MASSACHUSETTS INSTITUTE OF TECHNOLOGY

ANNUAL REPORT

OF THE

PRESIDENT AND TREASURER,

DECEMBER 14, 1898.

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1899.

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[1] Communications should be addressed to the Secretary of the Institute.
(See page 16.)

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To the Corporation of the Massachusetts Institute of Technology:

The past year has been to our Institute an *annus mirabilis*. The Treasurer's report shows an accession of $928,000 to the general funds of the Institute, and of $46,000 to the scholarship funds, and lately we have news of a legacy of $400,000 for the aid of scholars and teachers.

The Pierce Building has been built and made ready for occupation this autumn, and on the other hand we have suffered loss by fire in the adjoining building.

Death has removed one of the original charter members of the Corporation, and also a veteran friend of the Institute who long served on its finance committee.

The funds mentioned above are:

Estate of Henry L. Pierce	$750,000 00
" " Julia B. Huntington James	140,500 00
" " John W. Carter	6,250 00
" " John Foster	10,000 00
" " Susan E. Dorr	1,482 78
Gift from George A. Gardner	20,000 00
For scholarships:	
Estate of Ann White Dickinson	40,000 00
" " Willard B. Perkins	6,000 00

The confidence which the donors have displayed by making no restrictions upon the use of gifts is gratifying evidence of their trust in the wise administration of our school, and it greatly helps our endeavors to meet the pressing needs of the day.

The fact that Mr. Edward Austin's very generous bequest of $400,000 was made without solicitation, and that the donor had no immediate connection with the Institute, may be taken as a proof that the recognition of our usefulness is becoming more widespread in the community. For many years Mr.

Austin had been in the habit of rendering pecuniary assistance to students whom he thought worthy, and, at the age of ninety-four, set aside by will a large share of his property to be employed forever in aid of education. The will provides that the interest shall be paid to needy and meritorious students and teachers, to assist them in the payment of their studies.

In consequence of this bequest the proportion of income devoted to scholarships will be increased relatively to that available for general purposes, and we believe that ample provision is now made for the probable needs of young men who are unable to pay tuition fees and who at the same time are properly fitted to receive our education.

The chief desideratum for the immediate future is an augmentation of the funds for general purposes to aid in the continued progress of the school, and the introduction of higher branches of industrial and scientific education. Some details upon these points will be given later, but it is appropriate to say here that this progress increases the cost of education, which has already risen to sixty per cent. more than the tuition fee, and that by so much all students of the Institute are assisted by the gifts in land and money of the general government, the State, and private individuals. It is apparent, therefore, that the accession of a large number of students in consequence of scholarship endowments makes necessary a large increase of income from unrestricted funds to meet the added charge. The eventual destination of all funds is similar to that of the scholarships, and the chief distinction lies in the restrictions imposed upon the use of the latter.

The Pierce Building has increased the floor space devoted to laboratories and recitation rooms by about 25 per cent.; the addition has proved very useful, and it is hoped that for some time to come no important changes will be necessary in the quarters allotted to the departments which have been moved.

It is worthy of note that the numerical increase of late years which has called for additional accommodations has been rather in the instructing staff then in the total number of students.

If our position in respect to the number of students were isolated, the fact would be discouraging, but this is not the case, for although the number of engineering schools in this and in other countries is rapidly increasing, the total number of their students has not increased, and in most cases has notably decreased. Taking the available statistics for the technical institutions of this country, we find the numbers increasing by 10 to 20 per cent. per annum till they reach a maximum in the year 1894–5, and since then a decrease of about 5 to 10 per cent. Our numbers have not fallen off in the same measure, but the increase has been much less rapid since 1893–4, and for the last five years there has been little change.

During the same period since 1894 nineteen additional instructors have been appointed in consequence of an advance, not in numbers, but in the character of the studies. This progress has been due in part to higher entrance requirements, but even more to the greater expansion which has been given to laboratory work. Experimental work of a high order exacts ever more and more a special preparation on the part of teachers and a greater subdivision of classes.

It is scarcely necessary to explain that this movement is in the direction of increased expense, and we find each year that the ratio between the cost of education and the tuition fee is continually growing on the debit side. Yet each year's experience confirms us in the stand that we have taken regarding technical education, and makes us believe more firmly in the ability of laboratory work for giving a professional man those qualities of originality, readiness, and fertility of resource in dealing with practical problems, which prove of immediate value when he enters upon an industrial career. It is often thought that these qualities are formed

later, but in many respects problems of school work, especially chosen for that purpose, are more fitted for developing and testing character than those of after life, and during school years a student can always feel assured of just ranking and friendly appreciation, while afterwards amid the rivalry of a business career he often has occasion to perceive that success is not always proportioned to unassuming merit.

It is unnecessary to present an argument against the view that theory can best be taught in the school and practice in the field, the office, or the workshop; because, even if this were true, an industrial school would not fulfil its mission by sending young theorists to be accepted or rejected after trial in the office or manufactory. It is our business to test the capacity of young men on the practical as well as the theoretical side, and to make our diploma as far as possible a guarantee of fitness to enter immediately on a career of professional usefulness.

Nothing is harder to predict, and nothing is easier to test, than the capacity of a young man for observation, experiment, and original work. We are obliged to reject many of those who wish to pursue technical studies in our school, and experience shows that the necessary qualities are exceptional rather than common in the student of good ability who comes from preparatory schools to college. Whether a different scheme of preparatory studies would give widely different results is an interesting but unsolved problem. A student does not become a skilled mechanic in our workshops, nor does he often make original investigations of great value in our laboratories, but he is given an opportunity to show what he may hope to do in after life, and we often have the satisfaction of finding that education by observation and experiment is capable of developing faculties which would not otherwise be called into exercise.

The progress in the direction indicated should be continued, and as a next step it is earnestly desired that means shall be found to enlarge the sphere of usefulness of the de-

partments of industrial chemistry and of electrical engineering and physics. Museum rooms for the exhibition of our valuable collection of products, of apparatus, and of models would be of use to the school and of interest to the public. Teaching and entertainment by evening lectures could be still further extended were a suitable building and fund for maintenance provided. Increased laboratory accommodation for machinery in motion and for electrical experiments would be of use not only to these departments, but also to the whole school, and the manner of such usefulness is strikingly set forth by the details of the report from the department of electrical engineering and physics. During last year seven hundred and ninety-two students pursued leading branches of study in this department, and the report shows how these studies form essential features of almost every course given at the Institute.

It is believed that the true policy of the Institute for the present is to turn our attention chiefly to raising the standard of instruction and providing better and larger accommodations in anticipation of having these improvements followed by an accession of the numbers who will come to us for professional education. All the information which we can collect regarding the demand for highly trained scientific professional men leads us to think that it is increasing, and where one such man enters upon the management of an enterprise which before was in untrained hands the results soon lead to calling for more men to build up a scientific staff. In all the branches of manufacturing and engineering business and in architecture the same tendency is now manifest which has long existed regarding the legal and medical professions: a tendency to confide to trained hands business which was formerly done by every one without special preparation.

Some details regarding the new building may be of interest to the Corporation. The Executive Committee voted to give it the name of Henry L. Pierce, in commemoration of his munificent bequest.

It adjoins the former Architectural Building on Trinity place, and the façade continues the design of that building, gaining in dignity by increased dimensions. It was erected according to the plans and under the supervision of Professor Homer as architect, and Professor Woodbridge for heating and ventilation. Professor Lawrence was given charge of the calculations for the iron structure, and was greatly aided by the counsels of Professors Swain and Lanza. Professor Puffer made a careful study of the electric lighting system. Professor Miller undertook the supervision of the construction of boilers and machinery, and devoted much time to the superintendence of this work.

The erection of the Henry L. Pierce Building nearly completes the occupation of two sides of the lot of land on Trinity Place.

The new building is fireproof, and contains many modern improvements, some of them novel, in the equipment of the biological and industrial chemical laboratories. The architectural drawing rooms and some others are supplied with a new system of incandescent lighting by reflection from the ceiling, which is founded upon experiments made by Professor Puffer in the physical laboratory, and will, it is hoped, be especially well adapted to the trying work of architectural and mechanical drawing. Actual tests were made by draughtsmen, and two oculists kindly gave their advice.

The Pierce Building meets the call for more space so urgently made by several departments in late reports. The basement story of the old Architectural Building and two-thirds of the new one have been devoted to heavy machinery of the Mechanical Engineering Department. The remaining third of the basement has been arranged for the lunch room, which is removed from the Rogers Building to make room for the expansion of the Mining Department. The Margaret Cheney room, formerly in the Walker Building, has been given more space on the second floor of the Pierce Building, and the

Geological Department has been removed to this floor from the Rogers Building. The third floor is chiefly occupied by the Biological Department, which had long outgrown its quarters in the Rogers Building. The remainder of the Pierce Building, besides some general recitation rooms, is occupied by the Architectural Department and the industrial chemical laboratories. Their needs have been studied with care, and the special reports of these departments will speak of features of the installation which are particularly worthy of attention.

The engine-house has been enlarged, and provision has been made for all the boilers and machinery which will in the future be required for warming and lighting the series of buildings which may be placed upon the land in Clarendon street now owned by the Institute. Two additional boilers, together with engines and dynamos of 250 horse-power, have been put in this summer for the use of the present buildings. It is good economy to join the warming and lighting appliances, and a notable saving in running expense can be made in that way, but the expenditure of capital upon the purchase of the plant is very large and forms a considerable percentage of the cost of a modern building. The upper story of the boiler house and machinery building, with a good light from above, forms an excellent modelling room for the Architectural Department.

The removal of the Biological and Geological Departments from the Rogers Building has made it possible to meet the want, long felt, of a suitable library for general purposes, and a reading room which can be kept open at all times for the use of students. A fine room occupying the whole of the north side of the Rogers Building has been fitted up for these purposes, and the English Department with its library occupies adjacent rooms. Considerable enlargements of the Secretary's and Bursar's rooms have been made, and Huntington Hall has been repainted and upholstered.

On the twenty-eighth of April a fire occurred in the ceiling

of the life class room of the Architectural Building, and much damage was done to the upper stories of that and of the Engineering Building. The material loss was covered by insurance, but such an accident to the appliances of our crowded buildings was a serious interruption to the work of the school. Energy and good will on the part of teachers and students soon extemporized means for resuming the greater part of the exercises, and fortunately the rooms burned contained no valuable machinery or apparatus. The irreparable disaster of damage to the architectural and engineering libraries was averted by the quick removal of the books and plates by the assistant librarians, instructors, and students, who neglected personal property in the drawing rooms to save the library. The government of the Institute has reimbursed private losses, since they were only in small part covered by the insurance.

The President of the Worcester Polytechnic Institute made a kindly offer of use of rooms, but it was not necessary to avail ourselves of it.

Plans of the Pierce Building and of the ground floor of the Engineering Buildings devoted to Mechanical Engineering are to be found at the end of this report.

The members of the Corporation, whose loss by death has been referred to, are Frederic W. Lincoln and John M. Forbes.

Mayor Lincoln was a charter member of the Corporation. His services began in 1861, and have lasted thirty-seven years, until the date of his death, Sept. 13, 1898. He was at various times a member of the following standing committees: the Society of Arts, the Museum of Industrial Arts, the School of Industrial Science, the Museum of Fine Arts, the Departments of Modern Languages, of Literature, History, and Political Economy, and also a member of nearly all the special committees charged with transacting the current business of the Corporation. He never regarded his duties as perfunctory, but was always present when possible, and ready

to place at the service of the Institute his sound judgment and great experience with men and public affairs. His long connection with our body will always be held in affectionate remembrance.

The death of Mr. Forbes has followed closely upon that of his son, and we have lost the powerful support of men who were leaders in the community. It is proper to speak here only of the points in Mr. Forbes' varied and successful career which touch upon the work of this Corporation, although we had reason to think that the wide sphere of his remarkable activity enhanced his usefulness to our Institute. His gifts have been large and timely, beginning in 1864 and continuing till 1894. President Rogers was in close relations with him from early days, and regarded him as a devoted friend and benefactor of the Institute. He was a member of our finance committee from 1866 till the time of his resignation in 1892, and it is needless to recall that this period was one of difficulty and financial embarrassment, when the duties of the committee were onerous. We look back with gratitude upon the services rendered by his liberality and by his financial talent.

Since I made my last report two important negotiations have taken place which are interesting from the nature of the questions involved, although they have not led to material results. One was with Harvard University, and the other with the United States Naval Department.

A letter was addressed from the Corporation of Harvard College to the Chairman of our Executive Committee asking for a conference. A committee of five was chosen at a meeting of our Corporation, and they held conferences with two members of the Harvard Corporation during the summer and autumn of last year. Your committee reported results to you at your stated meeting, March 9, 1898, and I will briefly recapitulate the substance of this report. The question under discussion was the possibility of avoiding a duplication of courses of instruction in industrial science in the

two neighboring institutions. The desirability of this end was recognized by both committees, and finally the terms of a proposed agreement were signed by all the members in conference, with the understanding that they would be submitted to the Corporation of Harvard College, as a first step toward further action.

The proposal for agreement provided for the transfer to the Institute of Technology of the courses in Civil, Electrical, Mechanical, and Mining Engineering, Metallurgy, and Architecture, now given at Harvard, as well as the use of the income from certain funds destined to the support of these courses. It was provided that the five Fellows of Harvard College should have a place among the fifty members of the Corporation of the Institute, and that two of them should be added to the present seven members of its Executive Committee, making a committee of nine. The presence on the governing board of the Institute of the above-named Fellows of Harvard College was in consequence of the use of funds belonging to the University, and of the alliance of the two bodies for the purpose of technical education. No further change in the form of government, and no changes of title or of independence of action on the part of the Institute were agreed to by the joint committee.

It is impossible to give here the details of a long and friendly discussion in which the end held in view was the advancement of education and the diminution of undue rivalry; but in order to understand the eventual failure to carry out an agreement it is necessary to say that the University Committee put forward the view that the charge of technical studies properly belongs with a university, and that a union, however slight it might be, between the University and the Institute, was desirable. The Institute Committee insisted upon the absolute independence of its government, and believed that condition to be most favorable to the free development of studies in a school of applied science. Our committee also called attention to the local situation, which

renders it unnecessary to duplicate in Cambridge studies that have been long established at Boston, and we believe that this view should receive due consideration, even although under other circumstances it may be the mission of a university to direct schools of engineering and allied professions.

The proposal for agreement signed by the Conference Committee was returned with the assent of the Harvard Corporation, but accompanied by conditions which modified its character, and which looked in the end to the establishment of a closer union. The Institute Committee were unable to see the possibility of making a promise regarding the future, and it will be remembered that they reported to the Corporation at the meeting of March 9 that no decision requiring action had been reached. Their report concludes with the following words:

"Although the result has disappointed our expectations, we still feel convinced that as friends and earnest promoters of instruction we can so direct the course of our respective institutions that they shall mutually help one another and avoid duplication of work.

"It is possible that such a result may be better attained by a friendly interpretation of our common purpose than by any attempt at a formal agreement.

"Your committee are encouraged in this hope by the very friendly acknowledgment of their reply to the Corporation of Harvard, which reads:

"'At a meeting of the President and Fellows of Harvard College, in Boston, January 31, 1898, a communication from the Committee of Conference on the part of the Massachusetts Institute of Technology was received and placed on file.

"'Voted to send the following communication to the committee:

"'The President and Fellows regret that the alliance with the Massachusetts Institute of Technology, proposed by them in a communication dated April 12, 1897, has failed.

"'The President and Fellows cordially recognize the friendly

spirit of the letter of the Committee of Conference of January 10, 1898, and will at any time meet the authorities of the Massachusetts Institute of Technology in consultation, for the purpose of avoiding unnecessary duplication of instruction.'"

The second matter upon which I have to report should not properly be called a negotiation. The initial action by the Institute was taken upon receipt, July 26, of a letter from an officer of the United States Navy, stating that the Secretary of the Navy had under favorable consideration a plan for educating the naval constructors at the Institute, and a desire was expressed for a consultation on the subject. Professor Peabody took a very active part in the matter, and views were interchanged regarding the appropriate studies for a three years' course in Naval Construction, and particularly the building of warships, to be taken by certain graduates from the Naval Academy at Annapolis. The next step followed upon receipt of a letter, dated August 17, from the Chief Naval Constructor, Commodore Hichborn, stating that he was instructed by the Secretary of the Navy to ask the Institute to submit for his consideration a scheme for the technical education of naval cadets assigned to the Corps of Naval Constructors. The immediate presentation was requested of a draft of a course which we would recommend for this object, and which could be at once begun at the Institute of Technology. The question was considered by the Faculty, and, after some further consultation with members of the Board of Naval Constructors, a programme of studies was sent to Commodore Hichborn early in September. Captain Dickens, of the Board of Navigation, was ordered to visit the Institute September 20. He saw the Secretary and Professor Peabody. As it was in vacation, and no notice was given of his coming, the other members of the Faculty were absent, and the models and appliances for the course in Naval Architecture were packed for removal to the new building. Captain Dickens reported September

22 to the Naval Department, and portions of the report appeared in the newspapers September 30. I was only able to learn from the Naval Department on October 29 whether the citations from the report were correct. Certain misconceptions and the following extraordinary passage in the report led me at first to think that the newspaper version was incorrect, but the copy sent me by the Naval Department shows that the newspapers were well informed. The passage alluded to states that "there is no method by which students can be kept up to their work by any means of discipline at the disposal of the Institute." The writer of the report, after stating what he understands to be the views and practice of the Institute regarding the course in Naval Architecture, advises the government to establish a post-graduate course at Annapolis. I have since been informed that the Naval Department has deferred a final decision upon this matter, and that meanwhile the post-graduate studies in Naval Architecture will be carried on at Annapolis.

It is interesting to note that here, as in the negotiations with Harvard University, we take the ground that any branch of technical education is intimately associated with the general scheme of work in an industrial school, and that the traditions and plans of education of such a school are necessarily of slow growth, and that the best conditions for such growth are favored by the independent existence of a governing and educational staff devoting their entire attention to a special educational problem. In the instance before us we contrast a plan to form at Annapolis classes of three to five graduates, and for the detail of a certain number of officers to give a course of naval construction, which shall be added as a post-graduate study to a naval academy, with the programme which we offered to the Naval Department. The latter treats the question as a part of a general engineering problem, which can only be solved to the best advantage in a large engineering school. Our proposed plan of studies brings the students under twenty-five teachers,

each competent and interested in some special branch, and it may be added that in the work accessory to their strictly professional studies the small class of naval constructors would have found themselves in contact with students, as well as with teachers, who were looking to the professional application of the branches which for naval construction are accessory, such as electrical or sanitary engineering, etc. Each class of students in a large school contains a group of young men who intend to make the study in question their life's work, and who inspire the others with some share of the spirit of intelligent application which springs from a foresight of the advantage that a thorough knowledge of the study will afterwards bring in their professional work. Much of the success of a technical school depends upon the propagation of this spirit.

American Association for the Advancement of Science.

In the spring of 1897 the Corporation and the Faculty united with other colleges and learned societies in extending an invitation to the American Association for the Advancement of Science to hold its 50th anniversary meeting in Boston. This invitation was accepted and the meeting was held at the Institute, August 22 to 27, Professor Sedgwick being Chairman of the Local Committee of Arrangements and Professor Tyler Local Secretary. Although the reconstruction work in the Rogers Building could not be completed before the time of the meeting, the work was so well advanced that all needful rooms were made available. The attendance was very large, and much cordial appreciation was shown of the courtesies extended to our visitors.

Omaha Exposition.

The exhibition made by the Institute was a partial one. We supplied photographic and other material for the use of

the United States Commissioner of Education in the collective exhibit of the land-grant colleges, and a distinct Institute exhibit was made in the mining building. The cordial cooperation of two of our graduates in Omaha, Mr. Earl W. Gannett of the class of 1889, and Mr. Arthur S. Rogers of the class of 1894, enabled us with a very small outlay to make an exhibit of value in the gallery of that building. Photographs and other material illustrating the work of the Mining Department were naturally made prominent, but were supplemented by architectural designs, and by a liberal supply of publications. At the close of the exposition the Institute was awarded a gold medal for its exhibit. It may be added that the exposition from an architectural standpoint was largely the work of Institute men, including the architects-in-chief, Messrs. Walker and Kimball, and several of their associates.

The Libraries.

The total number of accessions is 3,261. Of these, 1,197 were obtained by purchase, 703 by binding periodicals and books received in parts, and 1,361 by gift and exchange. After making deductions for books counted twice, for those lost, etc., the total net increase is found to be 2,696 volumes and 516 pamphlets, so that at the end of the period covered by this report the libraries of the Institute contained a total of 46,711 volumes and 14,121 pamphlets and maps.

The expenditures for the year on account of the libraries may be summarized as follows:

Books and binding	$3,783.34
Periodical account	1,466.28
Expense account	176.59
Total	$5,426.21

Details in regard to the increase in the several libraries, and the expenditures of the departments on this account, are given in the following table. The arrangement of the items in this table differs somewhat from that given in the table

of last year, on account of the transfer of the libraries of English Literature, Modern Languages, and Military Science to the General Library.

TABLE OF NET INCREASE, 1897–98, SHOWING COST OF SAME, AND TOTAL CONTENTS OF THE LIBRARIES OF THE INSTITUTE, SEPT. 30, 1898.

LIBRARIES.	NET INCREASE.		Cost Departments.	TOTAL CONTENTS.	
	Volumes.	Pamphlets.		Volumes.[1]	Pamphlets and Maps.[2]
General Library. General	207	173	$47.80	4,005	3,423
General Library. English Literature	99	1	145.91	2,372	37
General Library. Modern Languages	29	18	91.69	594	18
General Library. Military Science	38	6	32.90	136	6
Totals General Library	373	198	$318.30	7,107	3,484
Architecture	195	15	446.59	2,225	200
Biology	121	30	203.73	2,071	404
Chemistry	272	38	379.19	7,228	1,515
Engineering (C.E., M.E., & N.A.)	640	55	899.06	7,922	3,374
Geology	73	13	103.46	1,838	818
Mathematics	108	50	151.82	648	163
Mining	151	18	151.29	2,054	341
Political Science. (Econ. & Hist.)	448	79	527.82	9,008	3,120
Physics	315	20	602.08	6,011	689
Margaret Cheney Room	.....	.....	.....	599	13
Totals	2,696	516	$3,783.34	46,711	14,121

The enumeration of pamphlets in this table does not fully represent the wealth of the libraries in that form of literature. In the Physical Library there is a large number of pamphlets, which were catalogued by the assistant in charge during the last year, but they do not appear in the table because they have not been entered in the record of accessions. Also in the Chemical Library there are many reports of state boards of health, bulletins of agricultural experiment stations, and

[1] Including volumes of collected pamphlets.
[2] Including pamphlets bound together in volumes.

the like, in pamphlet form, which require considerable attention from the Librarian, occupy space, and are of a certain amount of use, but which will not appear in the tables until they are collected together in volumes and bound.

