Mr. R. W. Porter, of Springfield, Vt., who is this year continuing advanced studies at the Institute. The Boston Society of Architects have also generously continued their two prizes, each of the value of $50 in books. These were awarded to Messrs. H. W. Chamberlain, of Hudson, Ohio,

and R. C. Henry, of Watertown, Mass. This year, again, in the competitions of the Beaux Arts Society of Architects of New York, the students of the Institute bore off the gold medal and the highest honors in each competition.

Courses V. and X., Chemistry and Chemical Engineering. — Professor Crafts, in a very public-spirited way, consented to continue, during the year on which I am reporting, that supervision and general direction from which the Chemical Department profited so much the previous year. The cares thus assumed by Professor Crafts were wholly in addition to his own proper work of instruction and research. We cannot be too grateful for this invaluable assistance, in our hour of need. Some changes have been made in order to secure more desk room, the fourth floor of the Walker Building is now occupied exclusively by the chemical laboratories, and the places are completely filled. Three hundred and seventy-one students take exercises in general chemistry; one hundred and thirteen students are in the analytical laboratory, and twenty-nine in the organic laboratory. The enlargements were made specially to meet the needs of an increased number of fourth-year students in Chemistry; and they have proved just sufficient for the purpose. It is thought they will also meet all the requirements that can be foreseen for the next two or three years.

The most important change has been the substitution of eight students' desks, and of two small private laboratory rooms for the Chemical Library. The library, which is one of the best in the world, was developed under the energetic direction of Professor Nichols, and each year adds to it every important work on chemistry and allied subjects. It has been of the greatest value to our own students; while the books on chemistry proper, and the rich collections of technical literature, are often consulted by workers outside of the Institute. For our own students the former situation of the library room, adjoining all the large laboratories, made it particularly convenient of access; and it was only after much hesitation transferred from the fourth to the third floor of the Walker

Building. We are pleased, however, to find that the change of place has diminished very little its usefulness to the students, while there is a distinct gain in larger accommodations and in a better ventilated space set apart for tables. In the portion of Room 39 which has been taken for the library the old cases with new additions will hold ten thousand volumes; and, when the time comes for further expansion, one-half more room can be added to the library by removing a temporary partition in Room 39, so that it may be considered that the Chemical Library has found its definitive home. Permanence of arrangement was also held in view in making the necessary additions to the organic chemical laboratory; and it is probable that the fourth floor of the Walker Building is now used to the best advantage; and that, if a new chemical laboratory is constructed, the present conveniences of plumbing, gas, and ventilation will continue to serve, with little change, for the analytical and organic chemical laboratories. At the time the Walker Building was constructed, it was an innovation to place laboratories in the highest story; but experience has shown that the best light and ventilation are thus obtained at the least cost, and that laboratories so placed do not interfere with other uses of a building.

The course of chemical instruction continues to aim at a completely systematized series of studies, while great freedom of development of each branch has found place in the system, stimulated or initiated by the professors or instructors in charge. Reports on these subjects in detail are given as follows: —

Analytical Chemistry. — The number of students in the analytical laboratory at the present time is one hundred and eleven, distributed among the courses as follows: graduate students, two; fourth year, Mining Engineering, seven; Chemistry, one; General Studies, one; third year, Mining Engineering, fifteen; Chemistry, twenty-eight; Biology, two; Sanitary Engineering, two; second year, Civil Engineering, one; Chemistry, thirty; Biology, six; Physics, two; Chemical Engineering, fourteen. The appointment of Mr. Good-

hue, as Assistant in Analytical Chemistry enables Mr. Rolfe to devote his entire time to sugar analysis, and to sanitary chemistry during the second term, and at the same time provides for the entire services of an Assistant in the analytical laboratory, — a much desired gain. The laboratory course of molecular weight determinations is now conducted in a small laboratory partitioned off from the chemical library in Room 39. A larger room is much to be desired, to accommodate more apparatus, thereby enabling more students to work simultaneously. The equipment of the laboratories and offices with electric lights has added much to their efficiency during the dark afternoons of the fall and early winter.

The instruction in analytical chemistry is continued along the same general lines which have been successfully followed for the last few years, with such minor changes as are necessary to keep abreast of the recent progress in this branch of the science. Much stress is laid upon the class-room instruction. One-half of this is devoted to a study of the current literature in German and French. The student is made familiar in this way with the vocabulary which he must command for the investigation of the records of earlier work written in these languages; and at the same time learns the most recent achievements in analytical chemistry. The results seem to show that such reading can best be done under the direction of an instructor to whom the scientific bearing of the subject-matter is familiar. Before the close of the course, the student is enabled to prepare properly a report upon the literature relating to a specific subject distributed through the various journals, in English, French, and German. The instruction in quantitative analysis of the second year will be facilitated by the use of a manual on the subject, prepared by Professor Talbot, with direct reference to the needs of our students.

ORGANIC CHEMISTRY. — For the first time a considerable number of students (six in all), taking the courses in Physics, Biology, or Chemical Engineering, have selected organic laboratory work as an option, or are taking it as an extra

subject. The professional value to chemical engineers of some practical experience with the principles and methods of organic chemistry is very great; and it is unfortunate that lack of time and accommodations have thus far prevented its introduction as a required subject into the Chemical Engineering course. No radical change has been made in the scheme of instruction. The special course of laboratory experiments on the detection and separation of the various classes of organic compounds, inaugurated last year and mentioned in the previous Annual Report, has been considerably extended and improved, by the publication of a text-book to accompany it. So far as is known, a course of this kind is not as yet presented by any other institution. The success which has attended its introduction here is, therefore, worthy of special notice.

SANITARY CHEMISTRY. — It is more and more clearly recognized that a knowledge of the applications of chemistry is fundamental for the solution of problems relating to private and municipal sanitation. The work, therefore, in sanitary chemistry gains in interest and in educational value year by year, and is demanding more time in the curriculum and more space in the laboratories than the present circumstances allow.

The careful and studied selection of the subjects to be considered, and the manner of treating them, enables the students to gain much more than the simple practice necessary to fit them to carry out analyses of water, air, butter, milk, cereals, etc. They acquire a comprehension of the wider and deeper significance of the work undertaken. Original investigation, limited in amount, to be sure, but illustrative and inspiring, is always encouraged; and this, together with a knowledge of many of the practical problems which are constantly brought to the laboratory from all parts of the country, helps to open out to the students the field of scientific and consulting chemistry. The chemists of the sanitary laboratory are engaged, as far as time will permit, on investigations, and standard methods are being continually

developed. On account of limited space very little new apparatus has been placed in commission. A Victoria centrifugal machine has, however, been added to the equipment. The completion of the laboratories at the State House will leave for the exclusive use of our students the best equipped laboratory for water analysis in the country. Exceptional advantages can then be offered to advanced students.

INDUSTRIAL CHEMISTRY. — With the co-operation of the Steam Users' Association, the subject of the corrosion of boilers by soft waters is to be investigated the present winter.

