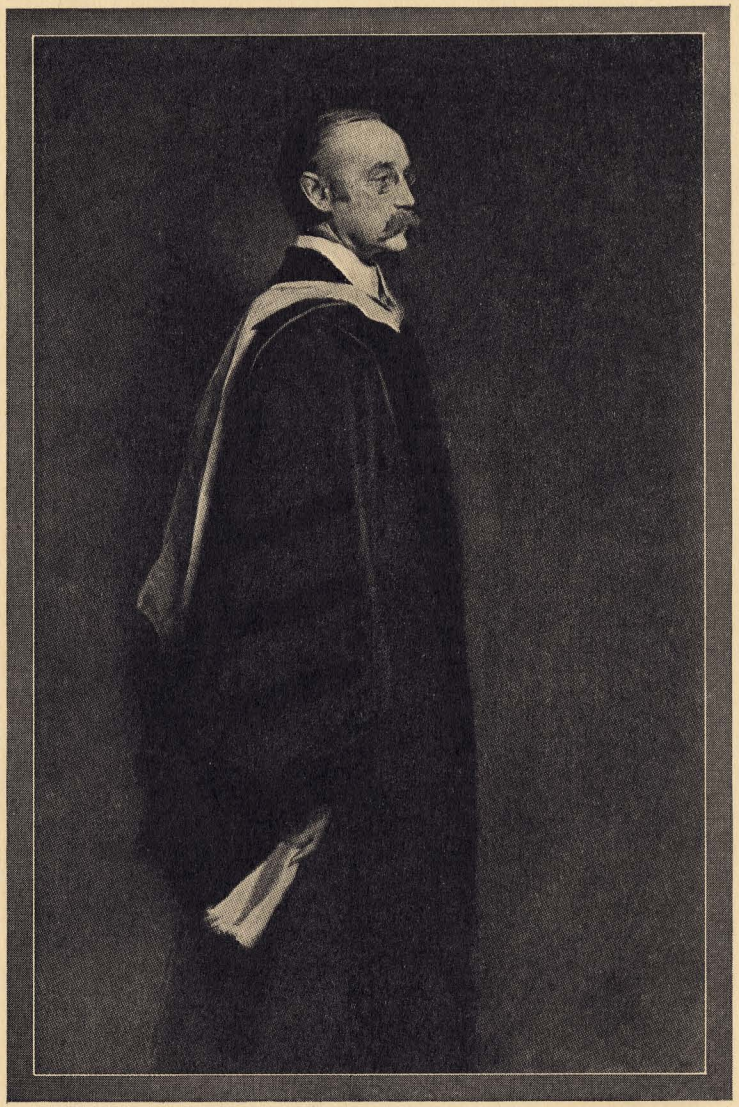


ALEXANDER CROMBIE HUMPHREYS
M.E., E.D., Sc.D., LL.D.