Some of the data usually given to show the amount of work done in the Library may be presented in the form of a table as follows:

Number of orders given for the purchase of books	1,349
Number of order-slips found to be duplicates and returned to heads of departments	173
Number of these reordered	5
Foreign books received for inspection	139
Number of these purchased	60
Orders for binding and lettering	1,053
Cards added to the main catalogue	2,469
Total number of cards in the main catalogue	42,142
Books borrowed from the Chemical Library for home use	2,199

Unfortunately the Chemical Library is the only one in which a record has been kept of the use of the books. Here the proportion of borrowings to the total number of books is high, about 2:7, but it is probable that this would be found not to be much above the average of the other libraries. The system of suggestions for purchase is continued as heretofore, with good results. Every week the American, English, French, and German lists are read over, and any title which appears likely to be of interest to any department of the Institute is brought to the attention of the head professor by means of a "Suggestion for purchase." A large proportion of these have been accepted, but no record was kept of the number.

The clerical force of the Library has reached a state of efficiency never before realized, and the Librarian is enabled to do the work more effectively than heretofore. It has been said that two of the most important libraries of the Institute were seriously threatened by the fire in the Engineering Building, and one of them, the Architectural Library, would

have suffered very serious damage, if it had not been for the prompt work of the students in the building. We cannot give too much praise to these students, who showed such practical loyalty to the Institute, and to Miss Loring, assistant in charge of the library, who coolly stayed upon the scene and directed the work until every book had been removed to a place of safety.

The end of this year marks the beginning of a new epoch in the history of the Library. Heretofore the General Library was simply the office of the Librarian, and incidentally served as a study for first-year students, and a place to store odds and ends that could find no place in the departmental libraries. Now the General Library has been removed to the large room formerly occupied by the biological laboratory. The room has been entirely remodelled, decorated, furnished in mahogany, and provided with electric lights. Adjoining the library is an office, where the Librarian is provided for the first time with room adequate for the work that he has to do. The books and periodicals of the Departments of English Literature, Modern Languages, and Military Science have been added to the General Library, and it is hoped this library will become more widely useful to instructors as well as to students.

Mrs. Henry Draper continues to give the Institute the "Comptes-Rendus de l'Academie des Sciences de Paris." In like manner we are receiving through the generosity of Mrs. William B. Rogers, "Nature" and "Popular Science Monthly." Mrs. Rogers has also given us a number of volumes, including two volumes of Hall's "Palæontology of New York." Among the other gifts to the Library may be mentioned: "History of the Lowell Institute," from Mr. Augustus Lowell, nine volumes on fuels and combustion from Mr. Charles F. Allen, and sixty-one pamphlets and five volumes from Professor Runkle. Professor Gill, Professor Bates, Professor Noyes and Doctor Mulliken, Professor van Daell, Professors Bailey and Woods, Mrs. Richards and Miss Maria Elliott,

and Professor Wells have each presented the Institute with copies of their published writings.

SCHOLARSHIPS.

The work of the Scholarship Committee of the Faculty has continued to increase, and the demand on the part of needy and meritorious students has more than kept pace with the large increase in available resources. A further payment from the estate of the late Mrs. Dickinson has recently increased our principal by $40,000, but the full income of this amount is not available for the present year. The number of applicants for Institute scholarships up to the present time has been 127, while 127 submitted applications for the forty State scholarships. Sixty-eight of these made applications in both places, leaving the total number of applicants considered by the Faculty and the State Board of Education 186. Of these, 38 have received scholarships to the amount of full tuition; 86 others have received smaller amounts, averaging somewhat more than one hundred dollars each.

Last year a decision from the Attorney-General's office appeared to preclude the further division of State scholarships in halves. As such division had made it possible to assist a much larger number of applicants to the extent needful, representations were at once made to the Legislature, which led to the enactment of a supplementary act authorizing division for the future.

Attention was called in the last report to the fact that repayment had not been made to the desired extent by past beneficiaries of the Rogers Fund. In view of the fact that returned amounts become immediately available for use as income, it seemed especially important to the committee that some improvement should be effected. Notes were accordingly sent by the Chairman of the Alumni Committee to those persons whose indebtedness was of somewhat long standing, and more than $300 has been returned for the immediate use

of the Scholarship Committee. It is hoped that many such returns will be made in the future.

GRADUATE SCHOLARSHIPS.

The graduate scholars of the current year are Messrs. D. W. Edgerly, of the class of '98; W. T. Keough, of the class of '88; E. S. Manson, Jr., of the class of '97; G. P. Stevens, of the class of '98; and C.-E. A. Winslow, of the class of '98. Of these Messrs. Edgerly, Stevens, and Winslow are candidates for the Master's degree; Mr. Manson received that degree last year; Mr. Keough is taking special work in naval architecture. By the generosity of Mr. Augustus Hemenway, Mr. Winslow receives a scholarship of $400, and will be designated in the catalogue as Hemenway scholar.

FELLOWSHIPS.

The Swett fellowship is retained by Mr. William David Coolidge, of the class of 1895. Mr. Coolidge's work in Leipzig has been so successful that he has received an appointment as private assistant to Professor Drude for the current year.

Mr. Wendell, who had held the Savage fellowship for two years, not having renewed his application, the fellowship has been transferred to Mr. George K. Burgess, of the class of 1896, who has been for the last two years Assistant in Physics. Mr. Burgess is now engaged in advanced studies at Paris.

Mr. Herbert William Chamberlain, of the class of 1895, was also an applicant for a fellowship, and it was with much regret that the Faculty found itself unable to assist him. He has, however, in recognition of his attainments and the merit of his plans for work abroad, been appointed a Fellow without pecuniary aid, and Mr. Wendell's name has also been retained as an honorary Fellow. It is believed by the Faculty that advanced work by our graduates under the general

direction of the Faculty may well be recognized in this manner.

Military Science and Tactics.

Captain Bigelow was called to active service shortly before the expiration of the time of his detail, and I desire to express our regret at the termination of his connection with our Institute. We are indebted to his initiative for the excellent footing upon which the military instruction has been placed, and to his zeal, untiring interest, and good judgment as a member of the Faculty in conducting these studies in harmony with the general policy of the school. It was impossible, on account of a decision of the War Department, to secure the detail at present of an officer on the active list, nor did we succeed in obtaining the appointment of a retired officer of the regular army, but we have secured the services of Captain John Bordman, Jr., Battery A, 1st Massachusetts Heavy Artillery, who has been appointed military instructor for one year.

Captain Bordman entered service in 1888; held commission in Harvard Rifles and studied military science at Harvard University, from which he holds degrees of A.B., 1894, and LL.B., 1897. He specialized in American history, taking highest second-year honors, and honorable mention twice. He performed active service when his regiment was mustered into the United States volunteer army.

The instruction in military science and tactics has proved of immediate advantage to certain of our students during the last summer, when the volunteer army was mustered into service.

A long continued correspondence with alumni and with special students who have followed courses at the Institute has given us the names of seventy-five who were engaged in the military service of the United States during the recent war with Spain, but some names are still wanting.

The following lists commemorate the names of these men:

Members of undergraduate classes who entered the United States service:

Adams, H. H., '99, engineering work at Fort Warren.
Borden, Raymond D., 1902.
Bowditch, Ingersoll, 1900.
Boyle, John, Jr., 1901.
Dodge, Lyman E., 1901.
Hasbrouck, R., '99.
Hitchcock, Albert W., '99, 2d Massachusetts Regiment.
Kendall, Frederic M., 1900, Sergeant, 6th Massachusetts Volunteers.
Little, James L., Jr., 1900.
Miller, Stuart B., 1900.
Patch, Claude E., 1901, 6th Massachusetts Regiment, Acting Bugler.
Pierce, Reginald K., '99, Troop A, N.Y.
Robson, Edward R., 1900, coast defence.
Snelling, Howard, '99.
Stevens, F. B., 1900, coast duty with Cadets.
Taylor, Denzil H., '99, Company A, 6th Regiment.

Former students serving in the Regular Army during the war with Spain:

Borup, Henry D., '84. Graduate of West Point, Lieutenant, U.S.A.
Füger, Frederick W., '91. 1st Lieutenant, 13th U.S. Infantry.
Haines, John T., '85. 1st Lieutenant and Quartermaster, 5th Cavalry, U.S.A.
Lyle, David A., '84. Graduate of West Point, Captain, Inspector of Ordnance, U.S.A.
Osgood, Henry D. Private, U.S.A.
Ripley, Henry L., '73. Captain, 3d Cavalry.
Russell, Andrew H., '68. Graduate of West Point, Inspector of Ordnance.

Weston, John F., '85. Graduate of U.S. Artillery School, Brigadier General, U.S.A.

Former students serving in the Volunteer Army or Navy:

Alden, Charles H., Jr., '90. Corporal, Company D, 1st Corps Cadets, M.V.M.

Allen, William H., Jr., '97. 1st Corps Cadets, M.V.M.

Ames, Azel, '95. Captain, 1st Regiment, U.S. Volunteer Engineers.

Ames, Butler, '96. 1st Lieutenant, Light Battery A, until May, '98. Resigned to accept Adjutancy of 6th Massachusetts Regiment. Appointed Lieutenant-Colonel.

Appleton, Charles B., '84. At Camp Dewey, on the Provost Guard.

Atwood, Thomas C., '97. April, '98, Naval Brigade, M.V.M. June 16, '98, enlisted U.S. Navy. Sept. 5, '98, honorably discharged from Navy. Served on gunboat "Inca," as gunner's mate.

Bemis, Albert F., '93. Company A, 1st Corps Cadets, M.V.M.

Borden, Charles N., '89. Sept. 30, '92, Naval Brigade, M.V.M. Nov. 1, '92, appointed Petty Officer. March 9, '98, received commission as Ensign, U.S.N. Sept. 16, '98, received honorable discharge from Navy. Now Ensign in Naval Brigade, U.S.N.

Coburn, Arthur S., '95. May 16, '98, machinist at Boston Navy Yard, detailed to U.S.S. "Southery."

Collins, Bertrand R. T., '88. May 24, '98, Ensign in U.S. Navy. June 2 to September 22, Watch and Division Officer, U.S.S. "Scorpion." October 22, honorable discharge.

Conant, Francis M., '96. 142d Separate Company N. G., N.Y.

Dana, Leslie, '96. Light Battery A, 1st Missouri Volunteers. Detached duty on the U.S.S. "Gloucester."

Daniell, Jere R., '97. Assistant Engineer with rank of Ensign, U.S. Navy.

DuBois, Barron P., '92. Past Assistant Paymaster, U.S.S. "Bennington."

Feland, Logan, '92, Captain, Company K, 3rd Regiment, Kentucky Volunteers.

Ferguson, John N., '94. March, '96, Massachusetts Naval Brigade.

Foster, Sumner H., '95. Captain.

Hammond, Charles F., '91. Chief Master-at-Arms, U.S.S. "Yosemite," acting May 19 to August 22, Michigan Naval Militia. August 22, honorably discharged.

Hayden, Charles, '90. 1st Corps Cadets, M.V.M.

Hewett, Joseph, '96. 1st Lieutenant, 2d Co., M.P.M.

Holton, Edward C., '88. Sergeant, Troop C, 1st Ohio Volunteer Cavalry.

Howard, Sheldon L., '98. 2d Lieutenant, 5th Massachusetts Infantry, U.S. Volunteers.

Howe, J. Wilder, '93. 2d Lieutenant, 2d Regiment of Engineers, U.S. Volunteers.

Hubbard, Chester D., '97. 1st-class Sergeant, 1st U.S. Volunteer Signal Corps.

Hunt, Alfred E., '76. Captain of Light Artillery, U.S. Volunteer Service from Pennsylvania. In camp at Mt. Gretna, Chickamauga, and Porto Rico. Service at Santiago.

Kent, William A., '97. May 15, Sergeant 1st Volunteers, transferred to 3d U.S. Volunteer Engineers. June 29, Sergeant-Major. September 12, 2d Lieutenant.

Kotzschmar, Hermann, '95. Engineer, U.S. Navy.

Lansingh, Van Rensselaer, '98. July 21, '98, U.S. Volunteer Engineers, 2d Regiment, 2d Battery, Company E, at Chicago.

Lenfest, Bertram A., '90. Company A, 6th Regiment, M.V.M.

Loomis, Henry M., '97. 142 Separate Company, N. G., N.Y.

MacClure, Colbert A., '94. June, '98, 2d Lieutenant, Company D, 17th Regiment, National Guards of Pennsylvania.

MacRae, Donald, '85. Captain of Company K, 2d Regiment, North Carolina Volunteers.

Messenger, William H., '92. Assistant Engineer, rank of Ensign, U.S.S. "Cincinnati."

Morris, Charles, Jr., '96. June, '98, U. S. Navy, as Assistant-Paymaster, U.S.S. "Hist."

Pierce, Edward L., Jr., '86. 2d Lieutenant, 1st U.S. Volunteer Engineers.

Pierce, Josiah, Jr., '86. Colonel on General Grant's Staff in Porto Rico, engineer's office.

Pope, Charles H., Jr., '97. Private.

Sears, Henry D., '87. Lieutenant in command of Company E, Massachusetts Naval Brigade.

Sears, Mortimer A., '96. May 1, '97, enlisted Denver City Troop N.G.C.

Smalley, F. N., '96, Hospital Corps, U.S.A., Manila.

Sprague, Timothy W., '87, Company B, 1st Corps Cadets.

Stearns, Frederic B., '98. With Cadets.

Stearns, Walter M., '96. 1st Corps Cadets M.V.M.

Strickland, William R., '98. May 14, '98, Assistant Engineer, U.S. Navy, relative rank of Ensign. Assigned to U.S.S. "Bennington."

Swift, William E., '95. July 20, '98, 2d Lieutenant, 20th Company Provisional Militia of Massachusetts. Aug. 3, '98, received commission.

Taylor, Edward M., '98. 1st Lieutenant, U.S. Volunteer Engineers.

Thompson, Frederic, '98. Oct. 5, '98, appointed Civil Engineer U.S. Navy, rank of Lieutenant (junior grade).

Tillinghast, Charles F., '95. April 28, '98, U.S. Volunteer Service, Rhode Island Regiment. May 10, '98, appointed Captain, Company A, 1st Rhode Island U.S. Volunteer Infantry.

Vielé, Maurice A., '86. Captain, 1st U.S. Volunteer Engineers.

Wells, Edward C., '92. Past Assistant Engineer, 2d Battalion, Naval Militia of Illinois.

Wood, Kenneth F., '94. Warrant officer with rank of Sergeant. Member of Hospital Corps Brigade of Rhode Island.

Changes in the Faculty and the Corps of Instruction.

Dr. H. O. Hofman has been appointed Professor of Metallurgy. He was made Associate Professor in 1891, after a previous connection with the Institute commencing in 1885. Born in Heidelberg, and trained in scientific studies in that university, he entered the royal Prussian School of Mines, and was graduated 1877 as mining engineer and metallurgist, and entered the government service at the Lautenthal Smelting Works in the Harz Mountains. In 1881 Dr. Hofman came to America and engaged in metallurgical work, being employed in Pennsylvania, Missouri, Kansas, Colorado, and Mexico. His thorough acquaintance with European and American metallurgical processes has been of great value in his teaching, and his text-book, referred to elsewhere, makes him a recognized authority on these subjects.

Dr. Henry P. Talbot has been appointed Professor of Analytical Chemistry. He graduated at the Institute in 1885, and studied in Germany for two years. Since that time he has been continuously connected with the chemical department of the Institute, and after the departure of Dr. Drown he performed with great fidelity and good judgment a large share of administrative work of the chemical departments. He has charge in the laboratory and the lecture room of the large classes in analytical chemistry.

Assistant Professor Bartlett has been appointed Associate Professor of Mathematics, having served the Institute with marked success, not only as a teacher of mathematics, but in other directions, since his graduation.

Mr. Henry G. Pearson has been appointed Assistant Professor of English. He received his A.B. degree at Harvard in 1893, and was appointed Instructor in English in the same year. The Department of English has been so much strengthened in recent years that it is now able to coöperate effectively in criticism of written work of students in other departments.

Mr. James Swan, '91, after spending the summer vacation in government service at Newport News, finally resigned his instructorship in Naval Architecture to enter the employ of the Newport News Shipbuilding Company. Mr. Swan's work in the department was taken by Mr. Carl H. Clark, '95, who was transferred from the Department of Mechanical Engineering.

The following assistants have terminated their connection with the Institute:

Frederic W. Howe, B.S.,
George K. Burgess, S.B.,
Leonard H. Goodhue, S.B.,
Fred E. Busby, S.B.,
Minor S. Jameson, S.B.,
William L. Root, S.B.,
Charles N. Haskins, S.B.,
Nathan Hayward, A.B., S.B.,
Herman W. Marshall, S.B.,
Minot A. Bridgham,
Ira G. Studley,
William F. Hyde.

The following new assistants have been appointed:

Charles B. Breed, S.B., in Civil Engineering.
Joseph G. Coffin, S.B., in Physics.
William T. Hall, S.B., in Analytical Chemistry.
George M. Holman, M.D., in Biology.
Areli H. Jacoby, S.B., in Industrial Chemistry.
Carleton S. Koch, S.B., in Mining Engineering.
Alice G. Loring, in Architecture.
Joseph C. Riley, S.B., in Mechanical Engineering.
Eugene W. Rutherford, S.B., in Mechanical Engineering.
Lewis J. Seidensticker, S.B., in Oil and Gas Analysis.
Harrison W. Smith, A.B., S.B., in Physics.
Maurice De K. Thompson, S.B., in Physics.
James Francis Leary, in Forging.
Joseph Albert Frizzell, in Woodwork.
Frank Cushman, Jr., in Machine Tool Work.

Entrance Requirements.

The addition of an elective subject to our previous entrance requirements was announced in the last catalogue, and has

gone into effect this year. The information obtained through the teachers' certificates has been of much value, and the laboratory note-books have shown that work of high quality in physics and chemistry is done in not a few of the secondary schools. Next year solid geometry becomes an absolute requirement for admission, instead of an alternative, as now, with advanced algebra. The Faculty are of opinion that all secondary schools preparing students for the Institute should be able to teach solid geometry, and it is in general better for students to prepare in this subject than in advanced algebra. It will still be possible, however, for the stronger schools to teach both subjects, as they have done heretofore.

Departmental Reports.

Mathematical Department. — No radical changes have occurred in the department during the past year. The number of sections has remained unchanged, and with the present constancy of the total number of students, no increase is likely to be needful in the near future. The department has shared to some extent in the Institute expansion, gaining the use of Room 20 of the Rogers Building for its library and collection of models. Delays have occurred in the preparation of cases for this room, but it will form when finished a commodious and accessible room for instructors and advanced students. A special appropriation has been made for the purchase of needful books of reference for the library. Professor Woods is at present giving an advanced course at Harvard, the occasion being the absence for the year of Professor Peirce.

The Department of Modern Languages has been called upon this year to take its share in the work of preparation for the industrial expansion which is expected to result from the conquest of colonial possessions.

The class in Spanish has mounted from eight to fifty students. It is probable that this large increase springs from temporary enthusiasm, but it is certain that we shall be

required to provide more than hitherto for the linguistic education of our graduates who seek occupation in foreign lands. If this movement takes place, it will be a new one, for the addresses of the graduates in 1896 and in 1897 show only two names of students now residing abroad, and one of these is an alien.

Courses I. and XI., Civil and Sanitary Engineering. — No changes have been made in the courses of study during the past year. The occupation of part of the new building has given a much needed increase of space in this department, and there is now ample accommodation for a number of years.

The greater part of the upper floor of the Engineering Building, which was formerly occupied by the second and third year drawing rooms, is now devoted to the second year alone, the partition, which was partially destroyed by fire, having been removed. This room will accommodate over one hundred and fifty desks, and will provide for considerable growth. The upper floor in the former Architectural Building is now occupied as the third-year drawing room, and will accommodate from sixty to eighty students. The floor below, of the same size, is occupied as the fourth-year drawing room. The old fourth-year drawing room has been given up partly to private offices which had to be moved on account of the extension of the library, and the remainder is used as a model room and museum in which the various instruments, models, and specimens of the department are kept in cases where they will be easily accessible, and where they may at the same time prove of interest to visitors. More ample space, together with the construction of the geodetic observatory, enables the work of the Civil Engineering Department to be carried on to much better advantage than ever before.

The geodetic observatory, to which reference was made in my last report, was completed during the last spring. It is located in the Middlesex Fells, upon a site which is very favorable for the observations which are there to be conducted. The thanks of the Corporation are due, and have been expressed, to the Metropolitan Park Commissioners for

permission to erect the building in this location. The observatory is a stone building fifteen feet square, and has already been equipped with a number of instruments, including a break circuit chronograph, a sidereal chronometer, a transit instrument with micrometer eyepiece, and various smaller instruments. The magnetometer, owned by the Physical Department, will also be used here. A dip circle has already been ordered, and during the present year the observatory will be further equipped with a pendulum apparatus for measuring the relative force of gravity and with a large altazimuth instrument. With this equipment, the Civil Engineering Department will be able to offer superior advantages for the study of geodesy.

The property of the department has been further increased during the year by the addition of a large number of photographs and slides, and during the coming year it is expected to make this collection very complete and valuable.

The extension of the engineering laboratory into the basement of the Architectural Building affords the much-needed increase of room in the hydraulic laboratory and pit, to which reference was made in my last report.

Various excursions have been made during the past year to works of interest in the neighborhood of Boston, and thanks are again due to President Lucius Tuttle, of the Boston & Maine Railroad; General Manager W. H. Barnes, of the Boston & Albany Railroad; General Passenger Agent A. C. Kendall, of the New York, New Haven & Hartford R.R.; Superintendent of Streets B. W. Wells; Deputy Superintendent C. R. Cutter; and various other gentlemen, for courtesies extended in connection with these excursions and with the general work of the department.

Summer School of the Civil Engineering Department. — The summer school for field-work in the Civil Engineering Department was held during the month of June at Lancaster, Mass., a new location for this work. This was the eleventh summer school of this department. Sixteen stu-

dents were in attendance. Instruction was given by Professors Burton, Porter, Robbins, and Barton, assisted by Mr. McKibben and Mr. Hosmer of the instructing staff, and by Mr. H. R. Thayer of the class of '98. The work was continued during nearly four weeks. The usual practice was given in topographical field work, and in triangulation and base-line measurements, and gaugings were made of the flow of water in the two branches of the Nashua River, and also in the mill flumes in Lowell. Under the direction of Professor Barton, geological field work was also carried on. A meteorological station was established on Mt. Wachusett, and the regular records of the weather bureau were there taken. Observations were also made for time and latitude. Practice was given in signalling with the heliotrope, and observations were made on atmospheric refraction.

Course II., Mechanical Engineering. — For the last two or three years the engineering laboratories have been gradually becoming more and more crowded, until they have reached such a condition that a part of the apparatus in our possession could not be utilized, and some could not be used to the best advantage. This matter has been remedied by the erection of the Pierce Building; there has been added to the engineering laboratories the basement of the former Architectural Building and also one-half the basement of the Pierce Building, making their total floor space about 21,000 square feet.