The course in sugar analysis under Mr. Rolfe, which was provided with a separate room last year, has gone on in a satisfactory manner, and two interesting researches in this field are mentioned among the publications of the year.

The instruction in Gas and Oil Analysis has been given by Dr. Gill, upon much the same lines as last year; but, in consequence of the increased size of the classes, a special assistant — Mr. W. L. Root of last year's class — has been appointed. Our experience since the opening of the year has fully justified this step. In Oil Analysis the collection of specimens has been enriched by the gifts of samples of oil from various manufacturers, who have shown a cordial spirit of co-operation with the department. In Gas Analysis, the notes upon the laboratory and of the lectures have been published under the title "Gas and Fuel Analyses for Engineers," which is believed to be the first work of its kind in the English language. The department is much in need of a larger room. Nor is this need restricted to this department alone; the students of Chemical Engineering have for the past two years had no room — as many other courses have, and as they formerly had — which is particularly their own, in which they can study while at the Institute. Furthermore, as this year's class is larger, the want is felt more pressingly than usual of some special laboratory where their theses can be conducted.

Among the features especially characterizing this depart-

ment is the employment of lecturers from the outside to present subjects with which professional practice has made them familiar. The following are the lecturers in Industrial Chemistry, who are not connected with the Institute: F. G. Stantial, S.B., on Sulphuric Acid; H. Carmichael, Ph.D., on Electrolysis of Brine; Chas. D. Jenkins, S.B., on Illuminating Gas, and on Pottery and Tiles; James W. Loveland, S.B., on Soap; Louis J. Schiller, Ph.D., on Sugar and Sugar Refining; Arthur D. Little, on Wood Pulp and Paper. Dr. Thorp has continued his regular course of lectures in Industrial Chemistry. Several excursions to works and factories in the neighborhood of Boston have been made during the year. The thanks of the Institute are due to the managers of these works for their courtesy and hospitality to our students. The number of lectures has been increased this year by twenty, which permits a more complete discussion of many subjects than was possible last year. The number of students in the class is thirty-seven. In Textile Coloring, Mr. Smith has made a change whereby two hours per week are devoted to lectures instead of one hour as formerly. This extra hour has been taken from the time given to laboratory work. Inasmuch as the greater number of dyeing operations require between three and four hours, and none more than four, this was done without curtailing the laboratory work, by utilizing an hour that had often been superfluous.

In conclusion it must be noted that the increase in the number of chemical students has made the old accommodations for lectures and recitations insufficient; there is the greatest difficulty in arranging appropriate hours, and experimental lectures are given an inadequate time for moving apparatus, so that, in this direction almost more than in any other, the need for a new building is felt.

The following publications have been made during the year by members of the Chemical Department:

Theoretical Chemistry.

A. A. Noyes: 1. Die katalytische Wirkung der Wasserstoffionen auf polymolekulare Reaktionen. 2. Bemerkung über das Gesetz der Geschwindigkeit der Reaktion zwischen Eisenchlorid und Zinnchlorür. 3. Instruction in Theoretical Chemistry.

A. A. Noyes and H. M. Goodwin: On the Viscosity of Mercury Vapor.

A. A. Noyes and C. W. Hapgood: An Investigation to Determine whether Diphenyliodonium and Thallium Nitrates are Isomorphous.

W. R. Whitney: 1. Untersuchungen über Chromsulfat-Verbindungen. 2. Translation of "The Elements of Electrochemistry," by M. Le Blanc.

Organic Chemistry.

H. Fay: The Action of Light on Some Organic Acids in the Presence of Uranium Salts.

J. F. Norris (with Ira Remsen): The Action of the Halogens on the Methylamines.

A. A. Noyes and S. P. Mulliken: Laboratory Experiments on the Class Reactions of Organic Substances and their Identification.

A. A. Noyes and C. W. Tucker: Formation of Diacetylenyl from Copper Acetylene.

Analytical Chemistry.

G. Defren: The Determination of Reducing Sugars in Terms of Cupric Oxide.

A. H. Gill: Gas Analyses for Engineers.

J. F. Norris and H. Fay: Iodometric Determination of Selenious and Selenic Acids.

G. W. Rolfe and G. Defren: An Analytical Investigation of the Hydrolysis of Starch by Acids.

H. P. Talbot and A. G. Woodman: Analysis of an Old Rail from an Unused Coal Mine.

H. P. Talbot: A Brief Course of Quantitative Analysis.

Sanitary Chemistry.

G. Defren: The Determination of Nitrites in the Air.

E. H. Richards and G. W. Rolfe: The Reduction of Nitrates by Bacteria and Consequent Loss of Nitrogen.

E. H. Richards: 1. Water and Air as Food. 2. The Teaching of Sanitary Chemistry. 3. Some Points in the Use of Depth of Color as a Measure of Chemical Contents. 4. Municipal Responsibility for Healthy School Houses. 5. Hardness of Water and the Methods by which it is determined. 6. Hospital Diet. 7. The Chemistry of Cooking and Cleaning. (New Edition.)

Inorganic Chemistry.

H. P. Talbot: On the Volatility of Ferric Chloride.

F. H. Thorp: 1. Manual of Inorganic Chemical Preparations. 2. A Review of Some Improvements in Chemical Industry.

Courses VI. and VIII., Electrical Engineering and Physics. — Very substantial additions have been made to the material for instruction in Physics and Electrical Engineering. Especially is this true regarding instruments of precision. Besides duplicating much apparatus of this kind already possessed, various new instruments have been added. Among these should be mentioned the gift by Mrs. Draper of a mechanical air-pump, a mercurial air-pump, and two dynamo-machines, which were used by the late Dr. Henry Draper in his researches. There has also been presented by the General Electric Company an Edison potential regulator, an instrument of much historical interest. We have made a great addition to our lantern-slides, about five hundred having been added. These have all been made in our own laboratory by Mr. Derr. A valuable addition to the workshop of the department has been made in the shape of a Fitchburg engine lathe with fourteen-inch swing. As an illustration of the exceptional manner in which the needs of our classes of students are provided for, it may be mentioned that we have fifty ampere-meters and volt-meters of the first grade of excellence

for accurate work, in addition to many of a less degree of precision.

Especially important is the large increase of our dynamo-electric machinery. During the past year there have been added a 30-arc light (2,000 candle-power) Brush machine; a 30-horse-power 4-pole direct-current Westinghouse machine; and a 10-horse-power Westinghouse direct-current machine, arranged so as to give also quarter-phase alternating currents when desired. This last mentioned machine can be used either as a direct or alternating-current motor, or as a rotary transformer. There have also been added two 20-horse-power transformers for electric-lighting currents, a transformer, giving a pressure of 40,000 volts, for the study of the insulating power of different materials, and a low-voltage transformer for the production of very heavy currents up to 3,000 amperes, besides several dynamo machines of smaller capacity. Still more important is the new experimental plant of combined dynamo and steam engine, the need of which was urged in the President's Report of last year, and its purchase authorized by the Executive Committee in the spring of 1896. This is now in process of installation. It consists of two similar 4-pole moderate-speed direct-current generators of 35-horse-power each, made by the General Electric Company. These are driven by a belt connection from a Westinghouse compound engine of 105-horse-power at 125 pounds steam pressure. This engine will be furnished with condensers and weighing tanks, for weighing the exhaust steam, and with an indicator rig. The plant is especially designed for purposes of accurate testing and measurement. A special switch-board will allow of all desirable electrical combinations of the dynamo machines.

