Massachusetts Institute of Technology.

Twenty-Fifth Anniversary.

COMMEMORATIVE ADDRESS

BY

AUGUSTUS LOWELL, ESQ.

Massachusetts Institute of Technology.

COMMEMORATIVE ADDRESS

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AUGUSTUS LOWELL, ESQ.,

AT THE

GRADUATION EXERCISES,

HUNTINGTON HALL, ROGERS BUILDING,

TUESDAY, JUNE 3, 1890.

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COMMEMORATIVE ADDRESS.

Gentlemen and Ladies, — Twenty-five years have passed since this building was finished and the Institute of Technology was opened, upon a very modest scale and with a very small number of scholars; but the germ was there, and its rapid growth has come from allowing the school to develop by a process of evolution which has accommodated its teaching gradually and surely to the wants of the age, until, although far from perfect, it is to-day in completeness and comprehensiveness of technical instruction unsurpassed, if not unrivalled, by any institution of its kind.

The term "Technology" was given it by Dr. Jacob Bigelow, one of its earliest advocates, to represent a new departure in the history of instruction. Previous to this attempt, science had been taught as other branches of polite learning, by the university method, with little profit to the ordinary student; while those who made it their serious study prepared to devote their lives to its service, with no thought of applying it to the affairs of life. Science, pursued for its own sake, had little concern for the demands of trade. Any such partnership was beneath its dignity, and justly so. A great change was approaching, however, in the industries of the country. New fields of labor were to be opened up, based upon the discoveries of science and the inventions to which these had given rise, and a class of men would be needed to conduct these new industries for whose instruction no provision had been made in the established systems of education. To meet this want was the aim of the founder of this school, Professor William B. Rogers. Himself a student of pure science and eminent in many of its branches, but gifted with a rare power rightly to interpret the coming movement, he threw himself enthusiastically into the work.

Professor Rogers was a native of Virginia. He had long been the Director of its Geological Survey, and Professor of Chemistry and Physics in its great University, but he had married here and had lately come to Boston to make it his home. To his high reputation as a scientist he added a rare power of lucid explanation, which enabled him to command the attention of all who listened to him, even when discussing the most abstruse subjects; and so simple and engaging was his manner that the fascination he exerted over all classes of men was irresistible. With these qualities he gathered about him a miscellaneous collection of persons distinguished in their several branches of business, but with little scientific knowledge or training. To them he explained the advantage which his science could bring to their pursuits, and invoked their public spirit to enable him to confer upon the community the inestimable blessing of such a school as he had conceived. Upon these men he relied for such advice and assistance in practical matters as he required, but the conception was his own, and for many years he not only planned, but carried on the work, supplementing the instruction, where needful, out of the fund of his own great knowledge and acquirements. It is not too much to say, not only that but for him would no such school have been founded, at least not at that time, but that it would have been impossible, with such a staff and such appliances as he had at command, to have held it together, had he not been endowed with so remarkable a talent for imparting the vast knowledge he possessed, and gifted with a power of sympathy and enthusiasm which affected all who approached him.

Having secured the interest of this knot of followers, Professor Rogers's next step was to obtain from the Legislature a charter and a grant of land. These were given in April, 1861, upon condition that fifty thousand dollars should be raised by private subscription to erect a building. The necessary sum was secured through the generous gifts of Dr. Walker and Mr. Huntington. The time, however, was not favorable to such an undertaking. The guns of Fort Sumter were still echoing in the public ear, and the demands upon the time and means of our citizens, and upon their interest and energies in the struggle for the maintenance of the Union, left little leisure or thought for other objects. The organization of the school was doubtless also hampered by the strangeness of the project, and the incredulity of the public as to the demand for such instruction. It was not to be expected that it should at once meet with such public recognition as to secure for it a proper organization and equipment. The project was novel, and as it had been started by the foresight and public spirit of a few individuals, it must be carried on by them at their own expense and by their own exertions until the public mind should have become educated to appreciate the service it was prepared to render. It was clearly a case where the supply must be expected to create the demand. To-day, after the Institute of Technology has been sending its young men out into the world for a quarter of a century, trained to apply the principles of science to the exigencies of the useful arts, there is a tenfold greater demand for its graduates than before such a supply existed.