The drawing-room No. 20, on the second floor, is now occupied by second and third year students, 124 in the first term and 171 in the second term. The drawing-room No. 30, on the third floor, is occupied by 117 third and fourth year students. Two hundred and eighty-five drawing tables are now used, and their number could be increased to 315, and a somewhat larger number of students could be accommodated because in the second year two can use one desk.

The laboratory of applied mechanics admits of experimental work with machines and apparatus for 135 students, with some margin for expansion.

The other portions of the engineering laboratories have space for about 300 students. The largest number which has yet worked in them is 243.

In the basement of the Pierce Building has been placed a McIntosh and Seymour 11-inch and 19-inch by 15-inch tandem compound engine, provided with a surface condenser and an air pump, all suitably arranged for purposes of experiment. The main drive wheels are rope wheels, and the power is taken from this engine to the main line of shafting by a rope drive. A Prony brake of 100-horse-power capacity is also placed in this laboratory. This brake was already in possession of the Institute, but could not be used for lack of room.

The 36-horse-power Otto gas engine and the rotary pump are on foundations in this room, and can now be operated at their full capacity for purposes of experiment. There is a large cistern for water, which is connected by a pipe with the cistern in the Engineering Building, thus furnishing a larger cistern capacity for water for the hydraulic experiments. The boiler-house has been enlarged, and two new horizontal tubular boilers have been added, these being fitted with Hawley down-draught furnaces. This furnishes additional opportunities for boiler testing.

Besides the improvements in the engineering laboratories, there has been added to the drawing-room space the second floor of the former Architectural Building, and a new drawing-room has been set apart for the Department of Naval Architecture, thus relieving our drawing-rooms from their crowded condition.

A new circular of the department has been issued, describing the equipment as it now exists, and containing plans of the laboratories. The following table, taken from this circular, shows the present occupations of all the living graduates from '68 through '97. It is interesting to follow the careers of those whom we have undertaken to train for industrial pursuits, and to find that ninety per cent. are now making a direct use of that training.

Professor Peabody has issued this autumn a revised addition of his "Thermodynamics of the Steam Engine." This standard text-book has undergone a thorough revision since the date of the last edition, 1889, and includes the last experimental work on the subject.

OCCUPATIONS OF THE LIVING GRADUATES IN MECHANICAL ENGINEERING, 1868–97.

Railroads, including brakes and signals	29	Lawyers and patent solicitors	6
Textile industries and machinery	30	Building materials	4
Steam-engine and steam-pump works	17	Cordage works	2
Steel and iron works	14	Contracting engineers	2
General machinery	27	Photographic materials	5
Electrical works	22	Testing laboratory	1
Ship and marine engine works	16	Astronomy and meteorology	2
Experts and consulting engineers	27	Editor	2
Experts' assistants	11	Chemist	1
Special machinery and manufactures	69	Architect	1
Teachers	36	Military	3
Mill insurance	7	Surveyor and landscape gardener,	4
Refrigerating machinery	4	Doctors	2
Paper making	4	Artist	1
Gas works	2	Farmer	1
Water and sewerage	5	In business	27
		Students	11
		No record	4
			389

The publication of the results of tests in the Technology Quarterly has been continued: No. IX. issued March, 1898, and No. X., September, 1898.

APPLIED MECHANICS. — The basement of the former Architectural Building has been added to the laboratory of applied mechanics, and in this room have been placed the transverse testing machine of 18,000 pounds capacity, the machine for testing sliding position, and the machine for testing the wear of brake shoes and wheel tires, all of which were in the other part of the laboratory, where they had not sufficient room. The two experimental governors have also been placed here.

The power is transmitted to this room from the other part of the engineering laboratories by a rope drive presented to the Institute by the Dodge Manufacturing Company.

There has been built, out of doors, a kiln for drying lumber, to allow of the study of the effect of different percentages of moisture upon full-size timber beams and columns.

SHOPWORK. — The total number of students taking shopwork is 231 (last year it was 210). Many of these take more than one course, and they are divided among the different shop departments as follows:

CARPENTRY AND WOOD TURNING, Courses II., VI., X., and Special Class	103
FORGING, Courses II., XIII., and Special Class	89
CHIPPING AND FILING, Courses II., XIII., and Special Class	54
MACHINE TOOL WORK, Courses II., XIII.	34
METAL TURNING, Course VI.	39
PIPING, Course XI.	2
	321
Students taking more than one course and counted two or more times	90
	231

The change of the shop entrance to the large central door in the front of the workshops, located on the driveway leading from Garrison street, has resulted in extensive improvements and enlargements. This entrance, which replaces the three doors previously used, now gives direct and convenient access to all of the shop departments. At the right of this main entrance a large lavatory (30 ft. × 40 ft.) has been fitted up with suitable sinks and 204 lockers. From the lavatory the students may go directly to the different departments, a partitioned passage through the carpenter shop leading to the forge shop. There can now be no interference with class work by students passing in or

out of the shops. To make room for the lavatory, the tool-room of the machine shop was moved to the west, where it is increased in size about one-third. It is now 40 ft. × 12 ft., and is more conveniently located. West of the tool room, and in the space formerly taken up in part by the entrance to the machine shop, an "instruction-room" for chipping and filing and machine-tool work has been fitted up with seats, forming an amphitheatre about an engine-lathe, speed-lathe, and chipping and filing bench. This, it is believed, will prove a great convenience and assistance in giving instruction. In the rear of this room an office has been fitted up for the instructor.

The removal of the machine-shop lavatory has made available a space about 10 ft. × 40 ft. This may be advantageously used for new machinery, which it is hoped we shall have before long. A new office has been constructed for the instructor in forging, without loss of shop room, and it has been found a great convenience when compared with previous arrangements.

Course III., Mining and Metallurgy. — This department has relinquished Rooms 36 and 37 on the third floor of the Rogers Building and has received in exchange the space recently occupied by the lunch-room. This change, together with the removal of the blowpipe work to the Pierce Building, has permitted the consolidation of the instruction to great advantage. The lectures are now all given in one room, with charts and specimens always at hand for illustration, and a much needed laboratory for mining and metallurgical tests on a small scale has been installed with desks for twenty students.

The assaying laboratory has been enlarged and now has desks for seventy-six students.

The other laboratories are arranged for the instruction of classes in sections of the following numbers:

Assaying laboratory	15
Smelting laboratory	10
Ore-dressing laboratory	10

The lavatory has lockers for one hundred students.

The room for assay supplies has been enlarged to meet the increasing demand.

Two new offices have been partitioned off, one for Professor Lodge and one for the assistants.

The collections of ores and metallurgical products have all been assembled in one room to be used as a museum, and are now being thoroughly arranged and labelled.

The Mining and Metallurgical Laboratory has been supplied with a new Root blower of greater capacity than that formerly used; with a new crucible furnace for larger crucibles and higher heats than that which it replaces; with a new chlorinating barrel for gas chlorination of gold ores; with a set of Devereux slag pots for the blast furnace; with an electric motor which will drive all the machinery in place of the engine; with a new Harz jig for concentrating ores. The crushing rolls have been newly mounted with Gates feeder and adjustments for graded crushing.

Professor Richards' book on ore dressing is nearly completed. During the year he has contributed an article on ore dressing to the Mineral Industry.

The new edition of Professor Hofman's work on lead has passed through the press and is just now coming out. This book contains a complete treatment of the processes used in America and of foreign methods so far as they interest our metallurgists, and it is a most important authority upon the subject.

Professor Hofman has written two papers on testing clays, one on coking in by-product ovens, and has contributed an article on "Lead" to the Mineral Industry.

Professor Lodge is preparing a new edition of his "Lithographic Notes on Assaying."

SUMMER SCHOOL OF MINING ENGINEERING. — The Summer School of Mining Engineering was this year held in Nova Scotia. Visits were made to mines, coke works, and furnaces; those to the mines were given the most prominence.

The party numbered fourteen, including Professors Richards and Hofman, Assistant Watts and eleven students of the second, third, and fourth years in the Department of Mining Engineering and Metallurgy. The party studied the plants and the methods of operation at the gold mines, mill and chlorinating works of the Brookfield Mining Company, Limited, at North Brookfield; at the coal mines of the Cumberland Railway and Coal Company at Springhill, of the Canada Coal and Railway Company at Joggins, and of the Intercolonial Coal Company, Limited, at Westville; at the iron mine, coke ovens, iron furnace and steel works, near New Glasgow, of the Nova Scotia Steel Company, Limited; at the coke and gas works of the Peoples' Light and Heat Company, Limited, at Halifax; and at the gold mine and mill of the Golden Group Mining Company, Limited, at Montagu.

Besides the above more strictly professional studies, excursions were made with Mr. B. B. Barnhill of the class of '73 at Joggins to inspect the geological exposures, and at Partridge Island to collect minerals occurring in the trap formation. The thanks of the department and of the Institute are due to the gentlemen in charge of the above works for the kind and sympathetic interest taken in the students, to whom the freedom of the works was cordially granted.

Course IV., Architecture. — The only important change in the courses of study offered by the Department of Architecture has been the introduction of the new option in Architectural Engineering. For some time it has been felt that a demand existed for men specially trained in the computation of all the details of modern steel construction, and that the regular course should be so modified that under-graduates might be allowed a choice between the academic and engineering sides of architecture. This choice is now offered at the middle of the third year, the introduction of courses in structures and structural design, in place of academic design, constituting an important addition to the engineering side of the established courses of the department. It is to be hoped

that graduates as well as under-graduates will take advantage of opportunities offered by this option.

By far the most important event during the past year has been the change to the new quarters in the Pierce Building. For the third time since 1883 the department has had to change its location in order to meet the constant need of expansion. From the small rooms at the top of Rogers it has so grown that it now occupies two and one-half floors of the Pierce Building and the large room at the top of the Dynamo Building.

The new quarters provide space for all the rooms of the former Architectural Building, and in addition give opportunity for increased accommodation for the architectural library, exhibition-room, and fourth-year and graduate drawing-rooms. The library and fourth-year drawing-room have now double the area of the old room, and the former crowding and interference have entirely disappeared. We are also to be congratulated on the fact that the library is now placed in a fireproof building where its valuable books will have proper protection. The adoption of the alcove system in the library greatly assists in the effective use of books by bringing together works of the same period and subject. The library is not only better arranged than heretofore, but also has room for the addition of some 800 quarto volumes, 250 large folio volumes, 10,000 photographs, and 12,000 lantern slides. Better table space is also provided, and many periodicals, catalogues, and plates formerly not accessible can now be placed on the shelves. In addition, an entire alcove has been devoted to the exhibition and use of books and photographs relating to the course on the History of European Civilization and Art.

The new exhibition room gives ample opportunity for the display and comparison of designs and sketches, and the continuous exhibition of students' work. It is therefore an important aid in architectural training. The new drawing-rooms are all that could be desired, and their walls are

rapidly being covered with the best examples of academic drawing and details of classic buildings. Daylight is well diffused by the special glass and light-colored walls, so that all parts of the room can be used to advantage. At present there are the following desks in the different drawing-rooms. The number which could eventually be placed in the rooms is given in the second column:

Second-year drawing-room,	37	desks;	limit	about	56	desks.		
Third-year	"	"	46	"	"	"	75	"
Fourth-year	"	"	41	"	"	"	56	"
Graduate	"	"	11	"	"	"	15	"

The new architectural studio is also a great improvement on the old room, for it now has both direct and north top light in addition to the light from the side windows. The great north skylight in this room gives a superb light for life-class work.

At present the department feels the need of large casts in order to familiarize the students with the scale and actual size of good architectural detail. The full-size models of the orders from the Theatre of Marcellus and the full-size cornice from the Temple of Concord at Rome have proved excellent aids in class work and general instruction, but more examples are needed, and it is hoped that a series of such casts from historic buildings may be obtained in the near future.

The prizes annually given to students in the department were this year awarded as follows:

Rotch prize, $100, for student graduating with greatest distinction, Mr. G. P. Stevens.

Rotch prize, $100, for special student completing course with highest standing, Mr. A. H. Cox.

Boston Society of Architects' prize, $50, Mr. E. H. Schroeder.

Boston Society of Architects' prize, $50, Mr. H. P. Richmond.

It may also be interesting to state that during the past

summer Professor Chandler has been head of the Architect's Department of the city of Boston and a member of the Fine Arts Commission; Professor Despradelle is one of the eleven competitors chosen for the second trial in the great Phœbe Hearst world competition for the University of California; Professor Homer has had charge of the construction of the new buildings of the Institute.

Courses V. and X., Chemistry and Chemical Engineering. — The removal of the third-year students in analytical chemistry to their new laboratory on the third floor has made available some additional space much needed for the growth and development of the fourth-year work.

The organic laboratory has been considerably enlarged during the preceding summer, so that it now accommodates thirty-six students instead of thirty as heretofore. It has, moreover, been much improved by a large increase in the number of hoods, by a more convenient arrangement of desks, and by the construction of a new skylight, so that the laboratory is now thoroughly lighted.

A laboratory has been equipped for the new course in proximate technical analysis referred to in the report of last year. This course, it will be remembered, comprises the examination of such industrial products as asphalt, rubber, soap, paper, and tannins, and is taken as an option by the larger number of the chemical students in their fourth year.

The facilities for thesis work have been increased by the construction of a photographic dark-room and of a tool-room equipped with a power lathe.

Several of the theses made by the chemical students during the past year have yielded results worthy of publication, fifteen or more articles on theoretical, analytical, and organic chemistry having been published by instructors and students.

No important changes have been made in the courses of instruction in organic chemistry. The fourth-year work has, however, been extended by the introduction of a lecture course on the history of chemistry, given by Dr. Norris,

and by that of a laboratory course in electrical and heat measurements in charge of the Department of Physics.

ANALYTICAL CHEMISTRY. — The total number of students taking analytical chemistry is 135; 92 taking qualitative and 43 quantitative analysis.

This total is larger than it has been ever before, but, with the exception of four students who work but three hours per week, and for whom special provision has been made, each student has a full desk at his disposal. The advantages in increased facility, both of teaching and working, are plainly apparent.

The analytical laboratory on the fourth floor of the Walker Building accommodates, since the alterations of the summer, ninety students, and the new laboratory on the third floor, which occupies the rooms formerly used for the textile coloring laboratory and a private laboratory, has working places for sixty students. The upper laboratory is now used wholly for students taking qualitative and preliminary quantitative analysis, while those taking more advanced quantitative analysis have desks on the third floor. The new laboratory is equipped with steam tables, steam baths, drying closets, and funnel closets of ample capacity, and gives promise of excellent service.

A new private laboratory for the use of the instructors greatly facilitates their work with the students. The former lecture room, which also connects directly with the new laboratory, has been converted into a private laboratory and office for Professor Talbot, and in convenience of access and general accommodation is proving highly satisfactory.

The absorption of the former balance-room on the fourth floor by the Organic laboratory made it necessary to transfer the balances to the former volumetric room, and to do away with the reservation of a special room for this work. The volumetric room was not sufficiently large to accommodate the entire number of students at work in that line, and so much of the volumetric work was necessarily done in the

large laboratory that the transfer of all will not cause a serious drawback. A new balance room is provided on the third floor, and the two rooms will furnish places for thirty balances.

The number of students in the upper laboratory is unusually large this year owing to the exceptional number in Course III., third year, and to the fact that a considerable number of students of the second year of the same course have satisfied the language requirements, and are anticipating the chemical work of the third year. Many of these students will enter the new laboratory next year, and will perhaps tax its capacity; but it does not now appear that the numbers will be as large in the following years.

In general, it may be said that the division of the work in analytical chemistry which is now made possible by the use of the second laboratory seems to be productive of increased ease in teaching, and to be generally beneficial. The changes are of such a nature that if further expansion becomes in time necessary, it can be accomplished with a minimum of change.

The transfer of the supply room to the room formerly known as the Margaret Cheney room is regarded as an improvement in itself, and the room formerly occupied as a supply-room is available as a research laboratory.

The portion of Room 3 formerly the industrial laboratory, which has been reserved to furnish a passageway to the vault, supplies the space needed for the unpacking of goods, and may also be used for special lines of chemical work.

The chemical library has received about the usual number of additions, and is believed to be supplied with all valuable works published during the year.

The outlay for apparatus to equip the new laboratories must necessarily involve a larger net expenditure for this year than is usual in the Department of Chemistry. This is, of course, a temporary demand.

SANITARY CHEMISTRY. — No new work has been undertaken. The pressing demands for space and time in other di-

visions of chemistry seemed to render advisable a temporary pause in the development of a subject which, both in its theory and in its applications, is of growing importance.

The students have had, as before, the benefit of many of the practical problems which are constantly brought to this laboratory from all parts of the country.

Mrs. Richards has had leave of absence for a few weeks in order that she might accept a position on the Faculty of the College for Women, Western Reserve University, Cleveland, where she is to give a course of lectures on the Economics of the Household interpreted in the light of Sanitary Science.

Several other colleges have availed themselves of Mrs. Richards' presence in the West to secure one or more lectures on Sanitary Science and the Chemistry of Food Materials.

OIL AND GAS ANALYSIS. — The facilities of the laboratory of Oil and Gas Analysis have been increased by the conversion of the small lecture-room into a private laboratory. A Hinman portable photometer has been added to the equipment of the laboratory.

The department still continues to give instruction to the mechanical and electrical engineers and naval architects in the subject of Gas Analysis. This includes not only the examination of chimney gases, but also the discussion of fuels, smoke prevention, and smokeless furnaces.

SUGAR ANALYSIS. — During the past year, owing to a change in the schedule, both junior and senior classes were given instruction in the regular fifteen-hour course in sugar analysis, making about forty students of Course V. Some extra instruction was given to the juniors who were lacking in experience in physical measurements and manipulation of instruments of precision, and their progress proved satisfactory. Four or five students were also given instruction out of course by permission of the Faculty. — Three students took thesis work in this laboratory: G. F. Ulmer ("An Analytical Investigation of the Torrefaction Dextrines"); W. H. Barlow ("The Hydrolysis of Cellulose"); A. L. Goodrich ("Com-

parison of Actual 'Total Solids' of Cane and Beet Juices with those obtained by the Brix Spindle").

The change of location of the laboratory is on the whole a decided improvement, as the present room has been specially fitted for the work.

INDUSTRIAL CHEMISTRY. — During the past summer the laboratory of industrial chemistry has been transferred to new and more commodious quarters in the Pierce Building. The laboratories comprise three work-rooms, large and small store-rooms, and private laboratories for the instructors.

The main laboratory is a room about 56 ft. × 37 ft. 6 in. It is lighted by seven windows in each end and by two large skylights, and is furnished with fourteen 50-candle-power incandescent electric lamps, thus insuring an abundance of light at all times. The ventilation of this new laboratory is far superior to that of the old one, the ventilating system being augmented, in this room, by three large ventilating cowls in the skylights. The number of steam evaporators has been increased from twelve to twenty. They are arranged in a corner of the room and under the skylight having the largest ventilating cowl, which carries off the steam from the evaporators.

The work-benches contain drawers and cupboards for forty-eight students, and that number can be accommodated by having two sections, there being ample bench room for twenty-five students at a time. In addition, there is a large bench set apart for the qualitative and quantitative examination of materials used and of product obtained. The benches are fitted with gas and suction pipes, and a portion of them also with water and waste pipes for distillations. The large gas burners are connected directly with the gas supply, thus avoiding the use of rubber tubing and consequent danger therefrom. The suction pipes — fitted with a tap for each student — are connected with Richards filter pumps and also with a new power-driven combined vacuum and pressure pump, which will also furnish compressed air for various purposes.

This laboratory has five new hoods with glass fronts and sides and soapstone tables. A notable feature is the ample water supply and sink space, there being five sinks placed in a row in the middle of the room, fitted with eight water taps, and having thirty-five feet of working room round them. A new Fletcher's largest size combined crucible and muffle-gas furnace has been added to the equipment for metallurgical work. The efficiency of the hydro-extractors has been increased by the addition of nickel-plated baskets of different sizes, so that small or large quantities of materials can be operated upon with equal facility. The extractors are arranged to be driven direct from an electric motor. A line of shafting driven by the electric motor serves to distribute power to the various machines.

The small industrial laboratory contains the filter press and large knuckle-joint press, and also specimens of work of the students, contained in cases. One-half of this room has been reserved for the students' use as a reading-room. It is furnished with a library table and twelve chairs, a large blackboard, and a small library of works of particular interest to students in industrial chemistry and textile coloring.

The textile coloring laboratory is a room about 40 ft. × 27 ft. 6 in., specially designed for its purpose. Its roof consists of four large skylights facing the north. These and the walls of the room are painted white, which insures the best light for the matching of colored fibres and fabrics. The room is furnished with new benches and work-tables fitted with new and improved dyeing apparatus. They are so arranged that each student has ample room for dyeing on the table at his right hand, and a bench with drawer and cupboard, a balance and all necessary apparatus at his left. A small steam-heated apparatus for aging aniline black colors has been fitted up in this room. A new steam-heated distilling apparatus has been added. It is automatically controlled, requires no attention, and supplies an abundance of distilled water for all needs in the textile and industrial chemistry laboratories.

The class in industrial chemistry this year is slightly smaller than in the two previous years, there being forty-three students enrolled. A slight change in arrangement of the lectures has been made, by which the first six or eight lectures are devoted to the general operations, such as crushing and grinding materials, solution, filtration, evaporation, crystallization, etc., which are commonly employed in all industrial processes. Following these the more important manufactures are taken up in detail, these lectures forming the major part of the course. In addition to written exercises, oral "quiz" exercises are now held in connection with the course, and assist in making clear many obscure points. The completion of Dr. Thorp's text-book will relieve the students from a part of the note-taking during the lectures and furnish them with a digest of the matter covering nearly all important points. The usual number of lectures continues to be given by gentlemen not connected with the instructing staff of the Institute. The customary excursions to factories will be arranged, and in this connection thanks are due to the following-named gentlemen for courtesies extended to the classes: Mr. A. P. Howard, Superintendent Merrimack Chemical Company; Mr. J. deCordova, President Union Glass Company, Somerville; Mr. G. E. Jordan, Agent, and Mr. Getchell, Superintendent, Waltham Bleachery and Dye Works, Waltham; Mr. Thomas H. Hintze, Superintendent Malden and Melrose Gas Light Company, Malden; Mr. E. D. Mellen, Treasurer Curtis, Davis & Co., Cambridgeport; Messrs. Hollingsworth & Whitney, proprietors of the Mattapan Paper Mills, and Mr. Mosman, Superintendent of the mill; Mr. D. J. Flanders, General Passenger Agent, Boston & Maine R.R., for special rates and transportation provided on several of the excursions.

Books Published.

H. P. Talbot: An Introductory Course of Quantitative Chemical Analysis (Third, revised and enlarged edition).

F. H. Thorp: Outlines of Industrial Chemistry.
F. H. Thorp: Inorganic Chemical Preparations.
G. W. Rolfe: Introduction to Sugar Analysis.

ARTICLES PUBLISHED.

Henry Fay and H. P. Talbot: On the Segregation of Carbon in a Piece of Boiler Plate.