Next to thorough and accurate teaching, perhaps nothing is more important in a professional course than the manner in which it is laid out, — the sequence of studies and the relative time assigned to each branch. The increased entrance requirements in Mathematics, the effect of which is now being felt in the upper years, are bringing about a marked improve-

ment in all the courses of instruction. In the courses in Physics and Electrical Engineering, in which there is desired an early introduction of more advanced mathematical methods than have hitherto been available, the gain is particularly helpful. Its full advantage will not be secured until next year, when the fourth-year class will for the first time proceed under the revised schedule, but improvement is already manifest in the work of the second and third years.

The principal change which proved feasible in the past year was the introduction of a new course of fifteen lectures given by Professor Cross in the first term of the third year, devoted to the principles of dynamo-electric machinery, and its applications to electric lighting, the electrical generation, transmission and utilization of power, and similar topics. This is to serve as an introduction to the more specific and technical treatment of these subjects in the last year of the course. After the present year, these lectures will also be attended by students of the courses in Civil, Mechanical, Mining, Chemical, and Sanitary Engineering, and in Chemistry. The exercises in memoir work, which for many years past have been held in connection with the fourth year of the Course in Physics, have been somewhat modified in a way decidedly to increase their value. A Physical Colloquium is now held once each fortnight throughout the year, under the direction of Dr. Goodwin; and much more practice than formerly is given in making abstracts of current literature in foreign languages. The course in Heat Measurements was given last year by Mr. Norton, that in Precision of Measurements by Professor Clifford, and that in Electrical Measuring Instruments by Mr. Laws, as the condition of Professor Holman's health was such as to forbid his taking charge of them. Mr. Laws also took the immediate charge of the Laboratory of Electrical Measurements. Several new courses of lectures to be opened in the department this year should be referred to here. The first of these, by Professor Clifford, will be devoted to an extended discussion of the Electromagnetic Theory of Light, intended especially

for the benefit of graduate students and advanced students of the Course in Physics. The second, by Mr. Derr, will be devoted to the subject of the theory and practice of Photography, and will be open to members of the three upper classes. It is hoped that in time this course may be extended to include a consideration of the arts of photo-mechanical printing and other like processes, which, as far as I am aware, are not at present discussed in any of our technical schools.

A course of combined lectures and laboratory exercises in Dynamo-Electric Measurements has been given for the first time by Professor Puffer to third-year students in Mechanical and Mining Engineering. This runs parallel with the lectures on the Industrial Applications of Electricity, already mentioned, which are also taken by these students. Instruction is given in the simpler methods of testing dynamo-electric machinery. The course of lectures in Electrical Measuring Instruments, given by Mr. Laws to students in Electrical Engineering and Physics, has been extended into the fourth year, in order to allow of a more detailed consideration of the measurement of alternating currents. During the past year a number of valuable papers, mostly based upon work done in the Physical Laboratory, have been published from the department in the "Proceedings of the American Academy," the "Technology Quarterly," and elsewhere. In the spring, extended experiments were carried on in the department in connection with the newly discovered "X-Rays" of Röntgen, and various important observations were made. Among these may be especially mentioned the independent discovery by Dr. Goodwin of the fact that these rays act to dissipate both negative and positive charges. The fact had not before been known in this country, and its original publication abroad was only a few days earlier. Messrs. Norton and Lawrence gave much assistance to Dr. F. H. Williams, of the Corporation, in developing an apparatus that should be suitable for ready use in surgery and medicine.

In my last Report I emphasized the difficulties sustained by this department from the entirely inadequate amount of room at its disposal. The great pressure which this restriction places upon the work of the fourth year in Electrical Engineering and Physics cannot be other than detrimental to its success. That it is not far more so is due only to most earnest effort on the part of teachers and pupils alike. In some of our higher work in Physics we now find ourselves in a position where it is difficult even to continue the work which we are doing. I refer to the courses in Heat Measurements and Physical Chemistry. It is over ten years since Professor Cross proposed the creation of a laboratory for the investigation of problems in heat, analogous to the laboratory of electrical measurements. For various reasons the institution of such a course in heat measurements and the establishment of such a laboratory were much delayed. This was finally done, however, the work being undertaken by Professor Holman; but no additional room could be obtained for it, so that a narrow strip had to be taken from one of the rooms constituting the laboratory of electrical engineering. This room, 16 × 29 ft., is all that we have now for this important work. Even this is not available except in the first term, as in the second term it has to be occupied in part for thesis work in electrical engineering or physics. The number of students taking Heat Measurements will be increased next year by the whole fourth-year class in Mining Engineering, which is likely to more than double the total number of those pursuing this subject. It is impossible to see how the needs of these students are to be met.

Even more serious at the present time is the fact that the laboratory of Chemical Physics, which was opened two years ago (the room for this also being taken from the laboratory of electrical engineering), is now crowded beyond its utmost capacity. It has been necessary to carry on some of the thesis work in Physics in this room. Up to the present time this has been possible, and not incompatible with the work of instruction in chemical physics. But the simultaneous in-

crease in the number of students in the Course in Physics, and the introduction of chemico-physical work into the Course in Chemistry, which latter course is rapidly increasing in numbers, is putting us in a most serious position. If nothing beyond the present room is to be available, the only apparent remedy is to cease to give a portion of the instruction which has been undertaken. This at least is feasible; and objectionable as such a procedure would be, it seems preferable to carrying on such work in an inefficient manner, which would be demoralizing alike to students and teachers. The work in heat measurements and chemical physics is of such present and growing importance as to demand for its full success a space comparable with that allotted to the laboratory of electrical measurements. There is, furthermore, as last year, a painful lack of general lecture and class-room accommodations. Were the pressure for room in the above mentioned directions less severe, I should call attention to the crowded state of the study-room and library (No. 14), and the need of more room for the safe-keeping of apparatus. The uniformly good order and quiet maintained by the students has, however, prevented detriment from the former of these causes.

Course VII., Biology. — For several years the Institute largely through the co-operation of the Biological Department with the Departments of Chemistry and Civil Engineering, has occupied the leading position in sanitary science among schools of engineering in the United States. The importance of this position is obvious when it is realized that some of the greatest engineering undertakings of the present time — such, for example, as the gigantic scheme of a metropolitan water supply for Boston and the more than two score cities within the Boston Basin — owe their origin chiefly to the enlightened demands of modern sanitary science.

The present year marks another notable development of the work of the Biological Department on the technological side, by the establishment of a regular course of lectures and laboratory work in Industrial Biology. As it is believed that

such a course is entirely new in the United States, it requires more than passing notice.