The close of the Civil War found the people of this country ripe for rapid development. The excitement and bustle of war were to be replaced by such an exhibition of national energy in the peaceful arts as the world had never before witnessed. Great inventions, due to the scientific progress of the past fifty years, were crowding upon us. Hereafter entirely new classes of activity were to appear, and the youth of the country, in order to take their place in the coming change, must be specially equipped for the work.

In February, 1865, the school was opened with 27 scholars; the following year there were 72, and from this the number rose rapidly, until, in 1872, it had reached 348. Then came the financial crisis, with the loss of credit, depression of industry, and reduction of private incomes, and the effect of these upon the school was most disastrous. The number of students fell in three years to little more than one half what it had been in 1872, and this was followed by a forced reduction of expenditures, dismissal of valued instructors and a call upon those who remained to do so at a serious reduction in their salaries. The retrenchments rendered necessary at this time came near destroying the Institute of Technology. It had few graduates to speak for it, and they were young men, occupying subordinate positions. Its friends were almost entirely confined to Boston, and some of these began to distrust the enterprise which they had assisted in founding, and more than one meeting of the Corporation was held which came near resulting in the abandonment of the whole undertaking.

The excellent work of its earlier days of poverty and depression and the reputation of its graduates saved it. With the revival of business prospects in 1879 dawned a new era of prosperity for the school. Again the number of scholars began to increase. In 1880 it was 200, and from that time it has steadily grown, until now it has reached 900, and this with no lowering of the standard of scholarship either for admission or graduation. Nine hundred students, ninety permanent instructors, and eleven separate courses, each comprising many branches of instruction, mark the point we have reached to-day. Truly a wonderful result to have been accomplished in so short a time!

Such an unprecedented growth has called for new and ever increasing expenditures by the Corporation, for which the means have never been in hand. Thus the building put up in 1883 cost $300,000, for which there was only $63,000 specially provided. The debt at one time reached $200,000, and but for the courage and generosity of the treasurer, Mr. John Cummings, who put his own name upon its paper, it would have been impossible to go on.

To superintend the work of such an institution demands courage and foresight on the part of its Directors. To recognize the requirements of an enterprise of such rapid growth, and to provide in advance that there may be no hesitation or delay in carrying on the work efficiently, calls for business talent of no mean order; to do all this, trusting to the future generosity of an appreciating public, requires a reliance upon human generosity, and a blind confidence in the future, which find no place in the ordinary conduct of affairs.

But even with a wise and efficient government, failure must have ensued but for the generous co-operation of the Faculty. Patience, resolution, and self-sacrifice have all been required at the hands of the Professors and teachers, and nobly have they done their part. In the early days of the school the service of these men was a labor of love, but animated by their leader and encouraged by his devotion, they labored on, at every sacrifice, and earned a debt of gratitude from all lovers of higher education, which was the only return they could hope to receive beyond that of their own approval. In the name of the Corporation I desire to put upon record our full appreciation of all that they have done and are still doing for the Institute, and to thank them in our own name and that of the public for their faithfulness and generosity.

I know they have a pride in their work. I know that they glory in the Institute; and well they may, for it is above and beyond all things the result of their conscientious and disinterested labors.

The debts of the Institute were paid in 1889, through the generosity of the Commonwealth, and by means of a large private contribution obtained chiefly through the exertions of Mr. William Endicott, Jr. But it was not destined to remain long out of debt. This condition had hardly been reached before it became evident that the renewed demand for space, due not more to the increase of students than to the rapid specialization of the work of the Institute and the higher and larger types of machinery and apparatus, had rendered the extension of only six years before inadequate.[1] To meet this want the Corporation was compelled last summer to erect a new engineering building on Trinity Place, at a cost of $120,000, of which we owe practically the whole amount to-day. We have now ample space, but there is much that ought to be done, in justice to the teachers especially, which we would gladly do, but cannot for lack of means. The school has grown so fast, that it has been impossible to preserve its due proportions. Much has been pushed aside to meet more urgent wants, and we are sometimes almost tempted to wish that we could pause and put our house in order. But as success means growth, and rapid growth must necessarily be accompanied by much incompleteness of detail, we must accept its conditions, while we triumph in the result of our work, and remember that the school can