J. F. Norris and Henry Fay: Iodometric Estimation of Tellurium.

J. F. Norris and A. I. Franklin: Composition of Nitrogen Iodide.

J. F. Norris: Some Double Salts containing Selenium.

A. G. Woodman: The Differentiation of Organic Matter in Water.

E. H. Richards and I. F. Hyams: *Oscillaria Profilica* in its Relation to Water Supply.

A. H. Gill and A. C. Lamb: The Constants of American Linseed Oil.

A. H. Gill and I. Hatch: On the Bromination Test for Oils.

G. W. Rolfe and Geo. Defren: The Manufacture and Use of Brewing Sugar in America.

A. A. Noyes: 1. Reliability of the Dissociation Values determined by Electrical Conductivity.

2. Die Theorie der Löslichkeitsbeeinflussung bei zweiionigen Elektrolyten mit lauter verschieden en Ionen.

A. A. Noyes and E. H. Woodworth: Investigation of the Theory of the Solubility Effect in the Case of Triionic Salts.

A. A. Noyes and D. Schwartz: The Solubility of the Salts of Weak Acids in Stronger Acids.

A. A. Noyes and E. S. Chapin: The Solubility of Acids in Solutions of the Salts of Other Acids.

A. A. Noyes and L. J. Seidensticker: The Solubility of Iodine in Diluted Potassium Iodide Solutions.

A. A. Noyes and G. T. Cottle: The Velocity of the Reaction between Silver Acetate and Sodium Formate.

Dr. Thorp's Outlines of Industrial Chemistry deserves a

special mention. It is designed for the use of students, and is also furnished with references to original work which will make a guide to the entire literature of the subject. It gives a concise and clear account of manufacturing processes, with an explanation of the chemical principles involved, and supplies a want long felt by teachers.

Courses VI. and VIII., Electrical Engineering and Physics. — The school year 1897–8 has been one of healthy growth in this department. The time gained in the fourth year in consequence of the advanced mathematical requirements for admission to the Institute has allowed the introduction into the Course VI. of a very large amount of additional instruction in the laboratory with great benefit to the students; furthermore, the instruction in dynamo design has been greatly extended. These exercises, however, seriously tax the resources of the department both as to room and instructing force. The same should be said of other additions to the instruction given in the department.

While the actual number of students taking Course VI. has suffered a diminution, coincidently with the increase of certain other courses, the actual work of the Department of Physics, which as a whole is determined more by the variety and specialization of the instruction given than by the actual number taught, shows every year a material increase. I cannot better illustrate this than by the following extract from a statement written a few months since to the Chairman of the Visiting Committee for the department:

"To the fourth-year students in electrical engineering we are this year giving, for the first time, five hours a week instruction in the electrical engineering laboratory, throughout the whole second term. This means that there are five sections in that laboratory, one section every day except Saturday, and practically from eleven to five each day. This is new work, replacing in part the mathematics, which in consequence of the advanced entrance requirements is now taken earlier in the course. In other branches there is also a marked increase of the work done in Courses VI. and VIII.

"But this is by no means all. From the beginning of the Institute the subject of physics has been recognized as of fundamental importance to all students in whatever department they might be studying, and with the development of the school the call for more instruction in special branches of physics, for the benefit of students outside the courses in physics and electrical engineering, has greatly increased. Within the past two years the Physical Department has been called upon to give lectures in applied electricity to all regular students in civil, mechanical, chemical and sanitary engineering, and chemistry, and to many of the mining engineering students as well. We have been asked to give, and hope next year to give, laboratory instruction in dynamo testing to all the mechanical engineering students of the third year. We have introduced an extended laboratory course in heat measurements for all the students in mining engineering, which course is also optional for students in chemistry. Also a course in the laboratory of physical chemistry is required by the course scheme of all chemists of the fourth year. Furthermore, the proposed new scheme of the course in architecture contemplates courses of lectures upon sound as related to architecture, and color, and also one upon the electric lighting of buildings.

"The bare enumeration of these important advances, all of them practically introduced or made effective within the past two years, will show the manner in which the advanced work in physics permeates almost every professional course in the Institute. It also shows that the increasing numbers of students in mechanical engineering, chemistry, and mining engineering and other courses have an immediate effect in increasing the demands upon the Department of Physics."

Apart from the introduction of new courses of instruction, those already existing, without exception, have been materially strengthened, so that the teaching of the department has never been more thorough than at present.

A number of valuable scientific papers have been pub-

lished from the department. There is, moreover, much material embodied in the theses from year to year which is well worthy of publication, if the time of the instructors were not so severely taxed as to render it difficult to put this into suitable shape.

A new edition of the circular relating to the courses in electrical engineering and physics was issued during the summer. Five years had elapsed since the issue of the previous one, and a comparison of the two will show the marked advance that has taken place in that interval.

The following gentlemen engaged in professional work have kindly given lectures during the school year 1897–8, many of them entirely without compensation:

Mr. George W. Blodgett, Electrician of the Boston & Albany Railroad, on the Application of Electricity to Railway Signalling; Mr. Hammond V. Hayes, Electrical Engineer of the American Bell Telephone Company, on Telephone Engineering; Mr. C. J. H. Woodbury, of the American Bell Telephone Company, on Electricity in its Relation to Fire Risks; Mr. Louis Bell, on the Electrical Transmission of Power and the Application of Electricity to Railway Transportation; Mr. S. Everett Doane, of the Marlboro' Electric Company, on the Manufacture of Incandescent Lamps; Mr. Hollis French, on Electrical Engineering Practice and Specifications; Mr. Howard C. Forbes, on the Design and Testing of Electric Light and Power Plants; Mr. John B. Blood on the Design of Alternating Current Machinery; and Mr. Odin B. Roberts, on the Nature and Function of Patents for Inventions.

Many additions have been made to the stock of apparatus of measurement and demonstration since the issue of the last President's Report, especially in heat and electrical measuring instruments. The photometric apparatus has also been brought up to date; and among other instruments a Koenig spectrum photometer has been added thereto. This was purchased from the income of the Katharine Bigelow Lowell

Fund. From the same fund has also been provided a high-grade modern automatic air-pump, the need of which for lecture purposes has long been felt. An unusual amount of apparatus has been constructed in the workshop of the department by the mechanician. Our facilities for such work have been increased by the addition of an engine-lathe larger than any hitherto in our possession.

A number of important changes have been made in laboratory rooms. The laboratory of heat measurements has been enlarged by the addition of a portion of the space vacated by the removal of the laboratory of industrial chemistry. This addition doubles the size of the former room and more than correspondingly increases its availability. While not allowing room for much growth or development, it is sufficient for the present needs of the work and will probably suffice for several years. The necessity for increased space in this laboratory has arisen, not from the demands of students in electrical engineering, who do not receive instruction therein, nor of those in physics, whose needs were previously satisfied, but from the constantly increasing instruction which this department offers to other courses, — in this instance, to those of chemistry, chemical engineering, and mining engineering. This is as it should be, for one of the noteworthy characteristics of the Institute, and one which has contributed very largely to its success, is the manner in which the work of the various departments is coördinated so that each does its appropriate part in the training of every student, forming a marked contrast to the policy of departmental isolation so often followed.

The laboratory of chemical physics has received a large increase in area through the absorption by it of an adjoining room hitherto devoted to certain work in electricity. This increase was imperative unless this laboratory was to curtail its work with the students of Course V. The room is now sufficient for the present work of instruction, but the growing demand for training in this new and important branch is

liable to cause crowding again before many years. The necessities of this laboratory have led to the removal of the photographic dark-room to another place. This has been reduced in size and placed in a corner of the acoustic laboratory.

The loss of room which has thus been sustained by the laboratory of electrical engineering, though unavoidable, is much to be regretted. An endeavor has been made to gain such room as is possible by a rearrangement of apparatus. The small room on the second floor formerly reserved for special measurements of electrical resistance has been converted into a photometer room for use with electric lights. The electric signalling apparatus, a portion of which was erected in this laboratory, is to find a location in one of the buildings on Trinity place, where it is expected to erect the whole of this large and valuable illustrative collection. A small increase has been made to the dynamo-room by the addition of a strip formerly belonging to the laboratory of industrial chemistry.

As to the serious manner in which the work of the department is hampered by lack of room, I can add nothing to what has been said in the Presidents' Reports of the past two years. In the laboratory of heat measurements the need has been met by a substantial addition, and in that of physical chemistry by taking a portion of the laboratory of electrical engineering, as already explained. But this has still further diminished the space devoted to electrical engineering and physics, for which no satisfactory provision has yet been found.

Professor Holman, who has for several years been debarred from school work by severe illness, has published a book upon Matter, Energy, Force, and Work, for the use of those who are dealing professionally as engineers, teachers, or students with these physical concepts. The book is dedicated to the Institute, and it is a remarkable effort of a keen and judicious mind remaining in touch with the work which

was loved so long and done so well. Mind dominating matter might well have been the sub-title of this valuable treatise, and the Institute accepts the dedication with respectful appreciation.

EXCURSIONS OF ELECTRICAL ENGINEERS. — An important feature in connection with the course of electrical engineering in the fourth year is the number of excursions that are made to the various electrical plants and factories in the immediate vicinity of Boston. Here it is that the student sees, generally for the first time, in actual commercial shape, the embodiment of the principles with which he has become familiar in the class-room and laboratory. He is intensely interested, and spends far more time on related problems than he would if these were presented only in a text-book or lecture. These excursions are frequently undertaken by the Electric Club, generally after consultation with some one of the instructing staff, and may be attended by the third and fourth year students.

The longest excursion in the past year, and one that was most highly appreciated by the class, was made under the charge of Professor Puffer, to the great factories of the General Electric Company, at Schenectady, N.Y., in the vacation following the semi-annual examinations.

An excursion like this has the value of a long experimental lecture, illustrated in a large way by machines in all stages of completion. It makes the students acquainted with the best electrical engineering method of dealing with the problems of the day, and of anticipating the wants of the near future.

Course VII., Biology. — For several years the quarters available for the Department of Biology have been totally inadequate. Class work and research have been carried on in one large room, subdivided by partial screens and partitions.

In the Pierce Building the department has now five laboratories, entirely separated one from another; namely, a second-year, or general, laboratory for all the larger classes, but especially for those in general (elementary) biology, micros-

copy, general zoölogy, and elementary botany. This room is used also by the classes in theoretical biology, and in the history of inductive science, as well as by the Journal Club of the department, and for occasional meetings or special lectures. There is, in the next place, a third-year laboratory of smaller size, used almost constantly by the classes in comparative anatomy and embryology, and in cryptogamic botany. Here, also, the fourth-year class in microscopic anatomy does its practical work. Two laboratories are devoted exclusively to the work of the fourth year, one to physiology, and one to bacteriology and its applications to industrial biology and sanitary science. A fifth, the research laboratory, is set apart for the use of investigators, who may be members of the instructing staff, graduate or special students, or regular students engaged in special investigation, such, for example, as thesis work.

In addition to the biological laboratories proper the suite of rooms provided for this department includes four private rooms for the offices, libraries, and personal effects of members of the instructing staff; dark-rooms for optical and photographic work; store and preparation rooms; and a library and reading-room in which are placed the biological books and periodicals belonging to the Institute. The floor area occupied by this new suite of laboratories, etc., is only about two and one-half times that vacated in the Rogers Building, but owing to the shape of the Pierce Building and the careful planning of the whole the convenience and efficiency of the new arrangement are far greater than these figures would indicate.

It is probably entirely fair to say that nowhere in the United States is there so compact or well-arranged a series of laboratories devoted chiefly to the sanitary, hygienic, and industrial aspects of biology. They should be a powerful aid to the Institute as a whole, not only in their own peculiar province, which is daily revealing fresh and important applications to modern life, but also as an ally in the train-

ing of the chemist, the civil and the sanitary engineer, the architect, the geologist, and the student of general science.

The work of the year in this department has been continued on the lines already established in previous years. Professor Sedgwick continues to serve the public in his capacity as an authority on sanitary science and the public health, two large cities in particular, Pittsburgh, Pa., and Newark, N.J., having recently referred to him for solution important questions relating to the purity of their water supplies. Side by side with this work in public hygiene, Professor Hough has begun the extended investigation of an important problem in personal hygiene, viz., the physiology of muscular exercise. Dr. A. W. Weysse, Instructor in Comparative Anatomy, has lately published, with Messrs. Longmans & Co., a useful volume entitled "An Epitome of Human Histology." Mr. S. C. Prescott, Instructor in Bacteriology and Industrial Biology, in coöperation with Mr. W. Lyman Underwood, has carried to a successful issue further researches on the theory and practice of food-preserving, with the result that the Biological Department of the Institute is now regarded by those conversant with the canning industries as the centre of scientific information in the United States for these industries.

This department, which was already under great obligations to Mr. Augustus Hemenway for the gift of a number of high-power microscopes, has recently received from his hand a generous contribution for the purpose of maintaining for the current year a much-desired graduate scholarship in biology. Mr. C.-E. A. Winslow, a graduate of the Institute in Biology in the class of 1898, has been appointed to hold this scholarship, and has entered on its privileges, having for this purpose resigned his position as Assistant Inspector of the Board of Health of Montclair, N.J.

Course IX., General Studies. — In the report of last year mention was made of the introduction of a new course to be given to fourth-year students in electrical engineering on

economics of corporations. This has been successfully undertaken. A list of the topics treated is as follows: the historical and legal development of corporations, forms of securities issued, analysis of corporation accounts, regulations in Massachusetts upon issue of securities, the position of quasi-public corporations concerned with the industrial application of electricity, taxes, status and organization of municipal corporations, street railway franchises, and control of electric lighting.

In accordance with a request from the Department in Biology, a brief course will be given this year by Professor Dewey to students of Course VII., on vital and sanitary statistics. This is designed to furnish elementary information in regard to the proper interpretation of registration and health reports which are necessary in problems of public hygiene.

The course heretofore known as "history and literature of the Renaissance and Reformation" has been rearranged and somewhat modified, and the lectures last year given to the students in architecture as a separate course on "the history of sculpture and painting" have been combined with it, the whole being now entitled "history of European civilization and art, principally in the classical, gothic, and renaissance ages." The class now meets in one of the lecture-rooms of the Department of Architecture. A considerable number of books has recently been purchased by that department with a view to the special needs of this course, and an alcove in the new departmental library has been fitted up with cabinets and show-cases for photographs. The collection of lantern-slides and other illustrative material has also been considerably increased — notably by a fine series of photographs of Greek sculpture.

The English Department has during the year endeavored to develop the scheme for the supervision of the written work of students past their first year. Many students have been given special work in writing, and have been guided by

personal advice in consultation. The results have been good, and seem to justify the belief that in this direction lies the secret of the most efficient training of those pupils who are by nature less gifted than others in the power of expression.

An encouraging sign of the increased interest in English is the fact that the advanced composition given for the third year of Course IX. is this term taken as an elective by more than twenty students from other courses. As several of these students are from Course IV., there is reason to believe that the work of the English Department in connection with the architectural memoirs has called attention to the desirability of more facility in composition on the part of those graduating in this course. It is the desire of the department that the system of having papers which are written in regular technical work specially corrected for their English should be extended to all courses.

Course XII., Geology. — The regular work of the classes as represented in the catalogue has been carried out during the year.

The leading event of the year has been the removal of the entire department from the Rogers Building to the new Pierce Building, Trinity place. That opportunity might be given for extensive alterations of the Rogers Building it became necessary to store the whole equipment of the department during the vacation weeks. More recently much time has been occupied in finishing and equipping the new rooms and in arranging the materials for the regular work of instruction. Although there has been much confusion and considerable delay, the classes have not been omitted nor neglected, but the instruction has not been as complete as it would have been if full use could have been had of the department collections.

The arrangement of the new rooms is found to be a decided improvement upon the former one. The articles that are needed for the different classes can now be used either in the room in which they are kept or in an adjacent one with

almost equal ease. Perhaps the most significant advantage of the new quarters is to be found in the mineralogy room. It is now fitted with tables with slate tops, and with drawers in which each student may safely keep his own instruments and notes distinct from others. A large case with many drawers provides for keeping in easy access the specimens to be used in teaching mineralogy. The ventilation and general arrangement of the room are such that the quality of the air in the room during two-hour exercises at blowpipe analysis is very much better than it has been before. The machine for slicing, grinding, and preparing thin sections for study and for giving students practice in this important kind of work is now placed in the same room, and its new location will be a great convenience.

Another important feature is that a special room has now been assigned for economic geology. Where the department was formerly located there was no opportunity for making satisfactory collections for teaching this important branch of the science. As it is now arranged the classes in ore deposits, building stones, and other advanced studies will be accommodated and receive instruction in the same room in which the collections are kept.

The geological library and laboratory are now much better accommodated than previously. In the former room it was impossible to arrange the books as in other department libraries; consequently it was with much difficulty that they were consulted. The size of the valuable palæontological collection was beyond the capacity for keeping it, and some of it remained in boxes and trays which encumbered the rooms. The new room is provided with a larger number of drawers so conveniently arranged that the work can be carried on with comparative ease and facility. A similar improvement has been made in the room for structural geology. The case-room has been largely increased, the room is well equipped, and the facilities for instruction are now satisfactory. The lecture-room is pleasant and very conveniently located.

On account of the value of space the method of keeping the collections in drawers has been generally adopted, only a few specimens being displayed. With the museum of the Boston Society of Natural History so accessible we may well use our own collections solely for the purpose of teaching. The department is now supplied with more than twelve hundred drawers for the convenient keeping and systematic arrangement of its specimens, maps, charts, and appliances for giving instruction.

Course XIII., Naval Architecture. — The work in the department of Naval Architecture is much facilitated by the commodious quarters now occupied. The drawing-room work is better in quality and larger in amount than in former years, because the students are less subject to interruptions and can make drawings to convenient and customary scales. This, together with the advance made in methods of drawing-room instruction, makes it possible to devote practically the whole of the drawing of the fourth year to design, and enables the students to make a design for a ship which shall be as complete as it is desirable to undertake in a technical school.

The valuable collection of drawings and models in the possession of the department is now assembled and arranged for convenient use, and steps have been taken to increase largely the number of both drawings and models.

Mr. James Swan, formerly Instructor in Naval Architecture, has resigned in order to take charge of the scientific department of the drawing office of the Newport News Shipbuilding Company. His work has been intrusted to Mr. Carl H. Clark, a graduate of the class of 1895 from the department of Naval Architecture, who has since been engaged as assistant and instructor, part of the time in marine engineering, and part of the time in naval architecture. He has also had some experience in designing both ships and engines.

Professor Peabody took an active and leading part in the consultations which were held this summer with reference to the programme of studies for United States naval constructors,

and laid out a course of advanced studies directed toward the special problems involved in the construction of warships. This programme formed the basis of the one which was eventually presented by the Faculty to the Naval Department.

Summer Courses.

These courses were given by our instructors with the attendance indicated. They may now be regarded as a well-established auxiliary to our regular work.

Programmes of Summer Courses.

I. Mechanical Drawing and Descriptive Geometry. 27. (Prof. Faunce.)
II. Mathematics: Analytic Geometry. 8. (Mr. George.)
III. Architecture. (*a*) Shades and Shadows. 4. (*b*) Elementary Design. 9. (Mr. Gardner.)
IV. Chemistry. (*a*) Analytical Chemistry. 23. (Dr. Walker.) (*b*) Water Analysis, and Air Analysis. 2. (Mrs. Richards.)
V. Physics. (*a*) Mechanics, Light, and Electricity. 7. (Mr. Drisko.) (*b*) Heat. 11. (Prof. Clifford.) (*c*) Physical Laboratory. 10. (Prof. Goodwin.) (*d*) Electrical Testing. 5. (Prof. Laws.)
VI. European History. 3. (Mr. Wentworth.)
VII. Modern Languages. (*a*) French. 5. (Mr. Bernard.) (*b*) German. 11. (Dr. Dippold.)
VIII. Mechanism. 8. (Prof. Merrill.)
IX. Shopwork. (*a*) Carpentry and Wood Turning. 4. (Mr. Merrick.) (*b*) Forging. 9. (Mr. Lambirth.) (*c*) Chipping and Filing. 8. (*d*) Machine Toolwork. 24. (*e*) Metal Turning. 2. (Mr. Smith.) (*f*) Pattern Making. 3. (Mr. Merrick.)

The "Technology Review."

During the last year the project of a publication intended to reach all the alumni has been carefully considered, and the "Technology Review" (quarterly) is to appear on the first day of January.

The "Review" is planned to be true to its name, and to look over all the widespread fields of interest into which our Institute has entered, to give news of the School to

the graduated classes and of the classes to each other, and to have an educational and literary side attractive to the general reader.

Class life during our busy school years is less active than in most colleges, but the close affiliations or kindred pursuits of the professional work of after years draw graduate class associations together by the closest bonds. They have reason to review their mode of life and training at the Institute during every year that they practise the professions for which we endeavored to educate them; and it is hoped that this new quarterly will be welcomed as a medium for communication about such matters.

STATISTICS.

The Corps of Instructors.

The catalogue of 1898–99 shows the number of instructors of all grades to be 134, inclusive of those concerned with the mechanic arts, but exclusive of those who are announced as lecturers for the year only. The addition of these raises the total to 164. Allusion has already been made to the augmentation of the number of the instructing staff; without counting lecturers, the number of instructors to that of students bears the proportion of one to eight and eight-tenths. This proportion is a most characteristic figure, and is intimately associated with the quality of the instruction. The following table shows the distribution among the several classes of instructors, in comparison with last year:

	1897–98	1898–99
Professors	23	23
Associate Professors	8	7
Assistant Professors	23	23
Instructors	53	53
Assistants	25	28
Lecturers	26	30
Total	158	164

STUDENTS AND GRADUATES.

The registration of this year, as by the catalogue now in press, amounts to 1,171. The following table shows the registration of successive years from the foundation of the Institute:

Year.	No. of Students.	Year.	No. of Students.
1865–66	72	1882–83	368
1866–67	137	1883–84	443
1867–68	167	1884–85	579
1868–69	172	1885–86	609
1869–70	206	1886–87	637
1870–71	224	1887–88	720
1871–72	261	1888–89	827
1872–73	348	1889–90	909
1873–74	276	1890–91	937
1874–75	248	1891–92	1,011
1875–76	255	1892–93	1,060
1876–77	215	1893–94	1,157
1877–78	194	1894–95	1,183
1878–79	188	1895–96	1,187
1879–80	203	1896–97	1,198
1880–81	253	1897–98	1,198
1881–82	302	1898–99	1,171

STUDENTS BY CLASSES.