The rapid progress of bacteriology has made necessary an entirely novel point of view in the arts and industries dependent on the activity or the exclusion of micro-organisms. Some industries, such as brewing, the leavening of bread, the making of butter and cheese, and the manufacture of vinegar, depend upon the successful cultivation and co-operation of micro-organisms (yeasts, molds, and bacteria), — facts which are often unknown even to those engaged in these arts or industries. Within two or three years the cultivation of butter-making bacteria has become of practical importance, and many creameries now use pure cultures of bacteria for the "ripening" of their cream as a preliminary to churning, instead of trusting to chance, as does the housewife, that the right micro-organisms shall fall in, and as was the universal custom, even in creameries, until very recently. In this new departure the Biological Department of the Institute has taken a prominent part, one of its graduates and former instructors being now engaged commercially in the propagation of the necessary butter bacteria for this new industry.

One of the latest developments along a similar line is the investigation of the bacteria of tanneries. It has long been known that hides and skins are fermented with great advantage after the hair has been removed from them, and before they are put into the tan-liquor. One of the instructors in Biology has for the past few months been carefully studying the micro-organisms concerned in these fermentations, and with most interesting and valuable practical results for the leather making industry.

Other industries, such as the preparation of canned foods, cold storage, drying, salting, smoking, and pickling, depend for their success not on the activity, but on the exclusion, inhibition, or destruction of micro-organisms. In this direction also much is being done. The causes of the spoiling of canned clams and lobsters are under investigation, with every indication of success and ultimate escape from the heavy

losses now entailed upon the manufacturer by imperfect processes. Some of these processes are briefly treated in works on industrial chemistry, but the time has now come when they must be more carefully studied from the biological standpoint, and to this end a course of three hours a week, for a half year, was established, and is now under way. It is open to graduate, senior and special students in Biology and Chemistry, and runs parallel with the course in general Bacteriology, of which it may be considered an outgrowth. Developments like these, in applied biology, make it not less but more necessary to maintain the purely scientific work of the department which underlies and supports them. The work in Physiology and Hygiene continues to be ably conducted by Assistant Professor Hough; that in Zoölogy and related subjects is in charge of Dr. Weysse; the instructor in Botany is Mr. Prescott, who also assists Professor Sedgwick in his courses in General Biology, Bacteriology, Industrial Biology, Microscopy, etc. Through the generosity of Augustus Hemenway, Esq., the equipment has been materially strengthened by the addition of several costly high-power microscopes, which were greatly needed on the bacteriological side. To Mrs. William B. Rogers the department of Biology is once more indebted for the use of tables in the Marine Biological Laboratory, at Wood's Hole, which were occupied with great advantage, during the summer, by Mr. Prescott and Mr. Stiles, a fourth-year student.

One of the most gratifying features of the year has been the resort to this department of several graduate, or advanced special students, who desire to make particular investigations chiefly in sanitary or industrial Biology. Every effort has been made to provide suitable accommodations for them; but the painfully congested state of the single room which still is made to serve for the steadily growing needs of the department has rendered it impossible for us to do for them what we should have been glad to do. Further adaptation has become impossible. Professor Sedgwick has only been able to meet the demands of the present year, and that

inadequately, by taking two workers into his own small office.

Course IX., General Studies. — I have spoken of the large amount of material, maps, charts, and diagrams, which has been prepared for illustrating the first and second-year courses in history which are taken by all regular students. The same aids are introduced into the course in the history of the Renaissance and the Reformation taken by third and fourth-year students of the Courses in Architecture, Biology, and General Studies.

Furthermore, for the history of the Renaissance several hundred of the best isochromatic photographs, many of them in carbon or platinum, were purchased for the department by Mr. Sumner while in Europe last summer. In this selection, the historical interest of the subject, as notably in the case of portraits, as well as the importance of the work in the development of art, was emphasized. This collection illustrates the development of Romanesque, Gothic, and Roman sculpture, both in Italy and the North of Europe. For purposes of comparison, a few photographs from the early German and Flemish masters are included. I very highly approve of Professor Currier's suggestion that, as soon as it can be done, arrangements be made for a permanent exhibition of these photographs in such a way that some considerable part of them may be displayed at any given time, other sections of the collection being introduced into the frames at stated times, so that all may be brought under the observation of the student in the most effective way.

It is a proper subject for congratulation that Professor Dewey has been appointed by the Governor a member of the State Commission, created under a recent law, to investigate the charitable and reformatory interests and institutions of the State. It will be remembered that, three years ago, Professor Dewey was called to serve the State as chairman of the commission appointed to investigate the subject of the unemployed. I consider it sound policy for an institution of the higher learning liberally to encourage its professors to

connect themselves with the public service, and with the active interests of the community in every way, and to every degree which may be compatible with the full and proper performance of their duties as teachers. Altogether in addition to the consideration of the service that may be thereby performed for the state and its citizens, I believe that the teachers bring back to their classes from such work and service much which is of great value to the student. It is in order also to make reference to Dr. Ripley's recent publications on Anthropology, and his Lowell lectures of the present season, on the same subject, which will be collected and published in book-form next year.

Another graduate in the course in General Studies at the Institute of Technology, Mr. William Herbert King, has been appointed to a fellowship at Columbia University. Mr. King is the third graduate from this course who has received that honor from Columbia University. A new circular has been prepared for the General Course, the issue of 1891 having become exhausted, and the changes of the intervening years being numerous and important.

Course XII., Geology. — The instruction in Geology and Mineralogy is largely auxiliary to courses in certain other departments. The classes in the general subjects are large, and the students show a commendable appreciation of the work.

The combination of studies in the schedule of the course has met with the approbation of working geologists and men of science. The demand for our graduates is so good that they have been more successful in obtaining satisfactory positions than is usual in professional life.

Three students took their degree in the department of Geology last June, two of whom had then accepted appointments for the present year, while the third was only prevented by temporary disability from engaging in work.

Much of the work of the students in the department last year is worthy of notice. Mr. A. W. Grabau's graduation thesis was "Characteristics and Succession of the Fossil

Faunas of the Middle Devonian (Hamilton) at Eighteen Mile Creek, New York; " and he has continued the same line of investigation in an extended and critical study of the fossil faunas of the Hamilton Group in Western New York, which is ready for publication in the official Reports of the Survey of that State.

The work represented by the graduating thesis of Mr. Myron L. Fuller has been amplified with the assistance of Professor Crosby, and will be published as a joint paper in the " Technology Quarterly " and the " American Geologist." A study which Mr. Fuller made as a student has been published in the Proceedings of the Boston Society of Natural History under the title of " A New Occurrence of Carboniferous Fossils in the Narragansett Basin."

In the preparation of her thesis upon " The Geological History of Lake Cochituate " Miss Elizabeth F. Fisher made a study worthy of record, and it is to be hoped that her observations may be extended and the results published. Miss Fisher is now Instructor in Geology in Wellesley College.