[1] The expense of instruction at a scientific and technical school increases far more rapidly, under an increase in the number of pupils, than at an ordinary classical college. The students must be taught in small sections, often in little groups around a machine or piece of apparatus, under the guidance of an instructor. The cost of delicate instruments and powerful machines, which must always be kept abreast of invention and the best professional practice, is also very great.

never be complete until it has ceased to grow, and that then its days of usefulness will be numbered. Great, however, as have been and still are the needs of the Institute, it never has been our habit to proclaim our wants. We have rather chosen to rely upon the recognition of a service well performed, knowing that the public is never slow to appreciate what deserves support, and may be trusted to see that an institution from which it gains so much is not suffered to languish for lack of means.

An institution of learning may make a demand upon public recognition and gratitude because of its good work in training successive classes of young men for usefulness in life, even though it be not an innovator in education, and uses only the old and familiar methods of instruction; but it may acquire a further and larger claim by becoming a leader in its department, by introducing new methods, and opening the way to a better kind of intellectual and professional training.

How the Institute of Technology has dealt with the thousands of young men who have been its pupils since 1865, what it has done for them, what places they now occupy in the industrial system, what services they have rendered to the arts and industries of the country, common fame will tell. Those who would study this matter more carefully will find material in the lists of its graduates and of the places they fill, as told in the annual catalogues.

But in addition to its work in training a certain number of young men for the duties of life, the Institute of Technology has been pre-eminently a leader in education. Its influence has not been confined to what it has done for its own pupils, but has extended as far as its example of advanced scientific and technical instruction has gone.

Almost at the very outset a long step forward was taken in the establishment of a laboratory of general chemistry.

Up to that time general chemistry had been taught wholly by means of text-books, or by lectures with experiments by the lecturer. The student's part was only to look and to listen, and learn in this way what he could. It was not until the student was put into the analytical laboratory, and took the retort into his own hand, that he did or discovered anything for himself. Under the inspiration of Professor Rogers and the enterprise and administrative skill of Professor Charles W. Eliot and Professor Frank H. Storer, a laboratory of general chemistry was established, and the pupil from the first day of his chemical studies was set to teach himself. This was no analytical laboratory. It was simply designed as a means of illustrating, emphasizing, and supplementing the instruction of the lecture-room in regard to the nature of chemical action and the characteristics of the principal elements. The student was not told what he should find. He was told to do something and note what occurred. He was thrown upon his own faculties of observation and reflection. He learned to know himself, and to measure his own power, and he acquired ease and accuracy of manipulation by practice. So far as known, this was the first laboratory of such a character set up in the world. Certainly it was the first one instituted in the United States for the instruction of considerable classes of pupils. The publication of Eliot and Storer's Manual, designed for students taking this course, marked an epoch in the history of education.

Another equally important step in scientific education, and one of which the originality is beyond doubt, was taken at about this time in the establishment of a laboratory now known as the Rogers Laboratory of Physics. Under the inspiration of President Rogers the scheme of a laboratory where the student of physics should be set to make observations and conduct measurements for himself, in demonstration and illustration of the physical laws taught in the lecture-room, was carried out with remarkable ability on both the scientific and administrative sides by Professor Edward C. Pickering, now Director of the Harvard Observatory. So complete was Professor Pickering's study of the needs and capabilities of such a laboratory, so masterly his treatment of it, that it has required only more room and additional apparatus to allow the system he then devised and formulated to be extended successively to classes of fifty, of one hundred, and even of one hundred and fifty students.