The aggregate number of students for 1898–99 is divided among the several classes as follows:

Fellows	4
Graduate students, candidates for advanced degrees	3
Regular students, Fourth Year	181
" " Third "	189
" " Second "	204
" " First "	282
Special students	308
Total	1,171

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.
Fellows	4	...	4
Graduates of the M.I.T.	3	...	3
Fourth Year	181	60	241
Third Year	189	106	295
Second Year	204	103	307
First Year	282	39	321
Total	863	308	1,171

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.	32	37	9	22	23	36	1	3	1	10	1	..	9	181*
3d " "	34	34	24	20	16	27	4	2	6	11	3	..	9	189*
2d " "	27	37	19	22	25	31	1	3	5	17	3	1	15	204*
Total . . .	93	108	52	64	64	94	6	8	12	38	7	1	33	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.
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
1897	109	119	38	71	60	90	8	9	10	36	7	1	26	578*
1898	93	108	52	64	64	94	6	8	12	38	7	1	33	574*

* Deducting those 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. .	4	..	..	..	..	..	..	..	..	..	..	..	..	..
2d . .	5	..	2	1	..	1	1	..	..	..	..	..	..	..
3d . .	5	1	1	..	..	1	1	..	..	1	..	..	..	..
4th. .	8	3	2	..	1	1	..	1	..	..	..	..	..	..
5th. .	4	..	2	..	1	1	..	..	..	..	..	..	..	..
	26	4	7	1	2	4	2	1	0	1	0	0	0	0

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 certain leading lines of study:

Applied Mechanics . . .	85	Language	171
Architecture	52	Mathematics	156
Biology	31	Mechanical Engineering .	79
Chemistry	115	Mining Engineering . .	19
Civil Engineering . . .	53	Naval Architecture . . .	6
Drawing	133	Physics	179
Electrical Engineering .	14	Political Science . . .	77
English	100	Sanitary Engineering . .	3
Geology	39	Shopwork	71
History	75		

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 . .	298	267	126	43	734
Chemistry . . .	353	63	103	71	590
English	302	247	32	1	582
French	162	88	48	..	298
Physics	...	284	301	169	754
German	74	187	173	8	442
Shopwork	12	109	48	57	226

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
California	..	2	3	1	2	8	3	11
Colorado	..	3	..	1	2	6	2	8
Connecticut	..	3	2	9	9	23	3	26
Delaware	..	1	..	1	..	2	1	3
Dist. of Columbia	..	1	..	1	2	4	4	8
Georgia	..	1	1	..	1	3	1	4
Hawaiian Islands	..	..	..	..	1	1	..	1
Illinois	..	7	10	8	13	38	13	51
Indiana	..	..	1	..	..	1	2	3
Iowa	..	4	2	1	..	7	..	7
Kentucky	..	2	1	2	3	8	2	10
Louisiana	..	..	..	1	..	1	..	1
Maine	..	3	6	3	3	15	4	19
Maryland	..	2	1	2	..	5	3	8
Massachusetts	7	106	119	126	187	545	174	719
Michigan	..	2	1	3	2	8	1	9
Minnesota	..	3	..	3	3	9	2	11
Missouri	..	2	1	1	4	8	2	10
Montana	..	..	..	1	..	1	1	2
Nebraska	..	..	1	..	..	1	..	1
New Hampshire	..	5	6	4	4	19	6	25
New Jersey	..	2	3	1	2	8	5	13
New York	..	4	11	11	14	40	28	68
North Carolina	..	..	1	1	..	2	..	2
Ohio	..	3	4	7	3	17	6	23
Oregon	..	..	..	..	1	1	2	3
Pennsylvania	..	8	7	4	3	22	12	34
Rhode Island	..	4	2	3	5	14	9	23

States.	Candidates for Advanced Degrees.	Fourth Year.	Third Year.	Second Year.	First Year.	All Regular Students.	Special Students.	Total.
South Carolina	..	..	..	..	..	..	1	1
Tennessee	..	1	..	..	..	1	2	3
Texas	..	..	..	..	..	..	1	1
Utah	..	2	..	1	2	5	..	5
Vermont	..	2	1	2	5	10	2	12
Virginia	..	1	..	1	..	2	1	3
Washington	..	1	2	1	2	6	1	7
Wisconsin	..	1	..	1	3	5	3	8
Foreign Countries.								
Cape Breton	..	..	..	..	..	..	1	1
Cuba	..	1	..	..	..	1	..	1
Denmark	..	..	..	1	..	1	..	1
Dutch Guiana	..	..	1	..	..	1	..	1
England	..	1	1	..	2	4	..	4
France	..	..	..	..	..	..	1	1
Germany	..	..	..	..	1	1	..	1
Japan	..	..	1	..	..	1	..	1
Mexico	..	..	..	..	1	1	6	7
New Brunswick	..	2	..	..	1	3	..	3
Nova Scotia	..	1	..	..	..	1	1	2
Quebec	..	..	..	1	..	1	..	1
Turkey	..	..	..	1	1	2	1	3
Total	7	181	189	204	282	863	308	1171

Thirty-five States of the Union, besides the District of Columbia and the Hawaiian Islands, are represented on our list of students. Of the total number of 1,171, 719 are from Massachusetts, or 61.4 per cent. of the whole; 105 are from other New England States; 346 are from outside New England. Of these, 27 are from foreign countries.

A table showing the number of students in each year, from 1892, coming from each State or Territory, and from each foreign country, may not be without interest and instruction:

States.	1892.	1893.	1894.	1895.	1896.	1897.	1898.
Alabama	4	2	1	..	1	1	1
Arkansas	2	1	..	..	1	1	..
California	14	15	9	8	9	9	11
Colorado	7	5	8	7	7	8	8
Connecticut	27	30	29	27	24	30	26
Delaware	2	4	3	5	5	6	3
Dist. of Columbia	4	7	12	16	17	13	8
Florida	4	3	2	1	..	1	..
Georgia	3	3	2	2	3	4	4
Hawaiian Islands	2	2	.	..	..	..	1
Idaho	1	1	..	1	1	1	..
Illinois	40	39	36	42	45	40	51
Indiana	5	6	3	2	3	7	3
Iowa	10	13	10	12	14	12	7
Kansas	1	1	4	4	3	3	..
Kentucky	7	11	12	11	12	10	10
Louisiana	2	3	3	2	..	1	1
Maine	39	36	38	38	27	24	19
Maryland	6	4	4	9	9	8	8
Massachusetts	603	665	707	721	730	739	719
Michigan	10	7	8	7	6	5	9
Minnesota	13	11	9	5	7	8	11
Missouri	13	17	14	9	11	6	10
Montana	..	2	2	1	3	5	2
Nebraska	4	3	4	2	2	2	1
Nevada	3	2	2	..	.	..	..
New Hampshire	29	32	27	30	26	25	25
New Jersey	11	6	5	5	13	15	13
New Mexico	2	2	1	1	..	..	..
New York	50	52	59	64	69	62	68
North Carolina	1	..	..	..	1	1	2
Ohio	39	45	50	37	28	30	23
Oregon	2	1	1	1	4	3	3
Pennsylvania	25	31	37	36	42	41	34
Rhode Island	24	33	25	21	20	19	23
South Carolina	1	3	3	5	6	4	1
Tennessee	1	1	1	1	1	3	3
Texas	5	6	6	3	2	2	1
Utah	1	2	2	5	2	3	5
Vermont	4	5	3	5	7	11	12
Virginia	4	3	2	5	3	4	3
Washington	3	1	3	1	5	4	7
West Virginia	2	1	1	3	2	1	..
Wisconsin	9	11	6	7	6	6	8
Wyoming	..	..	..	..	1	..	..
Foreign Countries.							
Belgium	1	1	1	..	..	..	..
Brazil	..	..	1	1	..	..	..
Bulgaria	1	1	..	..	..	..	..
Cape Breton	..	..	..	..	..	..	1
Central America	1	1	..	1	..	..	..
Chile	..	..	1	1	1	..	..
Columbia	..	..	..	..	..	..	..
Cuba	..	1	1	3	2	1	1
Denmark	.	..	..	..	..	2	1
Dutch Guiana	..	..	..	..	..	..	1
England	1	1	..	2	2	2	4
France	1	1	..	..	1	1	1
Germany	..	2	1	..	..	..	1
Guatemala	1	.	..	..	..	..	..
Holland	2	2	2	..	..	..	..
Ireland	..	1	1	..	..	..	..
Japan	1	1	1	2	2	..	1
Mexico	1	1	1	1	3	6	7
New Brunswick	1	1	1	1	2	2	3
New South Wales	1	1	1	1	..	..	..
Nova Scotia	..	..	1	2	1	1	2
Ontario	2	4	4	2	2	..	..
Peru	..	..	..	..	..	..	..
Porto Rico	..	1	1	1	..	..	..
Quebec	5	5	2	2	2	2	1
Scotland	1	2	1	..	..	..	..
Spain	1	1	1	1	..	..	..
Trinidad	..	..	..	..	..	..	..
Turkey	1	..	1	3	1	3	3
Venezuela	..	1	1	1	1	..	..
Total	1060	1157	1183	1187	1198	1198	1171

Residence of Massachusetts Students.

It has been said that 61.4 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 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 Middlesex sends two hundred and thirty-three and Suffolk two hundred and fourteen pupils; Essex comes third, with ninety-nine; Norfolk, fourth, with sixty-five.

County.	No. of Towns.	No. of Students.	County.	No. of Towns.	No. of Students.
Barnstable	5	6	Hampshire	3	3
Berkshire	4	10	Middlesex	34	233
Bristol	5	23	Norfolk	18	65
Dukes	1	1	Plymouth	10	23
Essex	21	99	Suffolk	3	214
Franklin	5	5	Worcester	9	22
Hampden	4	15			
			Total	122	720

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

Boston	200	Lawrence	10	Fall River	5
Newton	46	Lynn	10	Lexington	5
Cambridge	35	Springfield	10	Medford	5
Brookline	24	Winchester	10	Quincy	5
Lowell	23	Brockton	9	Weston	5
Newburyport	22	Hyde Park	9	Worcester	5
Somerville	18	Framingham	7	Andover	4
Malden	15	Haverhill	7	Everett	4
Arlington	12	Melrose	7	Holyoke	4
Gloucester	13	Waltham	7	Peabody	4
Chelsea	11	Fitchburg	6	Pittsfield	4
New Bedford	11	Natick	6	Taunton	4
Salem	11	Canton	5		

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 first 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.
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
1897–98	1,198	757	441	277	164
1898–99	1,171	769	402	278	124

Ages of Students on Entrance.

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

Period of Life.	1897-98.		1898-99.	
	Half-year Groups.	Yearly Groups.	Half-year Groups.	Yearly Groups.
16 to 16½ years	1	..	2	..
16½ to 17 "	1	2	5	7
17 to 17½ "	16	..	16	..
17½ to 18 "	33	49	32	48
18 to 18½ "	45	..	45	..
18½ to 19 "	39	84	51	96
19 to 19½ "	58	..	54	..
19½ to 20 "	25	83	28	82
20 to 20½ "	25	..	16	..
20½ to 21 "	9	34	10	26
21 to 22 "	9	9	13	13
	261	261	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 1897–98.

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

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

Under 20½	2
Between 20½ and 21	13
" 21 " 21½	16
" 21½ " 22	22
" 22 " 23	67
" 23 " 24	38
" 24 and over	40
Total	198

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

Graduates of Other Colleges.

The number of students who are graduates of this and other institutions is sixty-eight. Of these eleven are our own graduates, three being candidates for advanced degrees. Fifty-five are graduates of other institutions, pursuing courses of study with us either as regular or as special students. Twelve are graduates of Harvard University; four each of Yale University and Amherst College; three of Williams College; two each of Johns Hopkins, De Pauw, and Princeton Universities, and King's College, Windsor, N.S.; while the following institutions are represented on our list by a single graduate each: Brown, Chicago, Cornell, Georgetown, McGill, Michigan, Minnesota, Vermont, and Wisconsin Universities; Boston, Carleton, Central Turkey, Davidson, Doane, Hobart, Gonzaga, Iowa State Agricultural, Monmouth, New Hamp-

shire, R.I. Agricultural and Mechanic Arts, Robert, St. John's, Simpson, Smith, South Kentucky, and Vassar Colleges; Colegio de Carreras.

Women as Students at the Institute.

The number of women pursuing courses with us is forty-seven. Of these, two are graduates of colleges. Of the total number, three are regular students of the fourth year; four of the third year; five of the second year; five of the first year. Thirty are special students. Of the twelve regular students of the upper classes, three take Course IV., Architecture; four, Course V., Chemistry; one, Course VII., Biology; three, Course VIII., Physics; one, Course IX., General Studies. Of the special students, nine devote themselves to Biology, ten to Chemistry, four to Architecture, two to General Studies, one to Physics, one to Geology, two to Mathematics, and one to Drawing.

The diminution by twenty-two in the total number of women students is to be traced chiefly to the loss of twenty-one from the Biological Department. These are mostly special students, and were probably deterred from entering this year because of the removal of that department to the Pierce Building, which occasioned a delay of a month in preparation of the laboratories to receive students.

Statistics of Examinations.

Of the 1,171 students of the present year, 402 were not connected with the school in 1897–98. Of these, 269 were admitted as regular students of the first year upon the basis of their entrance examinations. The 133 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 regular second-year or 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 269 who were thus admitted to the Institute on examination, and have taken their place in the school, 55 were admitted on examination, but have not entered the school.

In the case of the 269 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	194
" on one condition	48
" on two conditions	20
" on more than two conditions	7
	269

Forty applicants were rejected.

Examinations at Distant Points.

In addition to the entrance examinations held at Boston in July and September, examinations were conducted in July at Albany, Belmont (Cal.), Buffalo, Chicago, Cincinnati, Cleveland, Concord (N. H.), Denver, Detroit, Easthampton (Mass.), Glens Falls (N. Y.), Kansas City (Mo.), Kingston (Pa.), Louisville, New York, Philadelphia, Pittsburgh, Portland (Me.), Portland (Oreg.), Pottstown (Pa.), Poughkeepsie, Springfield (Mass.), St. Louis, St. Paul, and Washington.

The following table exhibits the number of persons who have graduated within each of the several courses since the foundation of the school:

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	7	6	1	1	..	..	..	1	2	..	..	..	..	28
1876	12	8	7	..	5	1	..	2	3	4	..	..	..	..	42
1877	12	6	8	4	2	..	..	..	..	..	..	..	..	..	32
1878	8	2	2	3	3	..	..	..	..	1	..	..	..	..	19
1879	6	8	3	1	3	..	..	1	1	..	..	..	..	..	23
1880	3	..	3	..	1	..	..	..	..	1	..	..	..	..	8
1881	3	5	6	3	8	..	..	1	..	2	..	..	..	..	28
1882	2	5	5	3	6	..	..	1	1	1	..	..	..	..	24
1883	3	7	5	1	3	..	..	..	..	..	..	..	..	..	19
1884	5	6	13	..	12	..	..	..	..	..	..	..	..	..	36
1885	4	7	8	2	4	..	2	..	..	1	..	..	..	..	28
1886	9	23	7	1	7	..	10	1	..	1	..	..	..	..	59
1887	10	17	8	1	9	..	8	1	1	3	..	..	..	..	58
1888	11	25	4	5	10	..	17	3	1	1	..	..	..	..	77
1889	14	24	5	3	8	..	17	1	1	2	..	..	..	..	75
1890	25	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*
1897	25	40	7	16	20	..	33	2	3	7	12	4	1	9	179
1898	32	41	7	29	23	..	33	3	4	6	9	3	..	7	197
Totals	375	449	159	154	219	1	352	34	30	73	70	24	8	26	1,971
Deduct names counted twice															11
Net total															1,960

* Deducting names counted twice.

SOCIETY OF ARTS.

BOSTON, June 30, 1898.

To the President of the Institute:

SIR: On behalf of the Executive Committee, I have the honor to present the annual report of the Society of Arts for the year 1897–98.

The first meeting of the year was held on October 28, no meeting being called for the 14th because the Corporation had arranged for a Memorial Meeting to be held on that date in honor of the late President Walker. In all, twelve meetings have been held, and the following papers have been read: "Recent Work in Heat Measurement at the Institute," by Mr. Charles L. Norton; "Cable and Underground Electric Roads," by Mr. Louis J. Hirt; "Contributions to our Knowledge of the Micro-organisms and Sterilizing Processes in the Canning Industries, II., The Souring of Sweet Corn," by Messrs. S. C. Prescott and W. Lyman Underwood; "The Concentration of Ores, with Special Reference to Recent Investigations on the Subject," by Prof. R. H. Richards; "A New System of Pneumatic Dispatch Tubes," by Mr. B. C. Batcheller; "The History and Present Development of the American Bicycle," by Dr. Leonard Waldo; "On Town, State, and City Boundaries," by Mr. Henry B. Wood; "Certain Sanitary Aspects of Jamaica," by Mrs. Ellen H. Richards and Mr. Arthur T. Hopkins; "On Fire-Proof Construction," by Dr. S. Albert Reed; "On the Constitution of Steel Considered as an Alloy of Iron and Carbon," by Mr. Albert Sauveur; and "The Economic Relations of Deep Inland Waterways to the State of New York," by Mr. George W. Rafter.

The membership of the Society of Arts continues to increase, although there have not been added so many new

members as during the previous year. At the close of the year 1896–97 the number of life members was 59; 6 have died since then, leaving the present number 53. The number of associate members a year ago was 311; of these, 1 has died and 9 have resigned. These losses are offset by the election during the year of 22 associate members, making the total number 323.

Early in the autumn the Executive Committee lost one of its members by the death of Mr. Thomas Doane, who was distinguished as an engineer and as the founder of Doane College in Nebraska. He had been connected with the Society as a life member for many years. The other life members who died during the year are John M. Forbes, Joseph S. Fay, John Lowell, Theodore Lyman, and Jacob Norton. We have lost one associate member by death, Mr. C. H. Parker, of Cambridge.

A notable event in the history of the Society of Arts was the election of Professor James M. Crafts to be President of the Institute. He was introduced to the Society as its President at the meeting of October 28th.

An Amendment to the By-Laws of the Society of Arts was adopted by the Society December 9, with the approval of the Corporation. This amendment provides that three members shall constitute a quorum of the Executive Committee for the transaction of business.

The Board of Publication, which has charge of the "Technology Quarterly" and "Proceedings of the Society of Arts," was reappointed, with the exception of Prof. Henry M. Howe, who has removed to New York, Prof. Charles R. Cross being chosen in his place. The following members now constitute the Board of Publication, viz.: Prof. W. T. Sedgwick, Chairman, Prof. Charles R. Cross, Prof. Dwight Porter, A. Lawrence Rotch, Esq., and the Editor, Dr. R. P. Bigelow.

From 1880 to 1891 the Society of Arts published an annual volume of "Proceedings." The "Technology Quarterly" was founded in 1887 by the students, and was published by a

board of editors chosen from the junior and senior classes, William S. Hadaway, Jr., '87, being the first editor-in-chief. Two years later Mr. James P. Munroe became the sole editor, under the auspices of the Faculty, and in 1892 the control of the journal was transferred to the Society of Arts and it was united then with the "Proceedings." Thus it became an official organ of the Institute. By a vote of the Society, the Executive Committee was authorized to appoint annually a Board of Publication to exercise a general control and supervision over the "Quarterly." The active management, however, falls upon the editor, who is appointed by the Executive Committee upon nomination by the Board of Publication.

During the present year the "Technology Quarterly" has published not only the minutes of proceedings of the Society and a number of papers read at its meetings, but it has contained also a number of original articles, which have been presented to the Society by title only. The series of results of tests made in the Engineering Laboratories has been continued, as well as the Review of American Chemical Research.

The last meeting of the year was the 36th annual meeting of the Society of Arts. At this meeting Messrs. George W. Blodgett, Desmond FitzGerald, Edmund H. Hewins, Frank W. Hodgdon, and Charles T. Main, were elected members of the Executive Committee, and Mr. Arthur T. Hopkins was elected Secretary for the year 1898–99.

Respectfully submitted,

ROBERT P. BIGELOW,

Secretary.

LOWELL SCHOOL OF DESIGN.

The Lowell School of Design has a satisfactory report to make of the year's work. The number of students is limited to forty-two, and it is intended to open the class only for those who are thoroughly prepared to take the work. The students are diligent and take an intelligent interest in their pursuits, and coöperate with the director in maintaining a high standard of work. The accounts received from mill superintendents and others, employers of those students, who, since the opening in 1872, have received their education at this school, lead us to believe that the demands for a professional education of designers have been well understood and met. The embroidery designs, water colors, and decorated china made by the female students find a ready sale.

TREASURER'S REPORT.

STATEMENT OF THE TREASURER.

THE Treasurer submits the annual statement of the financial affairs of the Institute for the year ending Sept. 30, 1898.

The past year has been a remarkable one in the financial history of the Institute. More money has been received through bequests and gifts than in any previous year. Under the will of the late Hon. Henry L. Pierce seven hundred and fifty thousand dollars have been paid to the Institute by his executors. This is the largest sum ever given to it by any one person. In addition to this the executors of the late Mrs. Julia B. Huntington James have paid over the very notable sum of one hundred and forty thousand five hundred dollars. This is also one of the largest gifts ever made to the Institute.

George A. Gardner, Esq., has generously given twenty thousand dollars as a fund, the income from which is to be used in the payment of salaries, a purpose for which money is much needed. Ten thousand dollars have come from the estate of the late John Foster, and sixty-two hundred and fifty dollars from that of the late John W. Carter, and fourteen hundred and eighty-two dollars and seventy-nine cents have been added to the sum previously received from the estate of the late Mrs. Susan E. Dorr for the Rogers Physical Laboratory.

Besides these gifts to the Institute itself a Travelling Fellowship in the Architectural Department has been established by the will of Willard B. Perkins. For this purpose the sum of six thousand dollars has been given, the accumulated income from which is to be used every fourth year.

Forty thousand dollars have come from the estate of the late Mrs. Ann White Dickinson, the whole sum for scholarship purposes.

A friend has given five hundred dollars to meet a special want, and two hundred dollars have come from Mrs. William B. Rogers, to be used for periodicals.

This great increase in funds came at a time when it was very much needed. It led at once to the erection of the new fireproof building in Trinity place, which is to bear the name of the late Hon. Henry L. Pierce It has also made possible extensive changes and improvements in the old buildings.

In current expenses there has been a saving in fuel, water, gas, electricity, printing, interest, and expenses of the Society of Arts, amounting in all to nearly seven thousand dollars. This saving, however, has been much more than offset by an increase of about nine thousand dollars in salaries, sixteen thousand in repairs, and three thousand in general expenses.

The result is an adverse balance of more than seven thousand dollars in current expense account. It must, however, be borne in mind that all payments made for the extensive alterations and improvements in the old buildings have been charged to repair account. The increase of sixteen thousand dollars in the repair account is due to these changes. Next year we need not expect any such expenditure as this, but we shall have the increased expense involved in the use of the new building.

During the year the debt has been reduced from a hundred and twenty thousand dollars to twenty thousand. About a hundred thousand dollars have been paid on account of the new building, and there have been deducted from the bond premium account more than thirty-four hundred dollars

In addition to the payment of the above note, the property of the Institute, after deducting insurance money which will be required for restoring the buildings damaged by fire, has been increased by eight hundred and sixty-seven thousand two hundred and forty-six dollars and ninety-nine cents.

Securities Sold or Paid, General Account.

$1,000	Bur. & Missouri River R.R. 6s., 1918	1,000.00
3,000	Chi., Milwaukee & St. Paul R.R. 7 3/10s., 1898	3,000.00
3,000	Am. Bell Telephone 7s., 1898	3,000.00
16	Rights Boston Real Estate Trust	216.00
		7,216.00

Securities Bought or Received as Legacies, General Account.