The increased interest in nature studies has enforced requests from the teachers of science in the public schools for opportunities for laboratory practice in mineralogical and geological work. It is believed that a cordial response on the part of this department will add to the reputation of the Institute and aid the Commonwealth in its educational work. The Faculty has voted to introduce a course in Geological Laboratory work for special students.

The collections in Economic Geology, Mineralogy, and Paleontology have been improved in quality and extent. Each year the material is being better selected, arranged, and labelled, — a work which must be performed in the intervals of more pressing duties, and which requires a great deal of time and patience. The constant wear of maps, diagrams, and apparatus, and the advance of science have necessitated the replacing of some of the old by new and improved appliances. The geological library is steadily receiving accessions.

Course XIII., Naval Architecture. — The work of this department has gone steadily on during the year; but there have been no changes of sufficient importance to require to be indicated here. The need of a separate drawing-room for the students in Naval Architecture has been pointed out elsewhere in this Report. By permission of the Secretary of the Navy, and through the courtesy of Chief Naval Constructor Philip Hichborn and Commodore Miller, commandant of the Boston Navy Yard, the department has been able to give instruction in mould-loft work, for two years past, just after the close of the school year. The first year the instruction was given by an experienced mould-loft man, under the direction of Mr. Swan. Last year the instruction was given by Mr. Swan, assisted by Mr. Clark. The work lasted about ten days, during which the students learned to perform all the ordinary operations of the mould-loft, and laid down nearly all the lines for an important ship. It is found that students who have learned to draw ship-lines on paper, and who are familiar with the principles of descriptive geometry, learn mould-loft work rapidly, and that they take a great interest in their work. I do not know that this particular work is given in any other technical school of our grade.

Mr. James Swan, who has since 1893 been Professor Peabody's principal assistant, has been given a leave of absence for a year, to enable him to pursue advanced studies in shipbuilding at the University of Glasgow. His work this year is being carried on exceedingly well by Mr. Clark. I entertain no doubt that Mr. Swan will bring back from his foreign study much which will be of use in the further development of our course in Naval Architecture. Professor Peabody reports that all his last year's graduates are engaged upon professional work.

This concludes the history of the Institute since I last had the honor to make my report to the Corporation. Much might be added; but I have, I trust, given details enough to show the real condition of the school, and its most important

needs. I cannot close without a word to express the grief and sense of loss which the death of Mr. Bouvé has brought to the Faculty of the Institute. Notwithstanding his impaired strength and the infirmities which for years have made life a burden to him, he did not even diminish the attention which he had been wont, from the foundation of the school, to give to the interests and needs of the departments of Geology and Mining and Metallurgy. No school ever had a better adviser. When the history of this school shall be fully written, the name of Thomas T. Bouvé will be found high up on the roll of its founders and early directors.

TREASURER'S REPORT.

STATEMENT OF THE TREASURER.

THE treasurer submits the annual statement of the financial affairs of the Institute for the year ending September 30th, 1896.

The results this year are far more satisfactory than last, and show a balance of twenty-three hundred and fifty dollars and twenty-seven cents on the credit side of the account, instead of a deficit of fifteen thousand nine hundred and thirty-five dollars and twenty-nine cents, as was the case the preceding year. This favorable change is due for the most part to the generous grant of twenty-five thousand dollars made by the Commonwealth. The unfavorable side of the matter is that whereas the grant was twenty-five thousand, the balance is only a little over two thousand; and further, that the grant is only to continue for five years more.

Both repairs and general expenses have increased, and this is in part due to the overcrowded condition of the buildings. The effort to accommodate more students leads to many changes, which are in no sense permanent improvements. The need for a new building is becoming imperative, but the money for such an extension is lacking.

Generous gifts have been received during the past year.

Under the will of Ann White Vose, $52,827.36 have been added to the scholarship funds; and through the generosity of Charles H. Dalton, Esq., the Dalton Graduate Chemical Fund of $5,000 has been established.

The William Hall Kerr Library Fund of $2,000 was given by Mrs. Kerr in memory of her husband, and $500 were received from Augustus Hemenway, Esq., for the Biological Department. Mrs. William B. Rogers gave $200 for the purchase of periodicals, and from other friends came $400 for the Chemical and $250 for the Mathematical Departments.

There have also come to the Institute the following legacies and devise, which are not restricted to any special use, and are available, either as to income, or as to both principal and income, for the general purposes of the Institute: —

Henry E. Hutchins,	legacy	$2,000 00
Moses Kimball	"	5,000 00
Benjamin P. Cheney	"	10,000 00
Samuel E. Sawyer	"	4,414 66
Catherine P. Perkins	" (additional)	6,568 40
Susan G. Coolidge,	devise	14,500 00

As a result of all the above gifts, there has been a net increase in the property of the Institute to the amount of $107,178.10, of which more than half is for scholarships. The value of such scholarship funds is very great. They enable many excellent students to obtain the benefits of an education which they must otherwise forego. The average standing and scholarship of those receiving this aid is very high, and there can be no doubt that they will turn to good account in after-life the training which these generous gifts place within their reach. To these most deserving students the benefit is a great and a lifelong one.

As a purely financial matter, however, these scholarship endowments do not enrich the Institute at all or aid it to meet its expenses, as will readily be understood when it is borne in mind that the average student costs the Institute annually in cash payments about two hundred and sixty-seven dollars, while the tuition fee is only two hundred dollars. In fact, the student really receives from the Institute much more than two hundred and sixty-seven dollars, since he has also the use of the buildings and scientific apparatus. To meet the excess over the tuition fees the Institute must rely on the general, unrestricted funds, and it is only through these that its work can be continued. It is therefore important that the friends of the Institute should understand, — first, that scholarship gifts are most gratefully received, and do a most important work; but, second, that such gifts make only more necessary the gift of unrestricted funds with which to meet the general expenses of the Institute.

SECURITIES SOLD OR PAID, W. B. ROGERS MEMORIAL FUND.		
$7,000 Omaha & Southwestern R. R. 8s. 1896 . .		7,000.00
SECURITIES SOLD OR PAID. GENERAL FUND.		
$1,000 Union Pacific R. R. 6s. 1898	1,050.00	
27 Shares Essex Co. dividend of capital . . .	270 00	
		1,320.00
PURCHASE OF SECURITIES, W. B. ROGERS MEMORIAL FUND.		
$6,000 New York & New England R. R. 1st 6s. 1905		6,750.00
SECURITIES BOUGHT OR RECEIVED AS LEGACIES. GENERAL ACCOUNT.		
50 Sh. New York, New Haven & Hartford R. R.	8,000.00	
Real Estate, Main Street, Cambridge	16,154.38	
37 Sh. Nat. Mechanics Bank, Baltimore	706.70	
10 Sh. First Nat. Bank of Baltimore	1,293.30	
16 Sh. Boston Real Estate Trust	18,400.00	
$5,000 New York & New England R. R. 1st. 6s. 1905	5,612.50	
		50,166.88

GEORGE WIGGLESWORTH, TREASURER, *in account with*
GENERAL STATEMENT OF RECEIPTS AND DISBURSEMENTS
Dr.