In the school year of 1871–72 another forward step in education was taken at the Institute of Technology. Down to that time the instruction in mining engineering and metallurgy had been, here as elsewhere, conducted by means of text-books, lectures, drawing models, and assays of small pinches of ore, supplemented, in the case of the more fortunately situated schools, by occasional visits to mines in actual operation. In the year named a scientific expedition to the Rocky Mountains was undertaken by a large party of students and instructors from the Institute. While in the Colorado mining regions, Professor Runkle conceived the idea of a laboratory which should add to the existing means of instruction in mining and metallurgy the practical treatment by the students of economic quantities of ores. This conception, so fully in the line of the general work of the Institute, was given effect by the purchase in California, before the return of the expedition, of a number of pieces of apparatus suitable for the beginnings of such a laboratory. The apparatus thus obtained was set up by Mr. Robert H. Richards, then instructor, and now for many years Professor of Mining Engineering.

From these small beginnings made under Professor Richards's care it has grown steadily to this day. It was the first proper metallurgical laboratory devoted to the purposes of instruction in the world. It is under its title, "the

John Cummings Laboratory," by far the largest and the best in the world to-day. Its graduates are found in the most important mines and smelting and reduction works of the United States, showing the effect of their training at the Institute, in which theory and practice were so happily combined, and in which everything taught in the lecture-room is at once put to use in experiment and research.

In 1873 a further step in technical education led to the establishing of a laboratory of steam engineering. An engine of sixteen horse-power was set up, and the necessary apparatus for engine and boiler tests was provided. Out of this humble beginning has grown the largest and best equipped mechanical engineering laboratory to be found, in which not only is the work of instruction carried further than ever before, but original research, conducted jointly by the students and their instructors, is pushed to points often beyond the range of ordinary expert investigation within the profession. In the same year the Lowell Free School of Industrial Design was established at the expense of the Lowell Institute, for the purpose of promoting the industries of the country, and especially the textile manufactures, by cultivating the American taste in respect to form and color.

In 1876 the system of shop work as a means both of general and professional training was introduced. Half an acre of shops, filled with the best tools, machines, and engines, with over two hundred students pursuing this branch of instruction, represent to-day the poor, mean shed, with its scanty appliances, which was all that the funds at the command of the Institute allowed to be erected in 1876.

In 1881 was established a laboratory of applied mechanics, devoted especially to the tests of building materials in wood, stone, and iron. The equipment of the laboratory has been increased from year to year, until it comprises a great variety of apparatus and machines, designed largely by the instructors in that department, for making almost every kind of test which the purposes of the engineer, the architect, the shipbuilder, or the mill-owner may require, — beam tests, column tests, belting tests, rope and wire tests, shafting tests, tests by tension, by transverse strain, by compression, by tensile strain, and continuous, intermittent, or instantaneous tests.

In 1884 the germ of a biological laboratory, which had existed in a corner of the shed used for the workshops of 1876, was developed with the aid of a large amount of physiological apparatus. The resources of the laboratory were turned, first, upon the preparation of its students for subsequent medical studies, and, secondly, upon bacteriological investigations, to which the marvellous discovery of Koch and Pasteur had pointed. It is not too much to say, that there is scarcely a place in this country where as much important bacteriological work has been done during the past three years as in this laboratory of the Institute.

In 1882 the increased demands upon the department of physics for the higher and more technical instruction of students, looking forward to electrical practice, led to the establishment of a distinct service devoted exclusively to that end, and, in connection with the new building of 1883, to the equipment of an electrical laboratory, with engine, dynamos, electric motors, and a great variety of electric testing apparatus. Notwithstanding this equipment, this course in electrical engineering, as it has been developed at the Institute, could not be sustained but for the machinery and ample appliances of the engineering laboratories. The training of the electrical engineer at the Institute of Technology differs from that usually followed, in that the electrical engineer is here regarded as primarily a mechanical engineer, but a mechanical engineer who has specially studied the mechanical requirements of the electrical industries and enterprises, just as the chemical engineer under the course established two years ago is regarded in his relation to the chemical industries. And this introduces us to the last contribution made by the Institute of Technology to the philosophy of scientific and technical education, in the recognition of laboratory work in mechanics as an essential feature of a proper training in any branch of the great engineering profession. In the mechanical laboratories the students in each branch of engineering, civil, mechanical, mining, electrical, chemical, and sanitary, are called to perform the work of experiment, and to deal with the generation of power, and its application to the exigencies of their several contemplated professions.