$1,000	Bur. & Missouri River R.R. non-exempt 6s.,	1918	1,080 00
3,000	Chi., Milwaukee & St. Paul R.R. 7s.	1905	4,140.00
3,000	Am. Bell Telephone 7s.	1898	3,000.00
46,000	Chi. Junct. & Union Stock Yards 5s.	1915	51,340 00
5,000	Dominion Coal Co. 1st. 6s.	1913	5,150.00
2,000	Low., Law. & Haverhill St. Ry. 5s.	1923	2,020.00
2,000	New England Tel. & Tel. Co. 6s.	1907	2,160.00
2,000	N. Y. & New England R.R. 7s.	1905	2,340.00
21,000	N. Y. & New England R.R. 6s.	1905	23,220.00
100,000	West End Street Ry. 4s.	1917	104,000.00
50,000	Utah & Northern R.R. 1st. 7s.	1908	60,875.00
150,000	Walter Baker Co. Ltd. 4½s.	1903	150,000.00
50	Sh. Boston & Albany R.R.		10,750.00
50	" N. Y., New Haven & Hartford R.R.		9,000.00
50	" Boston & Maine R.R., common		8,300.00
25	" Boston & Providence R.R.		6,625.00
55	" Chi., Burlington & Quincy R R.		5,225.00
50	" Chi., Mil. & St. Paul R R., Pf.		7,000.00
50	" Chi., Rock Island & Pacific R.R.		4,350.00
50	" Fitchburg R.R., Pf.		4,800.00
55	" New England Tel. & Tel. Co.		6,755.94
50	" American Bell Telephone Co.		12,750.00
60	" Pullman's Palace Car Co.		10,200.00
23	" Boston Real Estate Trust		26,128.00
			521,208.94

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

Cash balance Sept. 30, 1897		35,962.67
From Augustus Lowell for Lowell Courses	5,700.00	
" " " " C. Kastner's salary	2,500.00	
" " " " School of Design	500 00	
		8,700.00
RECEIPTS FOR CURRENT EXPENSES.		
Income of funds for salaries	3,504.00	
" " " " scholarships (students' fees)	7,325.00	
" " " " Joy "	150.00	
" " " " Swett "	400.00	
" " " " Savage "	400.00	
" " " " Library	480.00	
" " " " general purposes	12,494.60	
" " Rogers Memorial Fund	10,949.00	
" " Charlotte B. Richardson Fund	1,495.15	
" " Rotch Prize Fund used 1897	450.00	
Letter Box Fund used 1897 [46.50]	125.00	
Students' fees	216,832.00	
State Scholarships	4,000.00	
U. S. Grant of 1862	5,131.37	
U. S. Grant of 1890	8,000.00	
Gift of State of Massachusetts	25,000.00	
Laboratory supplies and breakages	8,863.02	
Rents, per Table (page 94)	11,318.99	
Gifts	700.00	
Interest	9,673.03	
Boston University	1,150.00	
Sale printed Lecture Notes	2,593.87	
		331,035.03
GIFTS AND BEQUESTS FOR SPECIAL PURPOSES.		
Increase James Savage Fund	121.25	
" Dalton Graduate Scholarship Fund	212.76	
" Joy Fund	50.00	
" W. B. Rogers Fund [additional]	300.00	
Susan E. Dorr Fund [" 1,482.79]	1,662.79	
Ann White Dickinson Fund ["]	40,000.00	
Rotch Prize Fund	400.00	
Willard B. Perkins Fund	6,080.00	
Geo. A. Gardner Fund	20,000.00	
		68,826.80
GIFTS AND BEQUESTS FOR GENERAL PURPOSES.		
John Foster Legacy	10,000.00	
Henry L. Pierce Legacy	750,000.00	
John W. Carter Legacy	6,250.00	
James Fund	140,500.00	
		906,750.00
SECURITIES SOLD OR PAID. GENERAL FUND, page 85		7,216.00
SUNDRIES.		
Income credited to Bond Premium Acct.	2,920.51	
Income credited to Rogers Bond Premium Acct.	500.00	
Boston Art Students' Association on acc't	666.67	
Students' Notes paid	440.00	
Insurance, Engineering Building	27,979.20	
		32,506.38
		$1,390,996.88

MASSACHUSETTS INSTITUTE OF TECHNOLOGY.

FOR THE YEAR ENDING SEPTEMBER 30, 1898.

Cr.

Paid for Lowell Courses	5,700.00	
" " Charles Kastner's salary	2,500.00	
" " Expense Lowell School of Design	500.00	
		8,700.00
EXPENSES.		
Salaries, per Table (page 94)	231,955.72	
" paid from Gifts	500.00	
Fellowship paid from Swett Fund	400.00	
" " " Savage "	400.00	
Prizes, Rotch Funds	450.00	
Repairs, per Table (page 95)	27,206.89	
General Expenses, per Table (page 95)	17,245.67	
Fuel	5,360.16	
Water	1,810.40	
Gas	2,060.90	
Electricity	882.42	
Printing and Advertising	2,764.12	
" Lecture Notes	1,306.16	
" Annual Catalogues and Reports	2,313.82	
Rents paid Boston & Albany R.R. Co.	180.00	
" " Natural History Society	200.00	
Laboratory Supplies and Libraries, per Table (page 94)	34,784.05	
Society of Arts	593.31	
Interest allowed on funds not in Bonds and Stocks, at 4 per cent.	2,476.17	
Interest paid A. Lowell, Trustee	1,000.00	
" " on Mortgage Notes	2,000.00	
Mech. Eng. & Applied Mechanics Department Improvements	500.00	
Memorial of Francis A. Walker	1,453.67	
Omaha Exposition	326.62	
		338,170.08
[Expenses more than Income, $7,135.05]		
SECURITIES BOUGHT OR RECEIVED AS LEGACIES. GENERAL ACCOUNT, page 85		521,208.94
Pierce Building, Trinity Place, on acct.		99,638.90
Fire Repairs, Engineering Building		7,383.27
" " " Contents		4,133.30
SUNDRIES.		
Notes Payable	100,000.00	
Notes Receivable	200,000.00	
Students' Deposits	100.00	
Funds of 1897, used	1,094.76	
		301,194.76
Cash balance, Sept. 30, 1898		110,567.63
		$1,390,996,88

The following account exhibits the property held by the Institute, as per Treasurer's books, Sept. 30, 1898:

INVESTMENT OF THE W. B. ROGERS MEMORIAL FUND.

$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, Cl. & 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	2,221.40
	2,000 Income 5s.	1934	
1,000.00	Lincoln & Northwestern R.R. 7s. .	1910	1,000.00
1,000.00	Atchison & Nebraska R.R. 7s. . .	1908	1,000.00
42,000.00	Chi., Bur. & 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
37,500.00	Detroit, G. Rapids & Western R.R. 4s.	1946	37,500.00
	255 Shares Detroit, Grand Rapids & Western Pfd., par 100		12,500.00
	Advance to Bond Premium account .		7,400.00
	Bonds		249,453.90

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	Chicago, Mil. & St. Paul R.R. 7s .	1905	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	Chi., Bur. & 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
26,000.00	New York & New England R.R. 6s.	1905	26,000.00
46,000.00	Chic. Junc. & Union Stock Yards 5s.	1915	46,000.00
5,000.00	Dominion Coal Co. 1st. 6s. . . .	1913	5,000.00
2,000.00	Low., Law. & Haverhill St. Ry. 5s. .	1923	2,000.00
2,000.00	New England Tel. & Tel. Co. 6s. .	1907	2,000.00
2,000.00	New York & New England R.R. 7s.,	1905	2,000.00
100,000.00	West End Street Ry. 4s	1917	100,000.00
50,000.00	Utah & Northern R.R. 1st. 7s. . .	1908	50,000.00
150,000.00	Walter Baker Co. Lt'd. 4½s . . .	1903	150,000.00
	Advances to Bond Premium account		26,526.43
	Bonds		594,626.43
	Amount carried up		$844,080.33

Amount brought up $44,080.33

STOCKS.

SHARES.					
198	Boston & Albany R.R.	par	100	40,683.00	
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	
100	N.Y., New Haven & Hartford R.R.	"	100	17,000.00	
50	Boston & Maine R.R. common	"	100	8,300.00	
25	Boston & Providence R.R.	"	100	6,625.00	
55	Chi., Bur. & Quincy R.R.	"	100	5,225 00	
50	Chi., Milwaukee & St. Paul R.R. Pf.	"	100	7,000.00	
50	Chi., Rock Island & Pacific R.R.	"	100	4,350 00	
50	Fitchburg R.R. Pf.	"	100	4,800.00	
60	Pullman's Palace Car Co.	"	100	10,200.00	
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	
39	Boston Real Estate Trust	"	1000	44,212.00	
1	Boston Ground Rent Trust	"	1000	900.00	
50	American Bell Telephone Co.	"	100	12,750.00	
55	New England Tel. & Tel. Co.	"	100	6,755.94	
					290,923.44

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
Amount carried up	$1,154,127.47

Amount brought up		1,154,127.47

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 Bldg., Trinity Place	90,000.00		
		166,315.69	
Gymnasium Building		7,967.85	
Architectural "		57,857.10	
Lot No. 2, Trinity Place		137,241.60	
Pierce Building, Trinity Place		99,882.47	
Clarendon St. Land and Building		142,762.94	
House No. 34 Commonwealth Ave.		30,000.00	
Real Estate, Massachusetts Ave., Cambridge		16,154.38	
			1,089,022.03
Equipment, Engineering Building		16,555.24	
" Workshops		20,628.56	
			37,183.80

SUNDRIES.

Notes Receivable	278,500.00	
Boston Art Students' Association	11,666.66	
Students' Notes	1,405.50	
Cash Balance, Sept. 30, 1898	110,567.63	
		402,139.79
		$2,682,473.09

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 "	4,610.87	
John W. and Belinda Randall Fund	50,000.00	
James Fund	140,500.00	
		620,090.11
Amount carried up		$620,090.11

Amount brought up		620,090.11
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	
George A. Gardner, " "	20,000.00	
		107,600.00
SCHOLARSHIP TRUSTS.		
Richard Perkins Fund	53,209.82	
James Savage Fund	13,552 45	
Susan H. Swett Fund	10,182.95	
William Barton Rogers Fund	10,878.29	
Joy Fund	9,173.70	
Elisha Thatcher 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	2,796.19	
William F. Huntington Fund	5,208.33	
T. Sterry Hunt Fund	3,221.46	
Elisha Atkins Fund	5,000.00	
Nichols Fund	5,000.00	
Ann White Vose Fund	60,726.82	
Ann White Dickinson Fund	40,000.00	
Dalton Fund	5,531.81	
Willard B. Perkins Fund	6,080.00	
		251,145.14
OTHER TRUSTS.		
Charlotte Billings Richardson, Industrial Chemistry Fund		37,378.78
Susan Upham Fund		1,245.97
Susan E. Dorr Fund		5,420.59
William Hall Kerr, Library Fund		2,000.00
Biological Instrument Fund		143.50
Charles Lewis Flint, Library Fund		5,000.00
Rotch Architectural Library Fund		5,000.00
Rotch Architectural Fund		25,000.00
Rotch Prize Fund		5,200.00
Rotch " Special " Prize Fund		5,200.00
Letter-box Fund, balance		63.87
MISCELLANEOUS.		
Notes Payable	20,000.00	
Students' Deposits	150.00	
Fire Insurance, Engineering Building	16,462.63	
Moses Kimball Legacy, 1896	5,000.00	
Benjamin P. Cheney Legacy, 1896	10,000 00	
Susan G. Coolidge Devise, 1896	14,500.00	
John Foster Legacy, 1898	10,000.00	
Henry L. Pierce Legacy, 1898	750,000.00	
John W. Carter Legacy, 1898	6,250.00	
M.I.T. Stock Account	779,622.50	
		1,611,985.13
		$2,682,473.09

Comparative Statement of Funds, etc.

	Sept. 30, 1897.	Sept. 30, 1898.
Trusts for general purposes	479,590.11	620,090.11
" " Salaries	87,600.00	107,600.00
" " Scholarships	204,979.23	251,145.14
" " Library	7,000.00	7,000.00
Charlotte B. Richardson Ind. Chem. Fund	37,378.78	37,378.78
Susan Upham Fund	1,246.13	1,245.97
Susan E. Dorr Fund	3,757.80	5,420.59
Rotch Architectural Library Fund	5,000.00	5,000.00
Rotch Architectural Fund	25,000.00	25,000.00
Rotch Prize Fund	5,225.00	5,200.00
Rotch "Special" Prize Fund	5,225.00	5,200.00
Catherine P. Perkins Legacy	102,781.40	
Henry C. Hutchins "	2,000.00	
Moses Kimball "	5,000.00	5,000.00
Benj. P. Cheney "	10,000.00	10,000.00
John Foster "		10,000.00
Henry L. Pierce "		750,000.00
John W. Carter "		6,250.00
Susan G. Coolidge Devise	14,500.00	14,500.00
Letter-box Fund	110.37	63.87
Biological Instrument Fund	143.50	143.50
Students' Deposits	250.00	150.00
Notes Payable	120,000.00	20,000.00
Fire Insurance, Engineering Building		16,462.63
M.I.T. Stock Account	681,976.15	779,622.50
	$1,798,763.47	$2,682,473.09
Increase		
Consisting of:		
Bequests for Special Purposes, etc. See page 86		68,826.80
Gifts and Bequests for General Purposes. See page 86		906,750.00
Fire Insurance		16,462.63
		992,039.43
Less Notes Payable Paid	100,000.00	
" Funds of 1897 used	1,094.76	
" Students' Deposits	100.00	
" Expenses more than Income	7,135.05	
		108,329.81
		$883,709.62

INCOME FROM GENERAL INVESTMENTS, AND APPLICATION THEREOF.

Applied to Salaries	3,504 00	From Dividends, Bank Stocks	1,080.00
" " Scholarships	6,726.74	" State Tax returned on Bank Stocks	228.94
" " " James Savage Fund	400.00	" Bonds	15,410.38
" " Charlotte B. Richardson Fund	1,495.15	" Dividends, Railroad Stocks	5,608.00
" " Rotch Prize Funds	400.00	" " Coal and Gas Stocks	1,980.00
" " Library	480.00	" " Manufacturing Stocks	902.00
" " General Purposes	12,494.60	" Telephone Stocks	540.00
" " Increase of Funds	594.01	" Real Estate Stocks	789.52
" " Advances to Bond Premiums	2,920.51	" Interest allowed on Funds not in Bonds and Stocks @ 4%	2,476.17
	$29,015.01		$29,015.01

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

Paid Massachusetts Institute of Technology	10,949 00	Received Income from Railroad Bonds	11,449.00
Credited to Advances Bond Premiums	500.00		
	$11,449.00		$11,449.00

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			75 00
Land and Building, Clarendon St., on account			4,000.00
34 Commonwealth Avenue, 1 year		2,200.00	
less Annuity under Will	1,000.00		
less Tax	360.10		
		1,360.10	
			839.90
Use of Rooms and Gymnasium			1,393.79
			11,608.69
less Tax and Repairs, Cambridge			289.70
			11,318.99

Department Supplies.

Civil Engineering	2,738.52
Mechanical Engineering	2,903.32
Applied Mechanics	1,639.91
Mining	2,380.94
Architecture	2,652.15
Chemistry	8,944.39
Physics	6,127.90
Biology	1,127.87
English	928.58
Modern Languages	90.35
Geology	515.66
Naval Architecture	590.66
Drawing	100.51
Mathematics	103.89
Military	104.25
Periodicals	1,861.23
Workshops	1,973.92
	34,784.05

Salaries.

Instruction	186,170.02	
Administration	24,266.88	
Labor	21,518.82	
		231,955.72

General Expenses.

Fire Insurance			2,941.63
Stationery and Office Supplies			2,164.58
Furniture			2,201.87
Electric Wiring			2,162 05
Postage			1,612.51
Janitor's Supplies: Brushes, Paints, etc.			801.20
Entrance Examinations			723.83
Express Charges, Teaming, etc.			636 96
Sundries			614.37
Diplomas			587.40
Washing			519.44
Engine Room Supplies:			
Oil	242.29		
Cotton Waste	44.18		
Sundries	37.24		
			323.71
Ice			255.36
Glass			206.99
Books, Supplies, etc., for General Library			179.29
Lowell School of Design			161.74
Window Shades			159.35
Paints, Varnish, etc.			152.52
Graduation Exercises			149.85
Type-writing Machine			102.50
Examination Books			100.00
Raffle Plates for Boiler			100.00
Blackboards			99.16
Telephone & Telegraph Co.			94.24
Gymnasium Supplies			93.12
Union Deposit Vaults			75.00
Western Union Telegraph Co.			27.00
			17,245.67

Repairs.

Department Improvements:			
Civil Engineering	126.29		
Mechanical Engineering	1,037.45		
Applied Mechanics	126.20		
Mining	2,447.23		
Architecture	304.13		
Chemistry	4,050.33		
Physics	889.08		
Biology	16.25		
English	7.73		
Geology	123.75		
Naval Architecture	263.67		
Drawing	40.53		
Military	2.30		
Workshops	1,217.71		
			10.652.65
Sundries			6,212.13
Rogers Building			5,825.10
Walker Building			1,662.94
Steam Fitting			741.25
Architectural and Engineering Buildings			612.36
Gymnasium			435.28
Boilers, Tools, etc.			264.80
Huntington Hall			233.90
Ventilation Engineering Laboratory			224.55
Lawn Tennis Court			216.93
Deane Steam Pump			125.00
			27,206.89

BOSTON, December 7, 1898.

An examination of the accounts of the Treasurer of the MASSACHUSETTS INSTITUTE OF TECHNOLOGY for the year ending September 30, 1898, has been made by Mr. E. A. Stone, an accountant employed by this committee. We have also verified the evidences of personal property held by the Institute.

The report of Mr. Stone is hereto annexed.

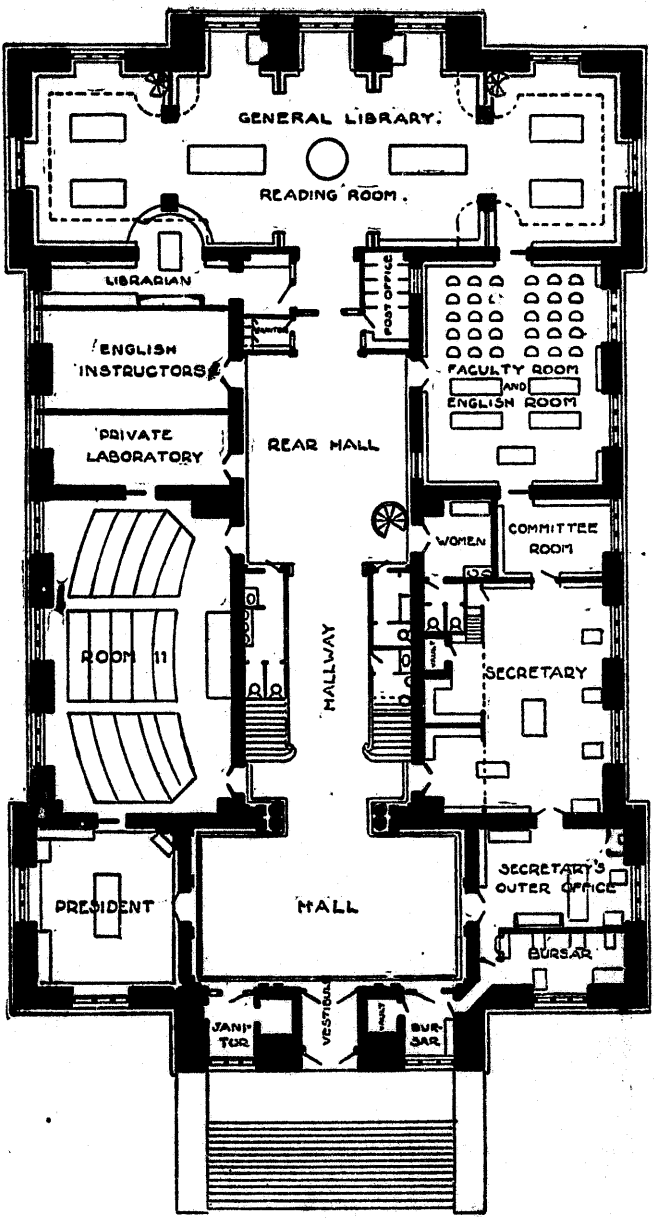
JAMES P. TOLMAN,
CHARLES C. JACKSON,
WILLIAM L. PUTNAM,
Members of the Auditing Committee.

BOSTON, December 7, 1898.

To the Auditing Committee of the
Massachusetts Institute of Technology:

GENTLEMEN: I have completed the examination of the Treasurer's accounts for the year ending September 30, 1898, and find them to be correct. I have also verified the bank balances. The trial balance corresponds with the ledger balances. I have also examined the vouchers, and find receipts for all items, except the amounts paid out on the weekly pay-roll, and these amounts correspond with the pay-roll.

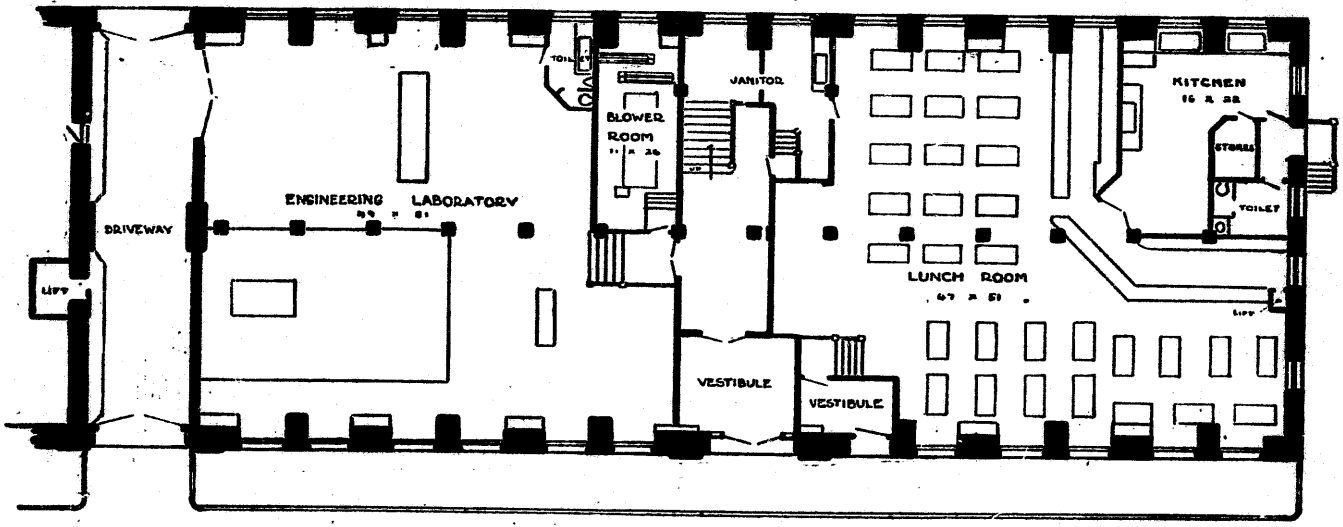
Yours truly,
EDWIN A. STONE,
Accountant.