Cash balance Sept. 30, 1895		21,807.33
From Augustus Lowell for Lowell Courses	5,825.00	
" " " " C. Kastner's salary	2,500.00	
" " " " School of Design	500.00	
		8,825.00
RECEIPTS FOR CURRENT EXPENSES.		
Income of funds for salaries	3,942.00	
" " " " scholarships (students' fees)	4,269.12	
" " " " " " " 1895	705.88	
" " " " Joy "	200.00	
" " " " Swett "	400.00	
" " " " Savage "	400.00	
" " " " Library	495.00	
" " " " general purposes	9,187.60	
" " Rogers Memorial Fund	9,570.09	
" " Charlotte B. Richardson Fund,	1,682.04	
Students' fees	216,767.50	
State Scholarships	2,000.00	
State Agricultural Fund	5,592.52	
State Endowment Fund	7,333.34	
Gift of State of Massachusetts	25,000.00	
Laboratory supplies and breakages	8,739.74	
Rents, per Table (page 92)	13,306.58	
Gifts	1,558.07	
Interest	3,670.41	
Boston University	1,150.00	
Sale printed Lecture Notes	3,006.12	
		318,976.01
GIFTS AND BEQUESTS FOR SPECIAL PURPOSES.		
Increase Richard Perkins Fund,	470.93	
" James SavageFund,	179.31	
" Joy Fund	567.87	
" Letter Box	111.00	
" Susan Upham Fund,	51.35	
" W. B. Rogers Fund, additional	50.00	
Susan E. Dorr Fund	115.09	
Arthur Rotch Prize Fund	225.00	
Arthur Rotch "Special" Prize Fund	225.00	
T. Sterry Hunt Fund, additional	82.74	
Ann White Vose Fund	53,232.36	
Dalton Graduate Chem. Fund	5,090.00	
Wm. Hall Kerr Library Fund	2,000.00	
Biological Instrument Fund	500.00	
Mathematical Department Fund	250.00	
		63,150.65
GIFTS AND BEQUESTS FOR GENERAL PURPOSES.		
Henry E. Hutchins Legacy	2,000.00	
Moses Kimball Legacy	5,000.00	
Benj. P. Cheney Legacy	10,000.00	
Susan G. Coolidge Devise	14,500.00	
Samuel E. Sawyer Legacy	4,414.66	
Catherine P. Perkins Legacy (additional)	6,568.40	
		42,483.06
SECURITIES SOLD OR PAID. GENERAL FUND, page 83		1,320.00
" " " Rogers Fund, page 83		7,000.00
SUNDRIES.		
Income credited to Bond Premium Acc't	533.90	
Income credited to Rogers Bond Premium Acc't	521.41	
Boston Art Students' Asso. on acc't	666.66	
Students notes paid	950.00	
Profit and Loss, per page 85	2,350.27	
		5,022.24
		$468,584.29

MASSACHUSETTS INSTITUTE OF TECHNOLOGY.

FOR THE YEAR ENDING SEPTEMBER 30, 1896.

Cr.

Paid for Lowell Courses	5,825.00	
" " Charles Kastner's salary	2,500.00	
" " Expense Lowell School of Design	500.00	
		8,825.00
EXPENSES.		
Salaries, per Table (page 92)	217,028.58	
" paid from Gifts	500.00	
Fellowships paid from Swett Fund	400.00	
" " " Savage "	400.00	
Repairs, per Table (page 93)	9,403.17	
General Expenses, per Table (page 93)	14,631.46	
Fuel	9,025.20	
Water	1,775.65	
Gas	2,254.81	
Electricity	782.01	
Printing and Advertising	2,360.37	
" Lecture Notes	3,708.93	
" Annual Catalogues and Reports	2,629.89	
Rents paid Boston & Albany R. R. Co.	180.00	
" " Natural History Society	200.00	
Laboratory Supplies and Libraries, per Table (page 92)	37,564.99	
Society of Arts	939.43	
Casts, &c., Rotch Fund	292.60	
Photograph, Gift	216.07	
Interest 4.50 per cent on funds not in stocks and bonds	5,765.63	
Interest paid A. Lowell, Trustee	1,000.00	
" " on Mortgage Notes	5,566.95	
Profit and Loss. Income more than expenses	2,350.27	
		318,976.01
SECURITIES BOUGHT OR RECEIVED AS LEGACIES. GENERAL ACCOUNT, page 83		50,166.88
PURCHASE OF SECURITIES WM. B. ROGERS' MEMORIAL FUND, page 83		6,750.00
Income of Joy Fund, deposited		567.87
Projected Building, Trinity Place, plans		169.50
SUNDRIES.		
Notes Receivable	60,000.00	
Students' Deposits	100.00	
Scholarship Funds, 1895, used	705.88	
		60,805.88
Cash balance, Sept. 30, 1896		22,323.15
		$468,584.29

The following account exhibits the property held by the Institute, as per Treasurer's books, Sept. 30, 1896 : —

INVESTMENT OF THE W. B. ROGERS MEMORIAL FUND.

$50,000.00	Saginaw & Western R. R. 6s.	1913	50,000.00	
30,000.00	Burlington & Mo. River R. R. 4s.	1910	25,787.50	
27,000.00	Kansas City Belt R. R. 6s.	1916	27,000.00	
16,000.00	Kansas City, Clinton & Springfield R. R. 5s.	1925	16,000.00	
6,000.00	New York & New England R. R. 6s.	1905	6,000.00	
5,400.00	Republican Valley R. R. 6s.	1919	5,400.00	
4,000.00	Cin., Ind., St. Louis & Chicago R. R. 6s.	1920	4,000.00	
2,000.00	Ottawa, Oswego & Fox River R. R. 8s.	1900	2,000.00	
2,000.00	Kansas City, Fort Scott & Gulf R. R. 7s.	1908	2,000.00	
3,000.00	Kansas City, Memphis & Birmingham R. R.			
	1,000 General Mortgage 4s.	1934		
	2,000 Income 5s.	1934		
			2,221.40	
1,000.00	Lincoln & Northwestern R. R. 7s.	1910	1,000.00	
1,000.00	Atchinson & Nebraska R. R. 7s.	1908	1,000.00	
42,000.00	Chicago, Burlington & Quincy R. R. Conv. 5s.	1903	40,820.00	
35,000.00	Fort Street Union Depot 4½s.	1941	34,825.00	
24,000.00	Rome, Watertown & Ogdensburg R. R. 5s.	1922	24,000.00	
	Advances to Bond Premium account.		8,400.00	
	Bonds			250,453.90

INVESTMENT OF THE JOY SCHOLARSHIP FUND.

	Massachusetts Hospital Life Insurance Co.	5,000.00	
	Deposits in Savings Banks	4,123.70	
			9,123.70

INVESTMENT SWETT SCHOLARSHIP FUND.

	Massachusetts Hospital Life Insurance Co.	10,000.00

INVESTMENTS, GENERAL ACCOUNT.