We have thus roughly traced the history of the Institute of Technology. We have seen within how few years it has grown from a doubtful experiment into one of the most important schools of the country. We have seen how largely it has enjoyed the confidence and liberality of the public, and we feel that we may securely rely upon the same generous support hereafter. We have seen how its methods of instruction have been adapted to the changes and developments of practical science. We have seen that in this mobility, this power of adaptation, lay the grand idea of the whole scheme, and we are sure that, so long as it continues to be its guiding principle, the Institute of Technology will stand; a monument to the character, learning, and wisdom of its founder, worthy the community in which its establishment was possible and by which it has been maintained, an honor to the instructors who have devoted their energies to its service, and fortunate, as we trust it may long be, under the direction of so distinguished and able a President as General Francis A. Walker.

ADDRESS OF PRESIDENT WALKER,

UPON PRESENTING DIPLOMAS OF GRADUATION.

MY FRIENDS, — It is now my pleasant privilege, on behalf of the Corporation and Faculty of the Massachusetts Institute of Technology, to present to you the diplomas of your honorable graduation and to greet you Bachelors of Science. It is rightly a subject of congratulation, on your part and on the part of all these friends, that you have passed so faithfully and patiently through one or another of the severe courses which lead up to the degree of the Institute. Doubtless at times it has gone much against the grain to do all that was required of you, and to do it all well. But you have striven, and you have conquered. Never hereafter can you be as those who have not been tried. I do not believe that any one of you to-day regrets the severe exertions and the great sacrifices that have been required. Those who do such things never regret the doing.

Behind you is a long course of laborious and honorable study and achievement; before you, a world which will never make upon you a severer demand than you have already successfully met. Are you not, then, glad that you have taken so brave a start in the cool of the day, and made so long a march in the morning of your lives, and now find yourselves so far on the way to personal and professional success, while sluggards are still droning and dozing away in camp the hours when the sun is low and the air is fresh and sweet? You are not to-day indulging in vain regrets as to hours which have been misspent, opportunities which have been neglected, and time that has been wasted in folly or vice. With the rightful pride of those who have fought a good fight, have kept the faith and finished their course with honor, you stand here and now, on the threshold of the great world, in the consciousness of duty hitherto well performed, of preparation for the labors of life carefully and thoroughly made, and of suitable and ample equipment for all the responsibilities of professional practice in the several lines for which you have been qualifying yourselves. I congratulate you. We say farewell without sorrow, since it was for this you came to us. But we bid you farewell in all affection and respect, with all honor and regard, with the most pleasant recollections of your straightforward and honorable conduct here, and with the strongest anticipations of your success and prosperity, both in professional and in private life.

CANDIDATES

FOR

THE DEGREE OF BACHELOR OF SCIENCE IN THE SEVERAL COURSES OF STUDY,

WITH

TITLES OF THE GRADUATION THESES.

The Course of Study is indicated by the numeral after the name, as follows: —

I. Civil and Topographical Engineering: II. Mechanical Engineering; III. Mining Engineering; IV. Architecture; V. Chemistry; VI. Electrical Engineering; VII. Biology; VIII. Physics; IX. General Course; X. Chemical Engineering; XI. Sanitary Engineering.

☞ Courses X. and XI. have been established too recently to be represented by graduates the present year.

ARTHUR HENRY ADAMS (II.) . . . . Newton, Mass.
An Experimental Investigation of the Slip of Leather Belts on Cast-iron Pulleys. (*With S. D. Flood.*)

CHARLES HENRY ALDEN, JR. (IV.) . . . . Boston, Mass.
A Design for the Plumbing System of a City House.

FRANK WILEY ATWOOD (V.) . . . . East Boston, Mass.
Oil of Maize.

ARTHUR WHITTIER AYER (II.) . . . . Somerville, Mass.
An experimental Study of the Effect of Kiln-drying on the transverse Strength of Spruce.