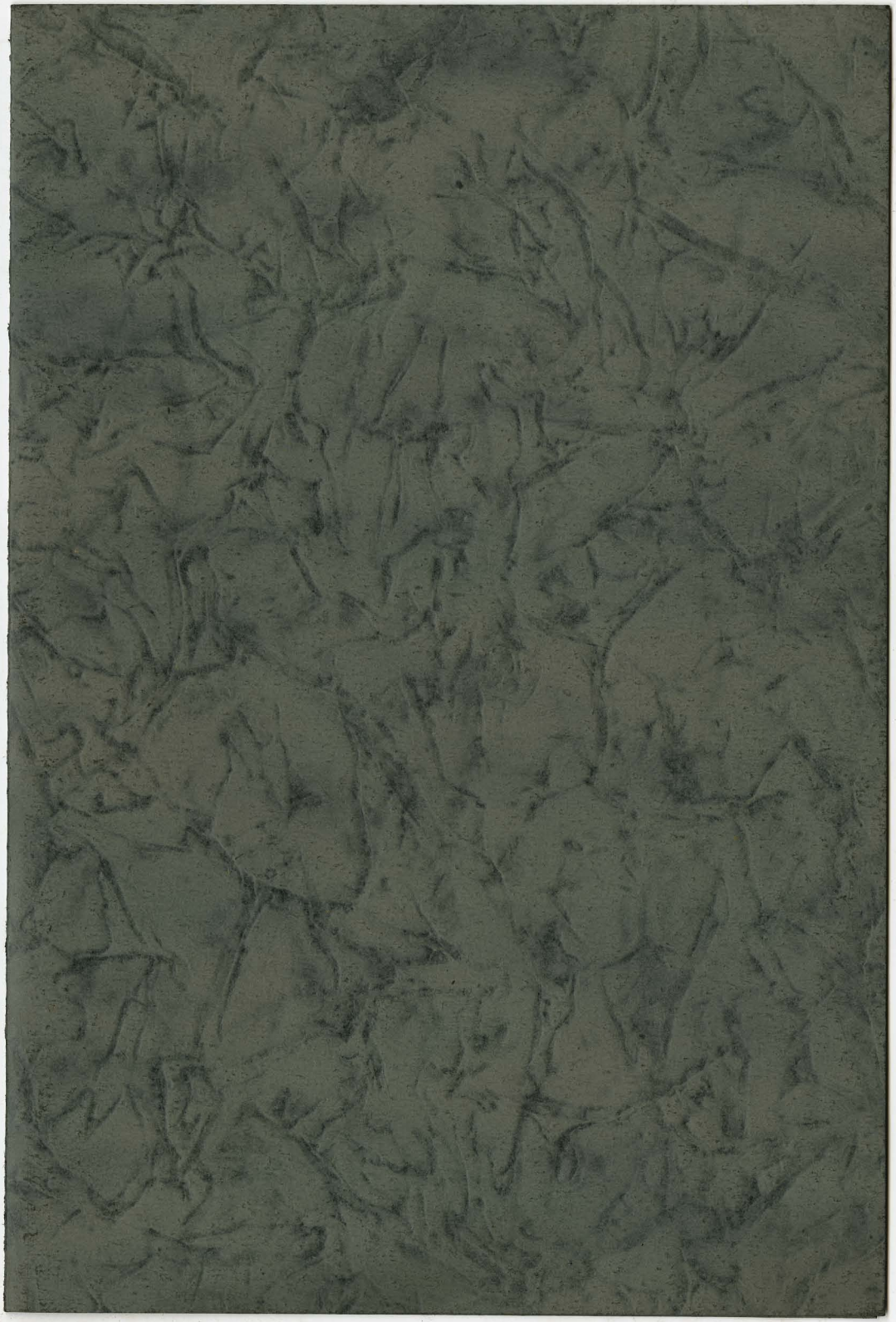
AS A RESULT of nearly two decades of untiring labor and remarkable achievement the name of Humphreys today stands beside those of Stevens and Morton in the eternal gratitude of the men of Stevens Institute of Technology. Just forty years ago Alexander C. Humphreys was graduated from Stevens. While carrying the course of studies at the College he was superintendent of a gas company in a nearby town and was married and maintaining his home. The great energy, the high character and the marked ability which enabled him to carry these responsibilities led him in the next twenty years to the highest place in the gas industry of this country. From this high station he was unanimously called in 1902 by his old professors and his brother alumni and by many friends of Stevens to take the presidency of the College, and he accepted!

Witness today the phenomenal progress of Stevens under President Humphreys: Increased attendance came without seeking and is more than trebled. Teaching methods have been advanced to new and original standards that are at the forefront of educational work, including student self-government and physical training. The college grounds have been extended in the face of trying circumstances and are enlarged by nearly twenty acres; five new buildings have been constructed or acquired excluding the Castle and several other buildings which have been adapted for general use.

The same characteristics that carried Dr. Humphreys to the top of his branch of the engineering profession and to the leadership of Stevens have led to his being drafted in other great works of national scope. He has been called to serve as president of the American Society of Mechanical Engineers, The Engineers' Club, the American Gas Institute, and the International Congress. He was a member of the Engineering Council and has done active work in a score or more of engineering or technical societies. He is Chairman of the Board of Trustees and member of the Executive Committee of the Carnegie Foundation for the Advancement of Teaching, etc. He has also served as president of the St. Andrews Society and the Canadian Society, and is now treasurer of the American Committee on Devastated France and a member of the Executive Committee of the Field Service Fellowship in French Universities. He has received honorary degrees from Rensselaer, Rutgers, University of Pennsylvania and Columbia, New York, Brown and Princeton Universities.

President Humphreys bears the love and admiration of the men of Stevens, who pray that for many years to come their Alma Mater may have the benefit of his experience and wisdom—to continue his present honored leadership.