$14,000.00	Bur. & Mo. River (Neb.) R. R. 6s. non-exempt	1918	14,000.00	
2,000.00	Bur. & Mo. River (Neb.) R. R. 6s. exempt	1918	2,000,00	
6,000.00	Chicago, Burlington & Quincy R. R. 4s.	1922	5,100.00	
3,000.00	Milwaukee & St. Paul R. R. 7 3-10	1898	3,000.00	
4,000.00	Chicago, Burlington & Northern R. R. 5s.	1926	4,000.00	
2,000.00	Kansas City, Fort Scott & Gulf R. R. 7s.	1908	2,000.00	
3,000.00	Hannibal & St. Joseph R. R. 6s.	1911	3,000.00	
15,000.00	Chicago, Burlington & Quincy R. R. Conv. 5s.	1903	15,000.00	
6,000.00	West End Street Ry. 5s.	1902	6,000.00	
2,000.00	Brookline Gas Light Co. 5s.	1913	2,000.00	
35,000.00	Fitchburg R. R. 5s.	1903	35,000.00	
65,000.00	Boston & Maine R. R. 4½s.	1944	65,000.00	
26,000.00	Am. Dock & Improvement Co. 5s.	1921	26,000.00	
3,000.00	Illinois Central R. R. 4s.	1951	3,000.00	
5,000.00	New York & New England R. R. 6s.	1905	5,000.00	
	Advances to Bond Premium account		5,539.84	
	Bonds			195,639.84
	Amount carried up			$465,217.44

Amount brought up				465,217.44

STOCKS.

SHARES.				
148	Boston & Albany R. R.	par 100	29,933.00	
194	Morris & Essex R. R.	" 50	14,690.00	
40	New York & Harlem R. R.	" 50	5,000.00	
85	Pittsburg, Fort Wayne & C. R. R.	" 100	12,880.00	
50	N. Y., New Haven & Hartford R. R.	" 100	8,000.00	
12	Cocheco Manufacturing Co.	" 500	6,000.00	
56	Hamilton Woollen Co.	" 100	5,390.00	
59	Everett Mills	" 100	5,310.00	
31	Great Falls Manufacturing Co.	" 100	3,472.00	
6	Manchester Mills	" 100	660.00	
2	Dwight Manufacturing Co.	" 500	1,600.00	
1	Merrimack Manufacturing Co.	" 1000	1,015.00	
1	Laconia Co.	" 400	605.00	
2	Pepperell Manufacturing Co.	" 500	2,300.00	
10	Lowell Bleachery	" 100	975.00	
27	Essex Co.	" 50	3,780.00	
158	Pennsylvania Coal Co.	" 50	23,160.50	
15	Consolidated Gas Co., New York	" 100	1,447.50	
7	Lowell Gas Light Co.	" 100	1,610.00	
40	Cambridge Gas Light Co.	" 100	7,000.00	
7	Lawrence Gas Light Co.	" 100	882.00	
55	Old Boston National Bank	" 100	5,510.50	
15	Merchants' National Bank	" 100	2,220.00	
25	New England National Bank	" 100	3,875.00	
25	Atlantic National Bank	" 100	2,875.00	
10	National Union Bank	" 100	1,240.00	
25	National Bank of the Republic	" 100	3,625.00	
40	The Molsons Bank, Montreal	" 50	3,000.00	
37	Nat. Mechanics Bank, Baltimore	" 10	706.70	
10	First Nat. Bank of Baltimore	" 100	1,293.30	
16	Boston Real Estate Trust	" 1000	18,400.00	
				178,455.50

REAL ESTATE.

Rogers Building		200,000.00	
Walker "		150,000.00	
Land on Garrison Street	50,840.00		
Workshops " "	30,000.00		
		80,840.00	
Land on Trinity Place	76,315.69		
Engineering B'ld'g, Trinity Place	90,000.00		
		166,315.69	
Gymnasium Building		7,967.85	
Architects' "		57,857.10	
Lot No. 2 Trinity Place		137,241.60	
Projected Building, Trinity Place, plans . . .		169.50	
Clarendon St. Land and Building		142,762.94	
House No. 34 Commonwealth Ave.		30,000.00	
Real Estate, Main Street, Cambridge . . .		16,154.38	
			989,309.06
Equipment, Engineering Building		16,555.24	
" Workshops		20,628.56	
			37,183.80

SUNDRIES.

Notes Receivable	61,500.00	
Boston Art Students' Association	13,000.00	
Students' Notes	2,783.00	
Cash Balance, Sept. 30, 1896	22,323.15	
		99,606.15
		$1,769,771.95

The foregoing Property represents the following Funds and Balances, and is answerable for the same.

The income of the following is used for the general purposes of the Institute:

William Barton Rogers Memorial Fund	250,225.00	
Richard Perkins Fund	50,000.00	
George Bucknam Dorr Fund	49,573.47	
Martha Ann Edwards "	30,000.00	
Nathaniel C. Nash "	10,000.00	
Sidney Bartlett "	10,000.00	
Robert E. Rogers "	7,680.77	
Albion K. P. Welch "	5,000.00	
Stanton Blake "	5,000.00	
McGregor "	2,500.00	
Katharine B. Lowell "	5,000.00	
Samuel E. Sawyer "	4,414.66	
		429,393.90

The income of the following is used towards paying salaries: —

Nathaniel Thayer, for Professorship of Physics	25,000.00	
Jas. Hayward, for Professorship of Engineering	18,800.00	
William P. Mason, " Geology	18,800.00	
Henry B. Rogers, for General Salaries	25,000.00	
		87,600.00

SCHOLARSHIP TRUSTS.

Richard Perkins Fund	53,175.17	
James Savage Fund	13,252.82	
Susan H. Swett Fund	10,182.95	
William Barton Rogers Fund	10,374.27	
Joy Fund	9,123.70	
Elisha Thacher Loring Fund	5,329.39	
Charles Lewis Flint Fund	5,253.93	
Thomas Sherwin Fund	5,000.00	
Farnsworth Fund	5,000.00	
James H. Mirrlees Fund	2,675.78	
William F. Huntington Fund	5,208.33	
T. Sterry Hunt Fund	3,082.74	
Elisha Atkins Fund	5,000.00	
Nichols Fund	5,000.00	
Ann White Vose Fund	53,232.36	
Dalton Grad. Chemical Fund	5,090.00	
		195,981.44

OTHER TRUSTS.

Charlotte Billings Richardson, Industrial Chemistry Fund	37,378.78
Susan Upham Fund	1,192.47
Susan E. Dorr Fund	2,672.65
William Hall Kerr, Library Fund	2,000.00
Biological Instrument Fund	500.00
Mathematical Department Fund	250.00
Charles Lewis Flint, Library Fund	5,000.00
Rotch Arch. Library Fund	5,000.00
Rotch Architectural Fund	25,000,00
Arthur Rotch Prize Fund	5,225.00
Arthur Rotch " Special " Prize Fund	5,225.00
Letter-Box Fund, balance	170.12

MISCELLANEOUS.