CYRUS CATES BABB (I.) . . . . Boston, Mass.
A Discussion of the Topography of Schoharie, N. Y., and of Camden, Me.

JOSEPH BLACK BAKER (VI.) . . . . Newton, Mass.
Experiments on Commercial Storage Batteries. (*With T. J. Sturtevant.*)

HIRAM ELLSWORTH BALDWIN (I.) . . . . Niles, Ohio.
Design for a Three-hinged Arch.

SPAULDING BARTLETT (V.) . . . . Webster, Mass.
An Investigation of Several Methods for Setting Indigo Vats.

JOHN LANGDON BATCHELDER, JR. (VII.) . . Jamaica Plain, Mass.
A Sanitary Bacteriological Study of the Milk Supply of Boston.

CHARLES BOARDMAN BEASOM (II.) . . . . Nashua, N. H.
Design for a Compound Engine.

ELIZABETH EMMA BICKFORD (VII.) . . . . Piermont, N. H.
A Study of the Zoögloea Stage of Bacteria.

JOHN BALCH BLOOD (VI.) . . . . Newburyport, Mass.
The Efficiency of Alternating Current Transformers. (*With W. L. Smith and F. W. Swanton.*)

AUSTIN DUNHAM BOSS (II.) . . . . Willimantic, Conn.
A Design for a Thread Mill. (*With E. F. Bragg.*)

EDWARD FRANKLIN BRAGG (II.) . . . . Taunton, Mass.
A Design for a Thread Mill. (*With A. D. Boss.*)

LOTTIE ALMIRA BRAGG (V.) . . . . Braggville, Mass.
Distribution of Nitrogen and Phosphorus in the Products of Modern Milling.

EDWARD DEXTER BROWN (VI.) . . . . Reading, Mass.
An Experimental Study of the Waste Field of Dynamos (*With F. M. Greenlaw.*)

ERNEST HENRY BROWNELL, A. B., Brown University (I.)
Bristol, R. I.
A Study of the Flow of Water in the Proposed Cape Cod Ship Canal.

EDWARD CLIFTON BURNHAM, A. B., Brown University (II.)
Pawtucket, R. I.
Tests on the Lift and Discharge of a Safety-valve.

GARY NATHAN CALKINS (IX.) . . . . Chicago, Ill.
Supreme Court Cases Affecting the Principle of Sovereignty, from 1791 to 1833.

MORTEN CARLISLE (VI.) . . . . Cincinnati, O.
The Effect of Projecting Teeth in Ring Armatures. (*With J. Clark, Jr.*)

CHESTER VERNON CARLTON (I.) . . . . Milford, N. H.
A Discussion of Various Forms of Easement or Transition Curves.

JAMES ANDREW CARNEY (V.) . . . . Lowell, Mass.
A Study of Brom- and Nitroso-Phenols.

George Daniel Chapman (II.) . . . . Fitchburg, Mass.
A Design for an Automatic Rack-Cutter, including some Tests on Milling Cutters.

Frank Linten Chase (I.) . . . . Louisville, Ky.
A Discussion of Column Formulas.

James Clark, Jr. (VI.) . . . . Louisville, Ky.
The Effect of Projecting Teeth in Ring Armatures. (*With M. Carlisle.*)

William Henry Collins (V) . . . . Fall River, Mass.
Nature of the Union between Benzidine Colors and Cellulose.

Walter Freeman Cook (IX.) . . . . Dorchester, Mass.
A Comparison of Retail Prices in Boston and Vicinity.

John Gooding Crane (I) . . . . Taunton, Mass.
Design for a Lock Gate for a Ship Canal.

Darragh de Lancey (II.) . . . . Plainfield, N. J.
The Design, Construction, and Testing of a Torsion Dynamometer. (*With K. C. Richmond.*)

Alexander James Delano (I.) . . . . Boston, Mass.
A Study of Wooden and Metal Railroad Ties.

John Oviatt De Wolf (II.) . . . . Greenfield, Mass.
A Theoretical and Experimental Study of the Deflection of Locomotive Parallel-Rods.