ALTERATIONS IN ROGER'S BUILDING

ELEAZER B HOMER - ARCHITECT.

PIERCE BUILDING

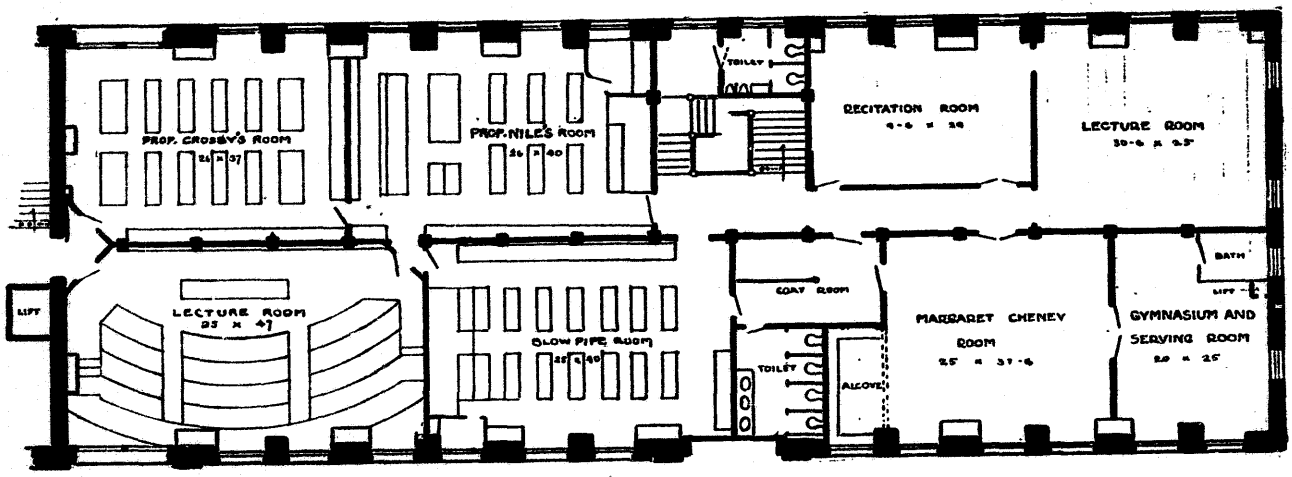


BASEMENT FLOOR PLAN

FIRE-PROOF BUILDING OF THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY

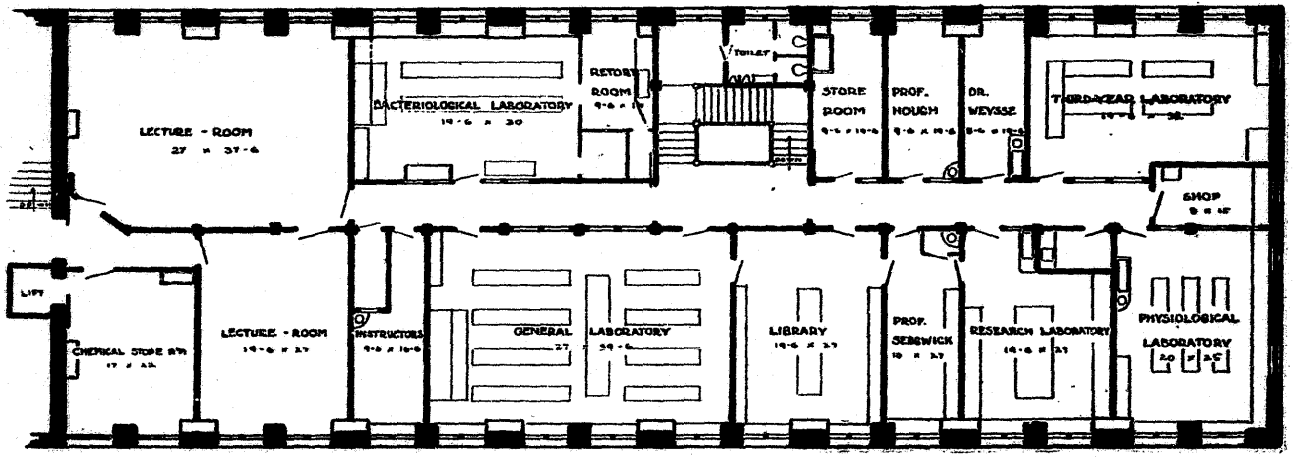
ELEAZER B. HOMER. ARCHITECT.

PIERCE BUILDING



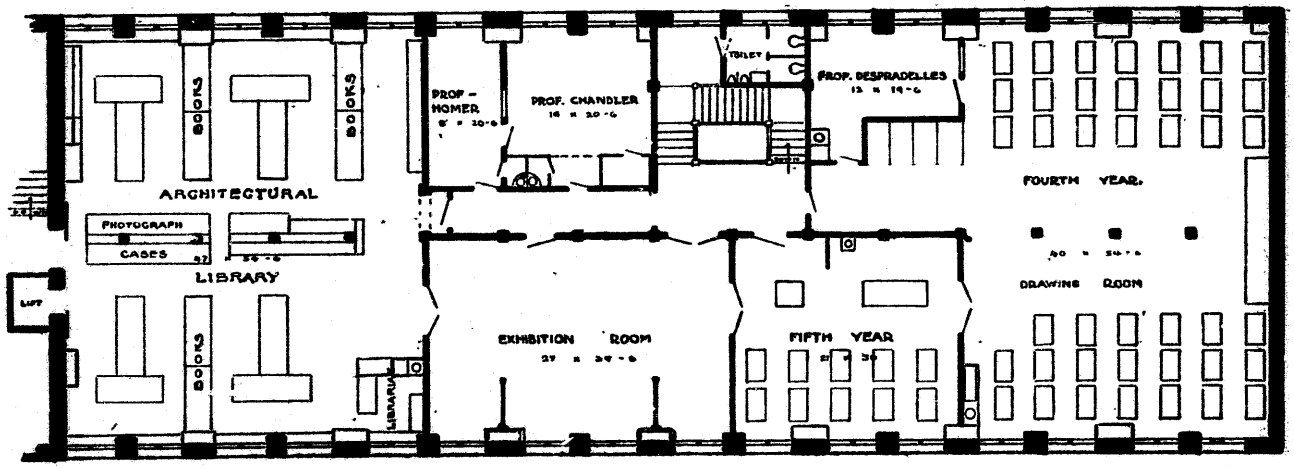
FIRST FLOOR PLAN.

PIERCE BUILDING.



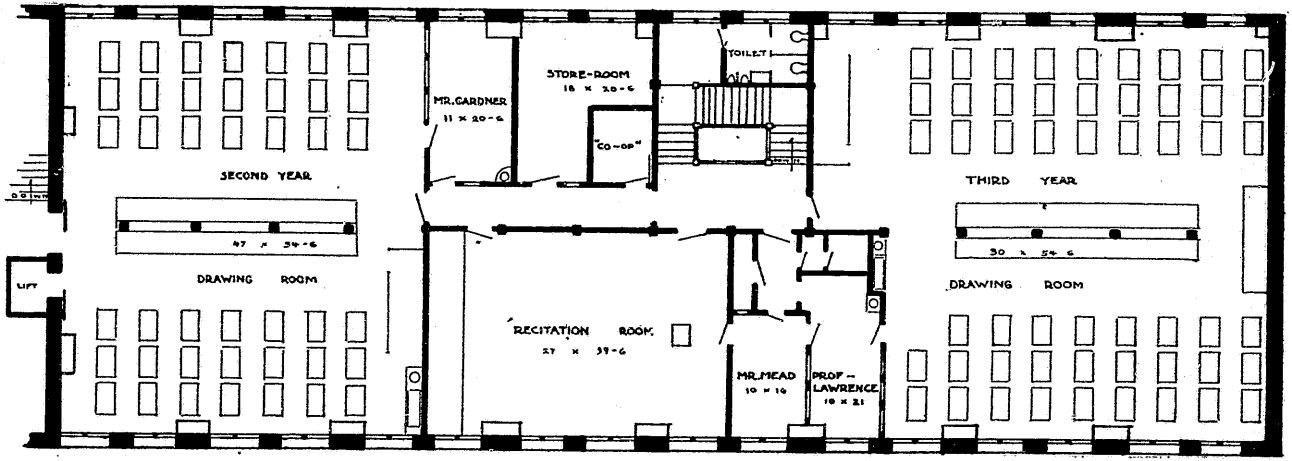
SECOND FLOOR PLAN

PIERCE BUILDING



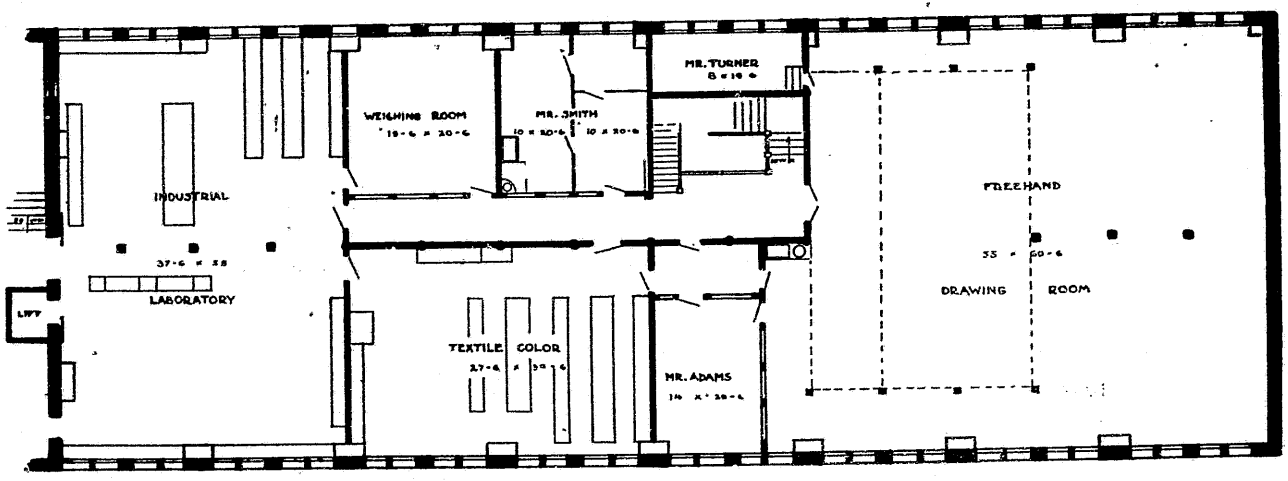
THIRD FLOOR PLAN

PIERCE BUILDING

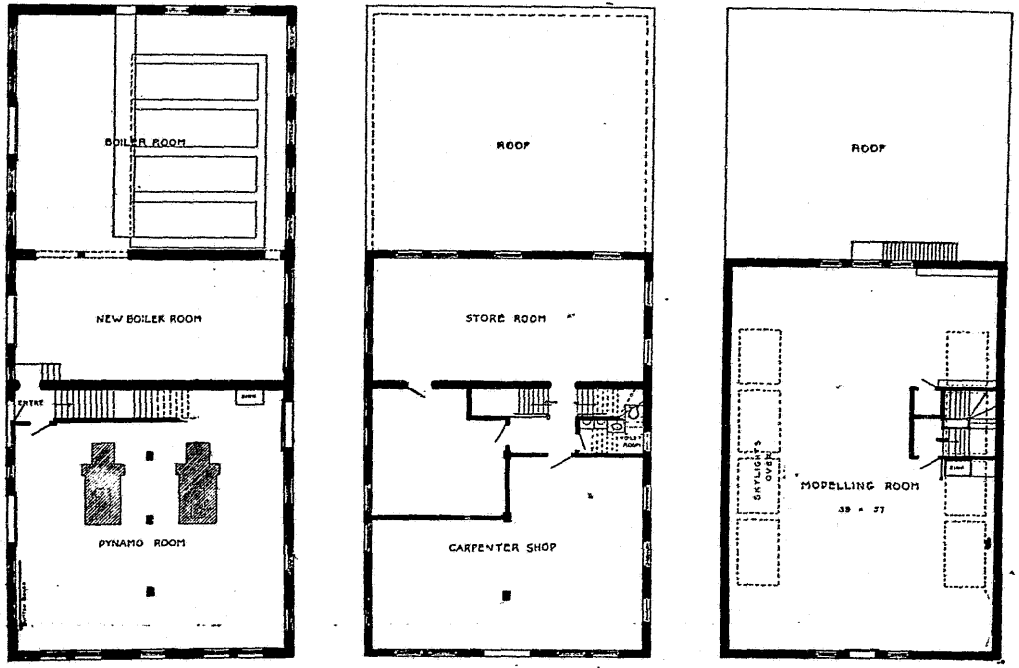


FOURTH FLOOR PLAN

PIERCE BUILDING



FIFTH FLOOR PLAN



FIRST FLOOR PLAN

SECOND FLOOR PLAN

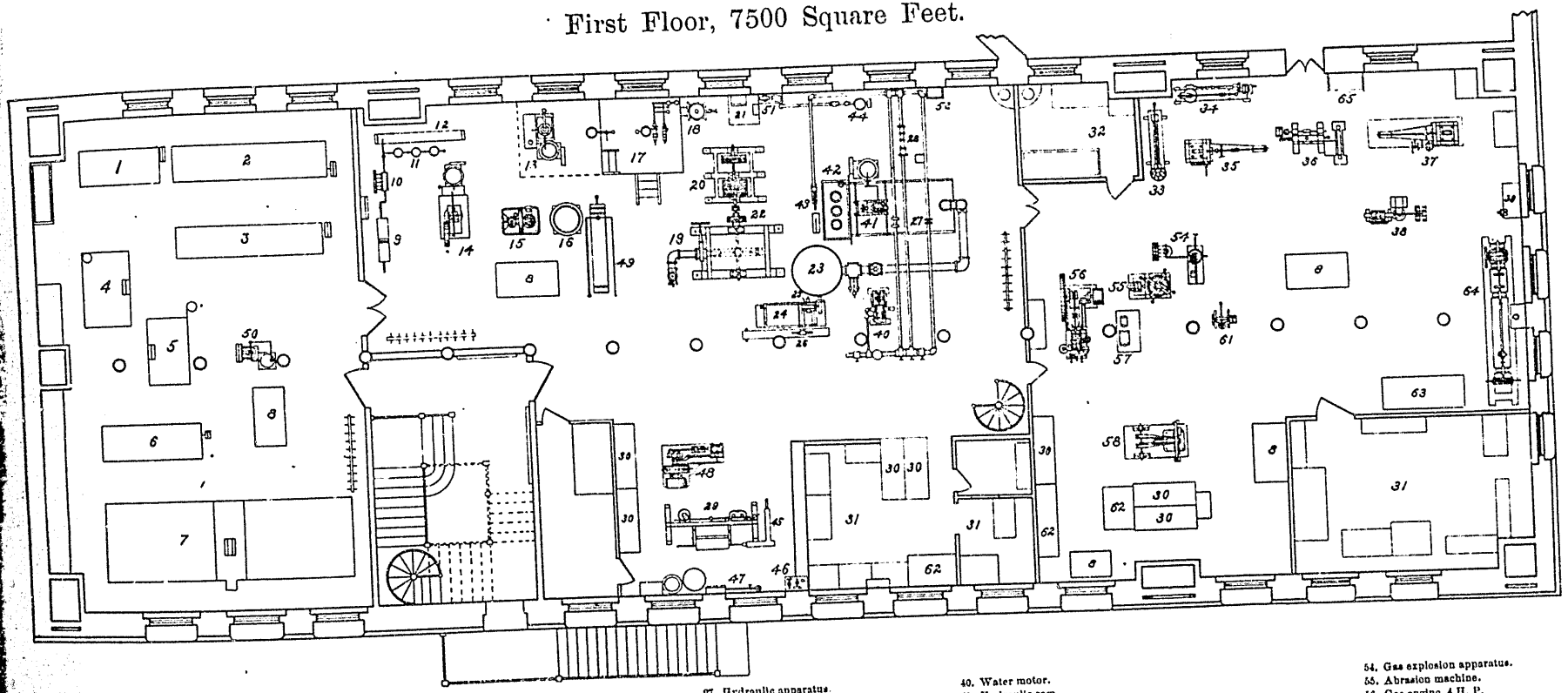
THIRD FLOOR PLAN

DYNAMO HOUSE - MASS. INSTITUTE OF TECHNOLOGY

ELEAZER B. HOMER - ARCHITECT -

MASSACHUSETTS INSTITUTE OF TECHNOLOGY.
ENGINEERING LABORATORIES.

First Floor, 7500 Square Feet.



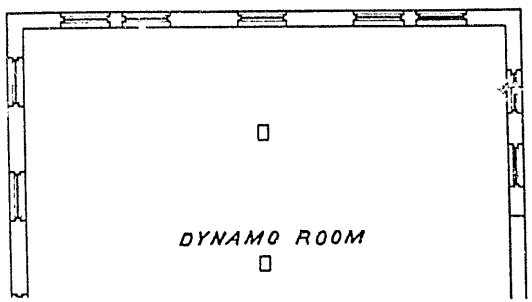
1. Drawing frame.
2. Speeder.
3. Fly frame.
4. Carding engine.
5. Carding engine.
6. Spinning frame.
7. Mule.
8. Tables.
9. Flow of steam apparatus.
10. Superheating calorimeters.
11. Throttling calorimeters.
12. Condenser.
13. Continuous water calorimeter.
14. Hot-air engine (Ericsson).
15. Hot-air engine (Rider).
16. Supply tank for hydraulic ram.
17. Injector testing apparatus.
18. Apparatus for testing the force of the jet of an injector.
19. Pelton water-wheel.
20. Brake for Pelton water-wheel.
21. Mercury column.
22. Emerson power-scale.
23. Tank for hydraulic experiments.
24. Eight-inch weir.
25. Water motor.
26. Ejector.
27. Hydraulic apparatus.
28. Venturi meter.
29. Air-brake pumps.
30. Instrument cases.
31. Offices.
32. Room for mixing cement.
33. Machine for testing cement.
34. Machine for testing cement.
35. 50,000 pounds testing machine.
36. Cloth testing machine.
37. 100,000 pounds testing machine.
38. Wire testing machine.
39. Work bench.
40. Water motor.
41. Hydraulic ram.
42. Adjustable weir and tank.
43. Apparatus for testing hose nozzles.
44. Hydraulic stand pipe.
45. Apparatus for testing anemometers.
46. Gauge tester.
47. Apparatus for determining the ratio of specific heats of gases.
48. Steam engine, 8 H. P.
49. Condenser.
50. Drosophore.
51. Water motor.
52. Seconds pendulum.
54. Gas explosion apparatus.
55. Abrasion machine.
56. Gas engine, 4 H. P.
57. Gas meters.
58. Lubricant testing machine.
61. Webber dynamometer.
62. Cases.
63. Repeated stress testing machine.
64. Dynamometer.
65. Scales for scaling weights.

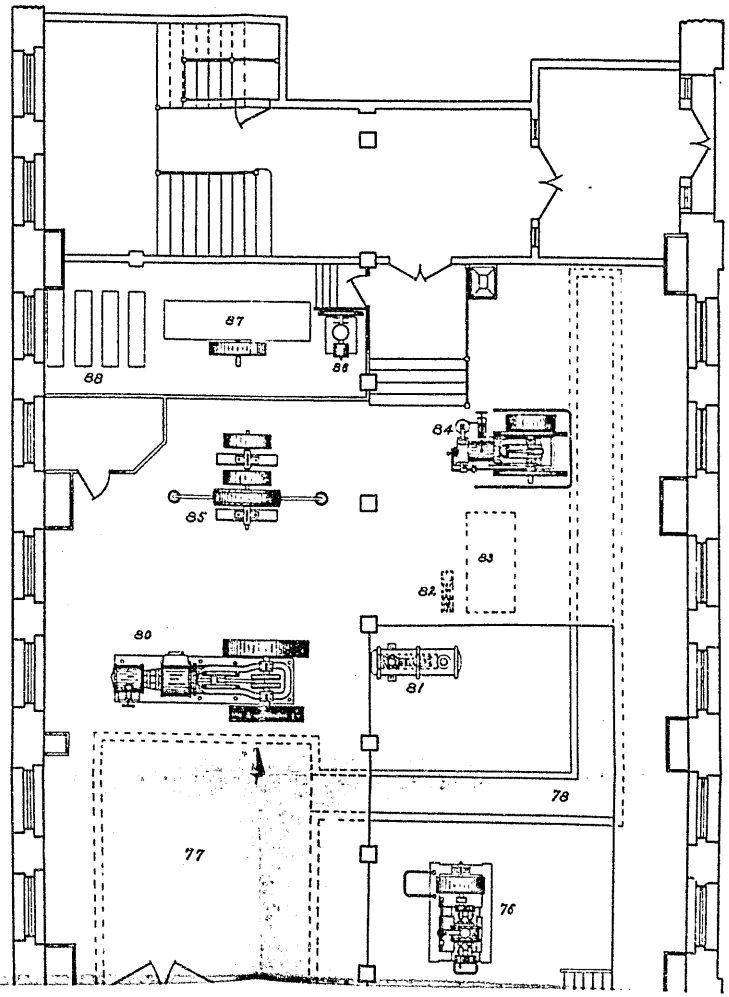
MASSACHUSETTS INSTITUTE OF TECHNOLOGY.