Notes Payable	150,000.00	
Students' Deposits	500.00	
Catherine P. Perkins Legacy, 1893	102,781.40	
Henry E. Hutchins Legacy, 1895	2,000.00	
Moses Kimball Legacy, 1896	5,000.00	
Benjamin P. Cheney Legacy, 1896	10,000.00	
Susan G. Coolidge Devise, 1896	14,500.00	
M. I. T. Stock Account	682,401.19	
		967,182.59
		$1,769,771.95

Comparative Statement of Funds, etc.

	Sept. 30, 1895.	Sept. 30, 1896.
Trusts for general purposes	424,979.24	429,393.90
" " Salaries	87,600.00	87,600.00
" " Scholarships	137,014.11	195,981.44
" " Library	5,000.00	7,000.00
Charlotte B. Richardson Ind. Chem. Fund	37,378.78	37,378.78
Letter-Box Fund	59.12	170.12
Notes Payable	150,000.00	150,000.00
Students' Deposits	600.00	500.00
Martha Ann Edwards Legacy	98,452.89	
T. O. H. P. Burnham "	20,000.00	
Catherine P. Perkins "	96,213.00	102,781.40
William J. Walker "	21,136.00	
Susan Upham Fund	1,141.12	1,192.47
Susan E. Dorr Fund	2,557.56	2,672.65
Henry E. Hutchins Legacy		2,000.00
Moses Kimball "		5,000.00
Benj. P. Cheney "		10,000.00
Susan G. Coolidge Devise		14,500.00
Biological Instrument Fund		500.00
Mathematical Department Fund		250.00
Rotch Architectural Fund	25,000.00	25,000.00
Rotch Architectural Library Fund	5,000.00	5,000.00
Arthur Rotch Prize Fund	5,000 00	5,225.00
Arthur Rotch "Special" Prize Fund	5,000.00	5,225.00
M. I. T. Stock Account	540,462.03	682,401.19
	$1,662,593.85	$1,769,771.95
Increase		
Consisting of: —		
Bequests for Special Purposes, etc. See page 84		63,150.65
Gifts and Bequests for General Purposes. See page 84		42,483.06
Income more than Expenses		2,350.27
		107,983.98
Less Scholarship Funds, 1895, used	705.88	
" Students' Deposits	100.00	
		805.88
		$107,178.10

INCOME FROM GENERAL INVESTMENTS, AND APPLICATION THEREOF.

Applied to Salaries	3,942.00	From Dividends, Bank Stocks	1,080.00
" " Scholarships	4,269.12	" State Tax returned on Bank Stocks	242.59
" " " James Savage Fund	400.00	" Bonds	9,221.12
" " Charlotte B. Richardson Fund	1,682.04	" Dividends, Railroad Stocks	2,678.00
" " Library	495.00	" " Coal and Gas Stocks	1,910.00
" " General Purposes	9,187.60	" " Manufacturing Stocks	1,248.00
" " Increase of Funds	1,761.68	" Real Estate Stocks	126.00
" " Advances to Bond Premiums	533.90	" Interest allowed on Funds not in Bonds and Stocks @ 4½ %	5,765.63
	$22,271.34		$22,271.34

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

Paid Massachusetts Institute of Technology .	9,570.09	Received Income from Railroad Bonds . . .	10,091.50
Credited to Advances Bond Premiums . . .	521.41		
	$10,091.50		$10,091.50

DETAILS OF SOME ITEMS IN TREASURER'S CASH ACCOUNT.

Rents.

Huntington Hall, for Lowell Lectures		3,500.00	
Lowell School of Design		1,800.00	
Chauncy Hall School, for Gymnasium		400.00	
State Board of Health, for use of Laboratories		750.00	
Land and Building, Clarendon St., on account		4,750.00	
34 Commonwealth Avenue, 1 year	2,200.00		
less Annuity under Will	1,000.00		
less Tax and Repairs	368.26		
	1,368.26		
		831.74	
Use of Rooms and Gymnasium		1,274.84	
			13,306.58

Department Supplies.

Chemistry	10,119.38	
Physics	7,981.90	
Mining	2,199.32	
Mechanical Engineering	2,779.24	
Naval Architecture	512.35	
Applied Mechanics	1,509.75	
Civil Engineering	2,724.56	
Biology	2,140.93	
Geology	907.19	
Architecture	2,147.24	
Drawing	38.75	
Mathematics	110.89	
English	1,381.43	
Workshops	1,614.68	
Modern Languages	134.54	
Periodicals	1,262.84	
		37,564.99

Salaries.

Instruction	178,445.40	
Administration	20,165.91	
Labor	18,417.27	
		$217,028.58

Repairs.

Department Improvements: —			
Chemistry	1,679.93		
Mechanical Engineering	720.43		
Physics	370.24		
Workshops	297.86		
English	281.92		
Civil Engineering	226.79		
Mining	191.92		
Biology	166.13		
Applied Mechanics	125.72		
Geology	89.11		
Mathematics	79.17		
Architecture	29.30		
Modern Languages	5.62		
Naval Architecture	5.30		
Drawing	1.87		
		4,271.31	
Rogers Building		1,170.50	
Walker "		954.67	
Sundries		821.36	
Steam Fitting		778.75	
Architectural and Engineering Buildings		686.46	
Gymnasium		399.57	
Boilers, Tools, etc.		145.00	
Ventilation, Huntington Hall		112.80	
Lowell School of Design		31.25	
General Library		25.88	
Military Department		5.62	
			$9,403.17

General Expenses.

Electric Wiring		2,148.85	
Stationery and Office Supplies		1,789.40	
Fire Insurance		1,683.20	
Postage		1,173.00	
Entrance Examinations		868.22	
Sundries		808.03	
Diplomas, Commissions, and Expense of Drill		732.07	
Washing		713.13	
Furniture		558.73	
Janitor's Supplies: Brushes, Pails, etc.		462.63	
Express Charges, Teaming, etc.		429.23	
Window Shades		402.39	
Lowell School of Design		387.82	
Gymnasium Supplies		377.42	
Examination Books		287.50	
Paints, Varnish, etc.		239.47	
Ice		237.48	
Engine Room Supplies: —			
Oil	153.12		
Cotton Waste	69.65		
		222.77	
Amount carried forward		$13,521.34	

Amount brought forward	13,521.34	
Transformer for Physical Department . . .	214.95	
Books, Supplies, etc., for General Library . .	193.90	
Mechanics' Fair, Atlanta and Swedish Exhibits	150.47	
Tennis Court	99.89	
Type-Writing Machine	97.60	
Glass	87.11	
Telephone & Telegraph Co.	85.58	
Military Department	83.62	
Union Safe Deposit Vaults	50.00	
Western Union Telegraph Co	27.00	
Legal Fees	20.00	
		$14,631.46

BOSTON, Dec. 4, 1896.

An examination of the accounts of the Treasurer of the MASSACHUSETTS INSTITUTE OF TECHNOLOGY for the year ending Sept. 30, 1896, 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.

C. C. JACKSON,
JAMES P. TOLMAN,
CHARLES FAIRCHILD,
Auditing Committee.