Frederick Holmes Dodge (II.) . . . . Toledo, O.
Some Experiments to Determine the Effect of Repeated Bending on Wrought Iron and Steel.

Francis William Dunbar (VI.) . . . . Canton, Mass.
An Experimental Investigation of the Various Electrical Methods of Testing Shunt Motors. (*With M O Southworth.*)

Pierre Samuel du Pont (V.) . . . . Philadelphia, Pa.
Determination of Silicon in Commercial Aluminum.

Edwin Forrest Dwelley (I.) . . . . . West Hanover, Mass.
A Project for a Railroad to Connect the Village of Brant Rock, Mass, with the Old Colony Railroad. (*With C. G. Norris*)

Elwood Allen Emery, B. L., University of Minnesota (IV.)
Minneapolis, Minn.
Design for a College of Music.

William Henry Fenn (I.) . . . . Jersey City, N. J.
A Discussion of the Application of Movable Dams to the Rivers of the United States.

William Parker Flint (II.) . . . . Brookline, Mass.
A Study of the Balancing of the Drivers of the Eight-Wheel Locomotive by Means of Counterweights.

Samuel Douglas Flood (II.) . . . . Chicago, Ill.
An Experimental Investigation of the Slip of Leather Belts on Cast-iron Pulleys. (*With A. H. Adams.*)

George Warren Fuller (V.) . . . . . . West Medway, Mass.
The Determination of Organic Nitrogen in Well Waters.

George L. Gilmore (II.) . . . . Charlestown, Mass.
An Investigation of the Temperature of the Gases in the Tubes of a Horizontal Multitubular Boiler.

John Willard Glidden (II) . . . . De Kalb, Ill.
Experiments on Explosive Mixtures.

Harry Manly Goodwin (VIII.) . . . . Roxbury, Mass.
Some Experimental Researches in Acoustics.

Frank Murray Greenlaw (VI.) . . . . Roxbury, Mass.
An Experimental Study of the Waste Field of Dynamos. (*With E. D. Brown.*)

George Ellery Hale (VIII.) . . . . Chicago, Ill.
Photography of the Solar Prominences.

John Richardson Hall (VI.) . . . . Brookline, Mass.
Efficiency Test of a Thomson-Houston Arc Lighting Dynamo. (*With E. B. Raymond.*)

Philip Melancthon Hammett, A. B., Harvard University (II.) Newport, R. I.
An Experimental Investigation of the Flow of Steam through an Orifice.

Charles Hayden (IX.) . . . . Boston, Mass.
An Historical and Statistical Study of Taxation in Massachusetts.

Sophia Gregoria Hayden (IV.) . . . . Jamaica Plain, Mass.
Design for a Museum of Fine Arts.

Frank Hayes (II.) . . . . Superior, Wis.
A Design of the Reciprocating Parts and Valve Motions of a Special Form of Compound Engine.

Harry Edgar Hayes, A. B., Harvard University (VI.), Boston, Mass.
The Influence of the Strength of the Core on the Action of the Magneto Telephone Transmitter and Receiver.

SCHUYLER HAZARD (I.) . . . . Georgetown, S. C.
A Project for Carrying Congress Street over the Tracks of the New York and New England Railroad at South Boston. (*With F. H. Kendall.*)

FREDERICK STEARNS HOLLIS (V.) . . Newton Highlands, Mass.
The Action of Alumina on Ammonia in Natural Waters.

SIDNEY ELLSWORTH HORTON (II.) . . . Windsor Locks, Conn.
Experiments on the Efficiency of Steam-Pipe Coverings.

FRANCIS HOWE KENDALL (I.) . . . . Belmont, Mass.
Project for Carrying Congress Street over the Tracks of the New York and New England Railroad at South Boston. (*With S. Hazard.*)

HARRY ADAMS KENNICOTT (I.) . . . . . Nebraska City, Neb.
A Comparison of Various Sewer Cross-Sections with respect to Velocity and Discharge.