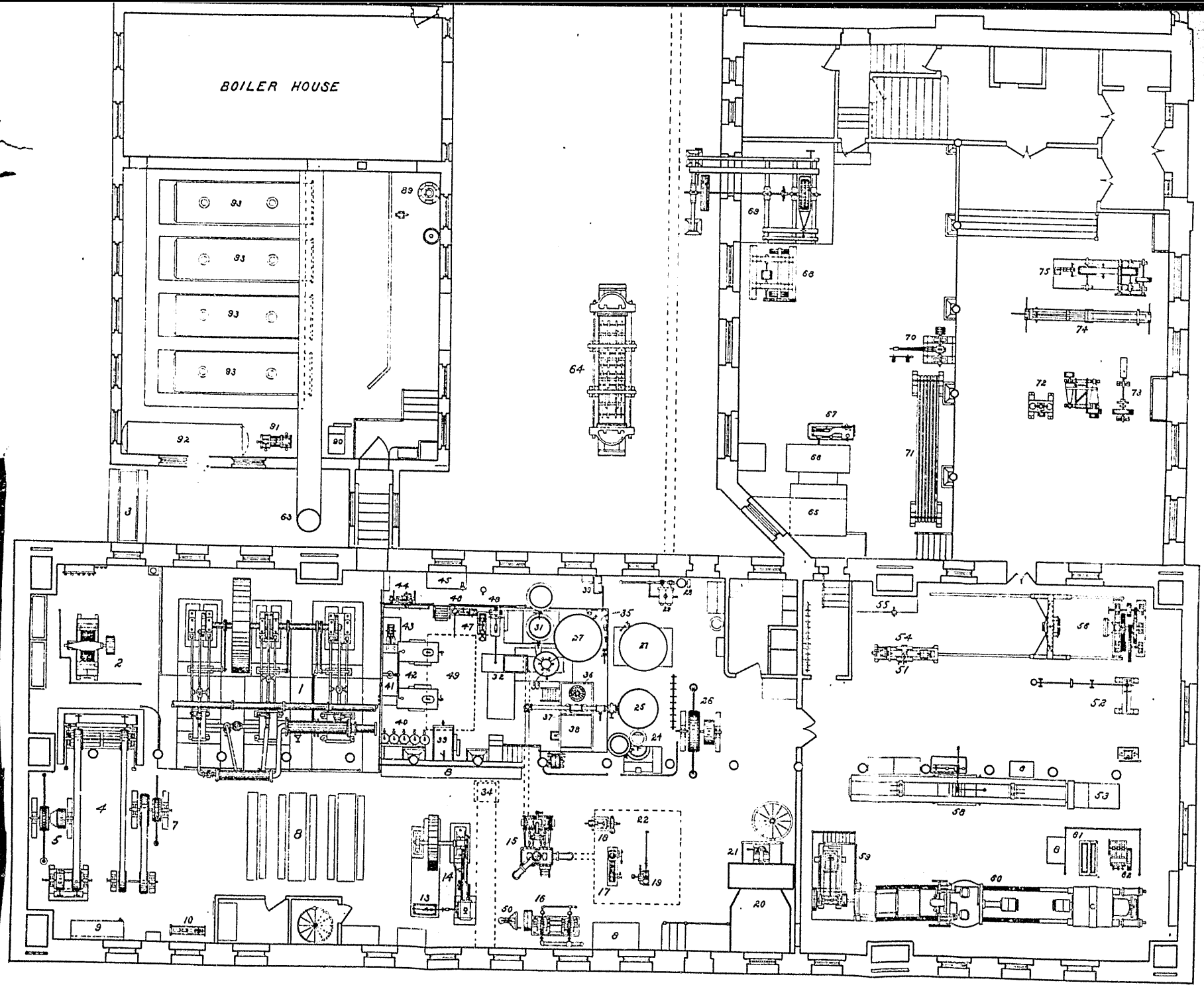
ENGINEERING LABORATORIES.

Basement, 13,500 Square Feet.

1. Triple expansion engine, 160 H. P.
2. Dynamo, 500 lights.
3. Resistance box.
4. Belt transmission testing machine.
5. Prony brake.
7. Prony brake.
8. Tables.
9. Carpenter's bench.
10. Lathe.
13. Condenser.
14. Steam engine, 16 H. P.
15. Duplex steam pump, 16" × 10½" × 12".
16. Gang pump.
17. Steam pump.
18. Centrifugal pump.
19. Pulsometer.
20. Main coils for heating and ventilating system.
21. Fan engine.
22. Cistern.
24. Weighing tanks.
25. Wrought iron tank for hydraulic experiments, 5 feet diameter, 27 feet high.
26. Prony brake.
27. Calibrated steel tanks, each 280 cu. ft. capacity.
28. Hydraulic stand-pipe, 10" diameter, 85 ft. high.
29. 3" water meter.
30. Mercury column.
31. Weighing tanks.
32. 12" weir.
33. Orifice tank.
34. Apparatus for testing pressure of air on surfaces.
35. Gauge testing apparatus.
36. Turbine wheel.
37. Hose nozzles.
38. 4-ft. weir.
39. Weighing tank.
40. Measuring tanks for steam jackets.
41. Surface condenser.
42. Weighing tanks.
43. Air pump.
44. Steam engine indicator tester.
45. Pipe bench.
46. Steam pump.
47. Steam pump.
48. Water wheel.
49. Cistern for oily water.
50. Emerson power scale.
51. Small torsion testing machine.
52. Hydraulic test-pump, 6,000 lbs. capacity.
53. Large weighing scales.
54. Lathe.
55. Bench.
56. Torsional shaft testing machine.
58. Beam testing machine, 100,000 pounds capacity, 26 feet span.
59. Rope testing machine.
60. Emery testing machine, 300,000 pounds capacity.
61. Scale case for Emery testing machine.
62. Power hydraulic pump for Emery testing machine.
63. Wrought iron stack, 3 ft. diameter, 100 ft. high.
64. Arch testing machine.
65. Main coils for heating and ventilating system.
66. Fan.
67. Fan engine.
68. Machine for testing wear of brake shoes and of tires.
69. Machine for testing transmission of power by ropes. (English system.)
70. Oil testing machine.
71. Time test of timber beams.
72. Experimental pendulum governor.
73. Experimental fly-wheel governor.
74. Beam testing machine, 15,000 pounds capacity, 14 ft. span.
75. Ma[illegible] for testing coefficient of sliding friction.
76. Rotary pump.
77. Cist[illegible]ted by 12" pipe with cistern numbered 22.
78. Extension of cistern.
79. Pu[illegible]e connecting cisterns 22 and 77.
80. Tandem [illegible]nd engine, 200 H. P.
81. Condens[illegible]air pump.
82. Pump.
83. Cistern [illegible]e water.
84. Gas engine [illegible] H. P.
85. Prony brake [illegible] H. P.
86. Fan engine.
87. Fan.
88. Heating [illegible]
89. Portable [illegible]
90. Tanks and [illegible] weighing water.





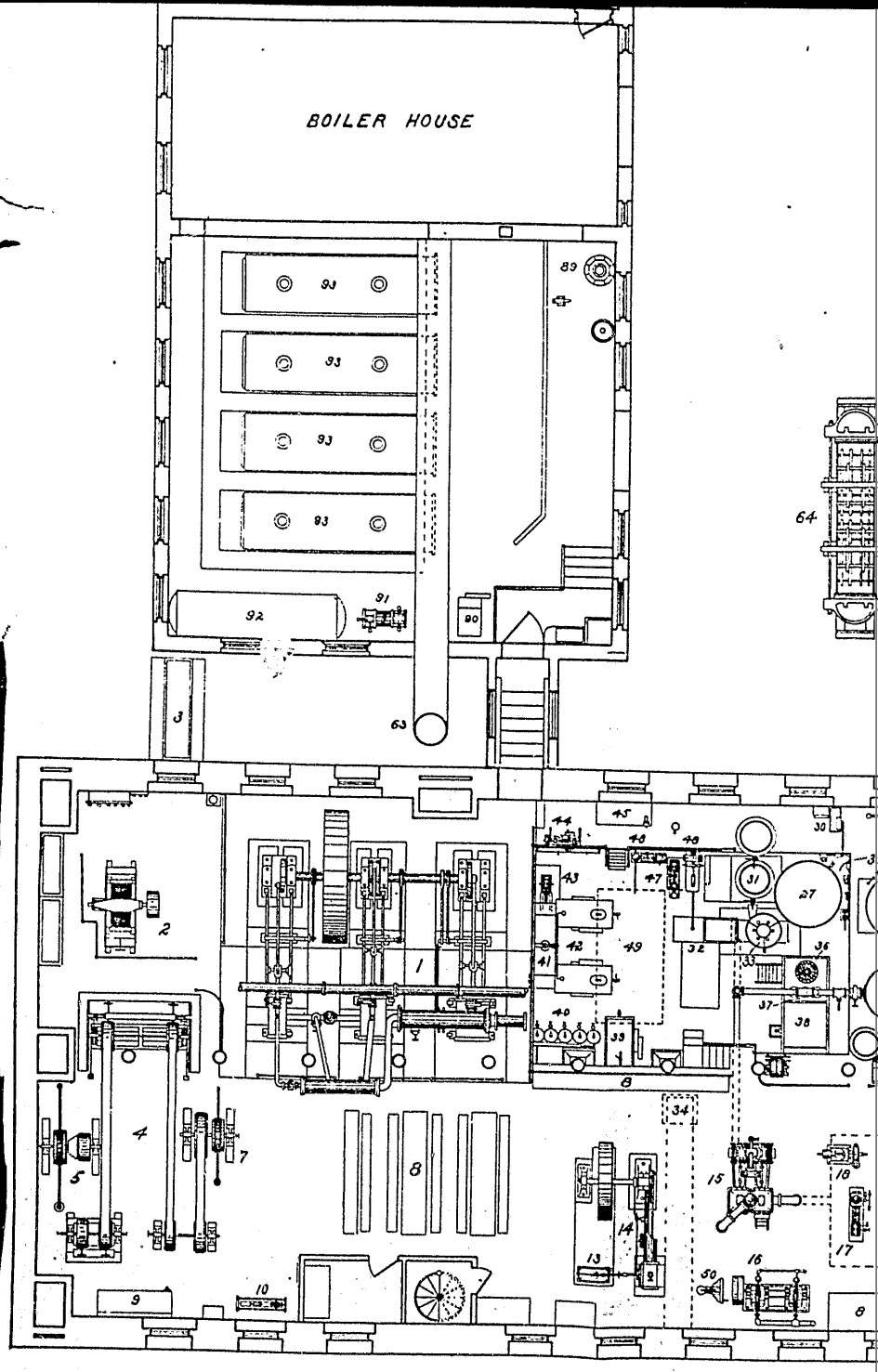

BOILER HOUSE

31. Weighing tanks.
32. 12" weir.
33. Orifice tank.
34. Apparatus for testing pressure of air on surfaces.
35. Gauge testing apparatus.
36. Turbine wheel.
37. Hose nozzles.

54. Arch testing machine.
55. Main coils for heating and ventilating system.
66. Fan.
67. Fan engine.
68. Machine for testing wear of brake shoes and of tires.
69. Machine for testing transmission of power by ropes. (English system.)
70. Oil testing machine.
71. Time test of timber beams.
72. Experimental pendulum governor.
73. Experimental fly-wheel governor.
74. Beam testing machine, 18,000 pounds capacity, 14 ft. span.
75. Machine for testing coefficient of sliding friction.
76. Rotary pump.
77. Cistern connected by 12" pipe with cistern numbered 22.
78. Extension of cistern.
79. Twelve-inch pipe connecting cisterns 22 and 77.
80. Tandem compound engine, 200 H. P.
81. Condenser and air pump.
82. Pump
83. Cistern for waste water.
84. Gas engine, 30 H. P.
85. Prony brake, 100 H. P.
86. Fan engine.
87. Fan.
88. Heating coils.
89. Portable forge.
90. Tanks and scales for weighing water.
91. Steam pump.
92. Tank for returns.
93. Steam boilers.

DYNAMO ROOM

BOILER HOUSE


BOILER HOUSE
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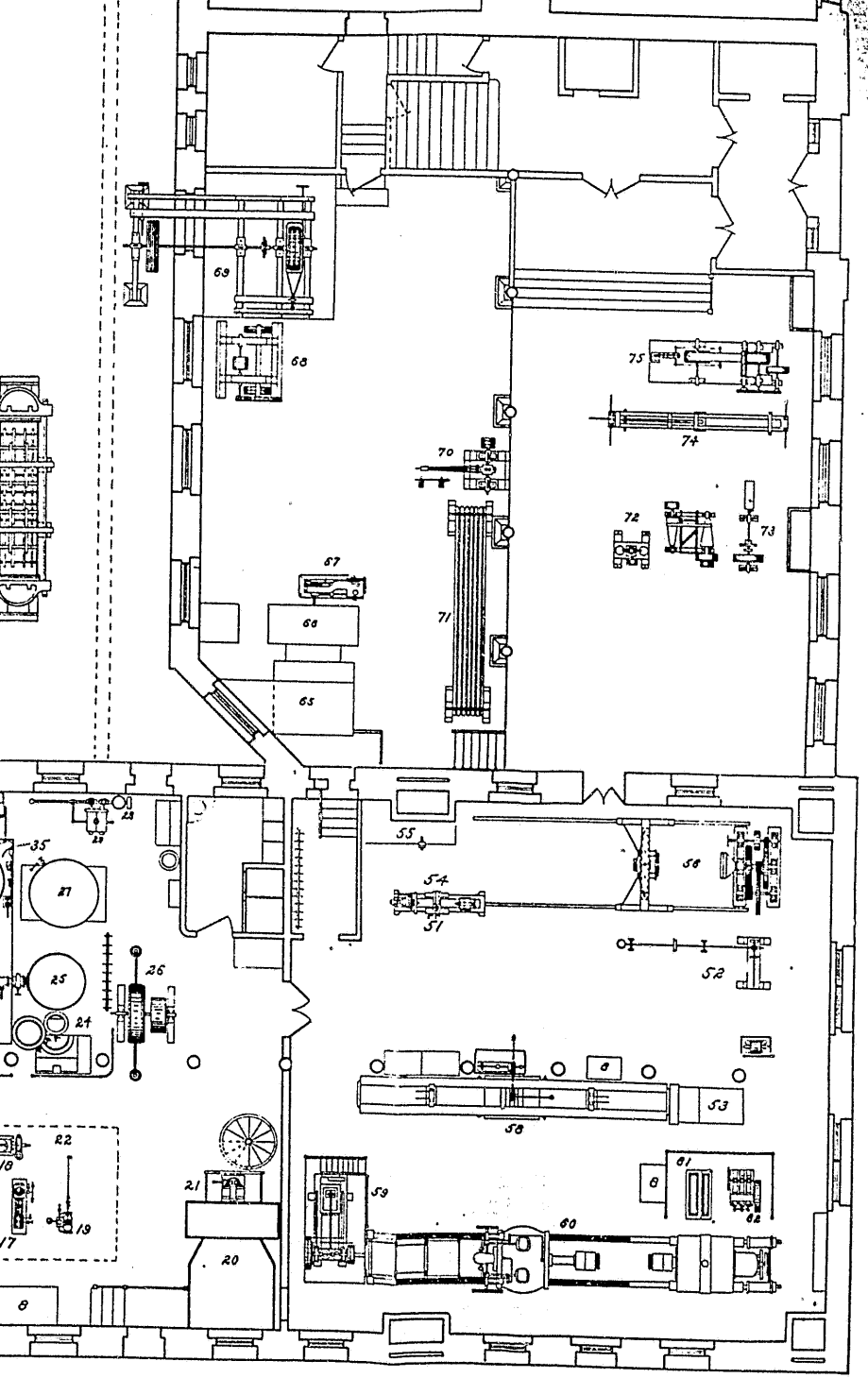
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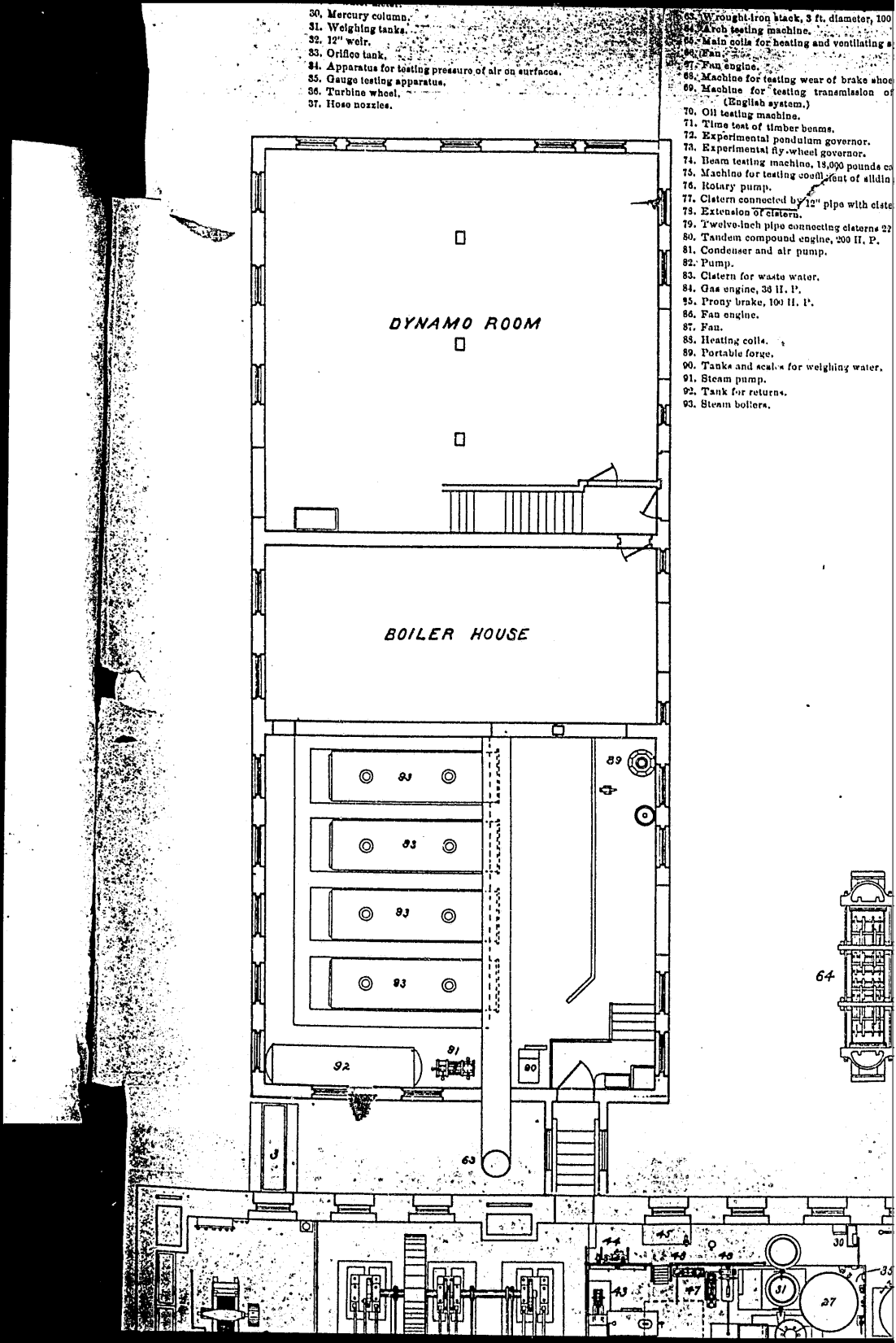
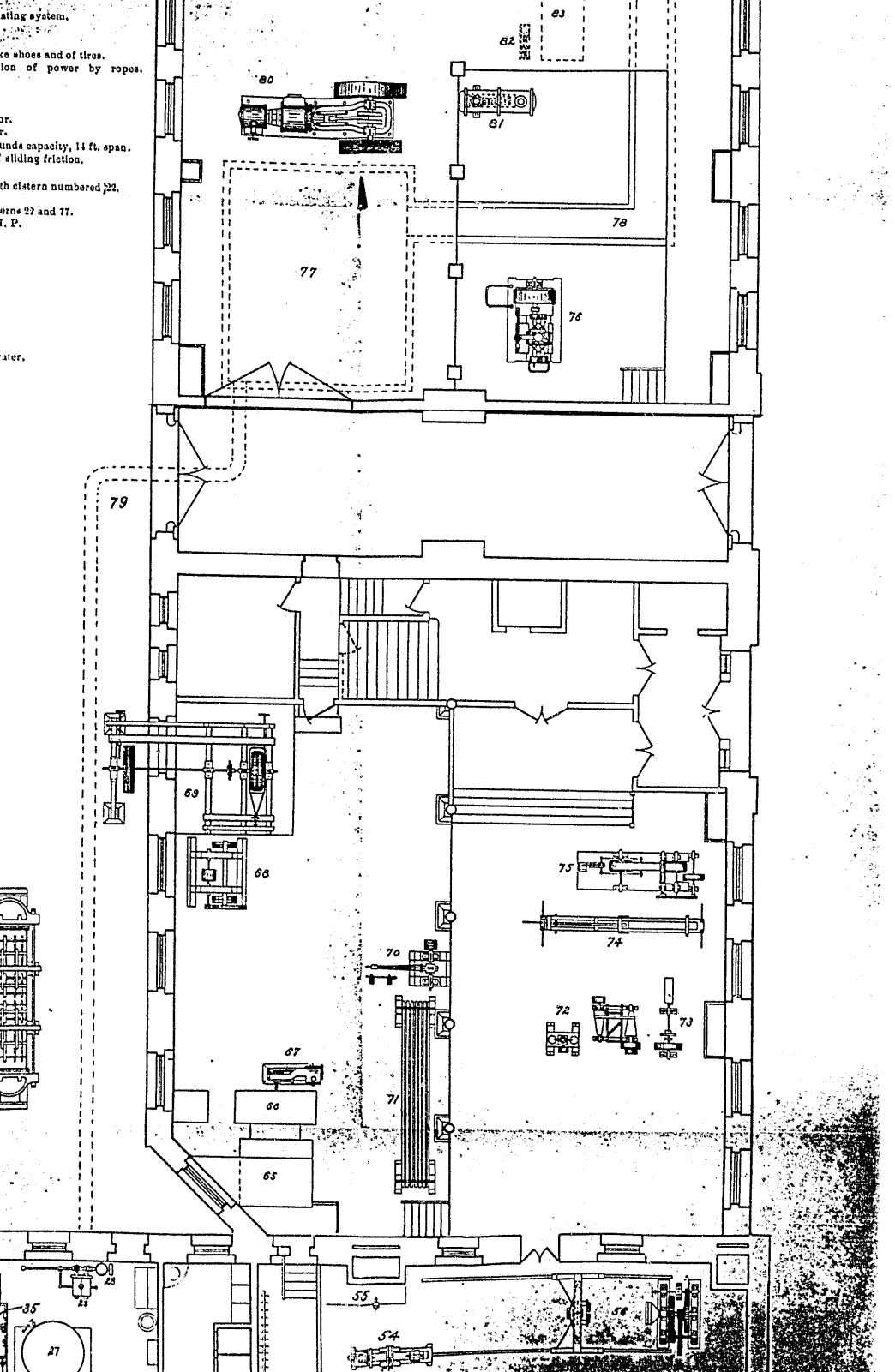
30. Mercury column.
31. Weighing tanks.
32. 12" weir.
33. Orifice tank.
34. Apparatus for testing pressure of air on surfaces.
35. Gauge testing apparatus.
36. Turbine wheel.
37. Hose nozzles.



65. Wrought-iron stack, 3 ft. diameter, 100
66. Arch testing machine.
67. Main coils for heating and ventilating
68. Fan.
69. Fan engine.
70. Machine for testing wear of brake shoe
71. Machine for testing transmission of (English system.)
72. Oil testing machine.
73. Time test of timber beams.
74. Experimental pendulum governor.
75. Experimental fly-wheel governor.
76. Beam testing machine, 18,000 pounds ca
77. Machine for testing coefficient of slidin
78. Rotary pump.
79. Cistern connected by 12" pipe with ciste
80. Extension of cistern.
81. Twelve-inch pipe connecting cisterns 22
82. Tandem compound engine, 200 H. P.
83. Condenser and air pump.
84. Pump.
85. Cistern for waste water.
86. Gas engine, 36 H. P.
87. Prony brake, 100 H. P.
88. Fan engine.
89. Fan.
90. Heating coils.
91. Portable forge.
92. Tanks and scales for weighing water.
93. Steam pump.
94. Tank for returns.
95. Steam boilers.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