FRANKLIN KNIGHT (I.) . . . . Lynn, Mass.
A Project for Abolishing the Grade Crossing at Bridge Street, Northampton, Mass. (*With W. Z. Ripley.*)

BERTRAM AUGUSTUS LENFEST (II.) . . . . Wakefield, Mass.
Experiments on Surface Condensation. (*With S. W. Moore.*)

H. WARD LEONARD (III.) . . . . New York, N. Y.
Modern Methods of Distributing and Utilizing Electric Energy, with Special Reference to Mining Work.

ERNEST ARTHUR LE SUEUR (VI.) . . . . Ottawa, Can.
An Investigation of the Manner of Decomposition in a Certain Class of Electrolytic Cells.

BERTRAM HASKELL MANN (VI.) . . . . Weymouth, Mass.
The Insulation Resistance of the Rail Circuits in Railroad Block-Signals.

GEORGE BANCROFT McCONNELL (I.) . . . . . Roxbury, Mass.
Water-Waste: Its Cause, Detection, and Prevention.

GEORGE EDWARD MERRICK (V.) . . . . Holyoke, Mass.
Experiments on the Electrolysis of a Solution of Common Salt, together with some Experiments on the Effect of the Base on the Bleaching Efficiency of certain Hypochlorites.

FREDERICK METCALF (II.) . . . . Providence, R. I.
Strength and Elasticity of Fine Worsted Wool Fibres.

BURDETT MOODY (I.) . . . . Deadwood, So. Dak.
A Study of Bridge Floors.

Stephen Wallace Moore (II.) . . . . Newton, Mass.
Experiments on Surface Condensation. (*With B. A. Lenfest.*)

Charles Neave, B. A., Yale University (VI.) . . Boston, Mass.
Efficiency of Induction Coils used in Telephony.

Allan Hovey Newell (II.) . . . . Stockton, Cal.
Experimental Determination of the Modulus of Elasticity of the Skin of Cast-iron Beams.

Norman Granville Nims (IV.) . . . . Keene, N. H.
Design for a Chamber of Commerce and Exchange.

Almon Evans Norris (II.) . . . . . . Cambridgeport, Mass.
Design for an Automatic Tandem Compound Engine.

Clarence George Norris (I.) . . . . Hyde Park, Mass.
A Project for a Railroad to connect the Village of Brant Rock, Mass., with the Old Colony Railroad. (*With E. F. Dwelley.*)

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Brakes for Railway Trains; with a Discussion of the Value of the Westinghouse Freight Brake to the Boston and Albany Railroad.

Joseph Karr Noyes (I.) . . . . Binghamton, N. Y.
A Review of the Plans of a Deck Plate Girder Bridge over the Chenango River, at Binghamton, N. Y.

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The Extraction of Silver from Argentiferous Blende, and from Chloride and Sulphide of Silver.

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Strength of Western White Pine.

William Babcock Poland (I.) . . . . Boston, Mass.
An Investigation into the Causes of Failure of Dams.

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Efficiency Test of a Thomson-Houston Arc Lighting Dynamo. (*With J. R. Hall.*)

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Tests of Commercial Registering Current Meters.

Knight Cheney Richmond, B. P., Brown University (II.)
Providence, R. I.
The Design, Construction, and Testing of a Torsion Dynamometer. (*With Darragh de Lancey.*)

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A Project for Abolishing the Grade Crossing at Main Street, Northampton, Mass. (*With F. Knight.*)

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Investigation of the Valve Gears of the Triple Expansion Engine in the Mechanical Engineering Laboratory.

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Experiments on an Otto Gas Engine. (*With H. C. Slater.*)

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Concentration of Copper in Calumet & Hecla By-Products.

Minnie Hempel Rogers (IX.) . . . . . . Jamaica Plain, Mass.
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The Action of Nitrous Acid on Para-bromaniline.

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Martin Otis Southworth (VI.) . . . . . . Stoughton, Mass.
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Andrew Whitney Woodman (I.) . . . . Chelsea, Mass.
A Study of the Methods of Connecting Floor Beams to Trusses.