On the occasion of the Fiftieth Anniversary
of Stevens Institute of Technology
Castle Point, Hoboken, New Jersey
June, 1921





STEVENS INSTITUTE OF TECHNOLOGY 1871-1921

1871-1921

Fifty Years of Progress and Service

Stevens Institute of Technology
Castle Point Hoboken, N.J.

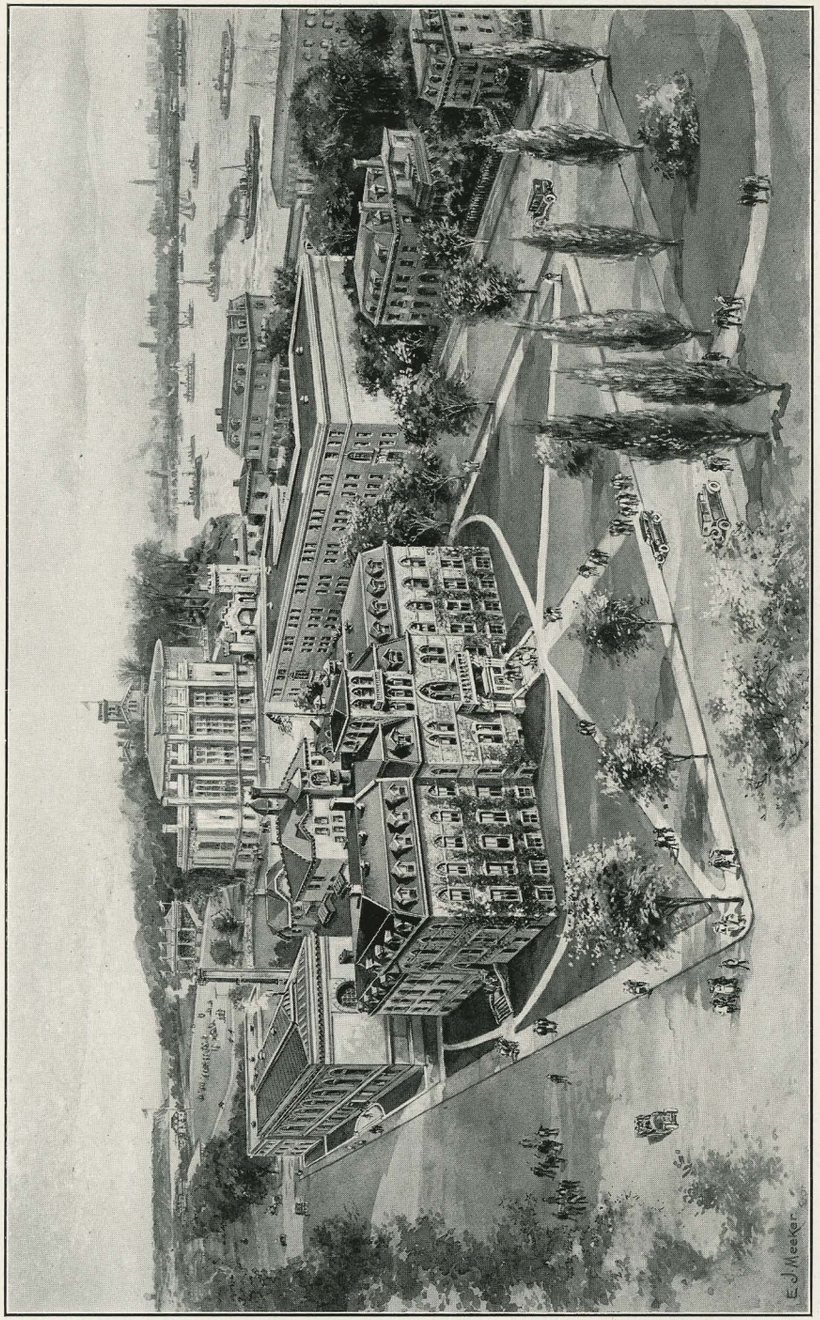
THIS BROCHURE was compiled and arranged under the direction of a committee of the Alumni from photographs and text supplied by Professor Franklin DeR. Furman, M. E., head of Department of Machine Design and Dean of the Junior Class, Stevens Institute of Technology, Castle Point, Hoboken, N. J., June 3, 1921.

THE YEARS spent at Stevens mark such an interesting period in the lives of many of the alumni that it seemed fitting on this the fiftieth anniversary of the Institute, to prepare a brief story of Stevens' growth and progress.

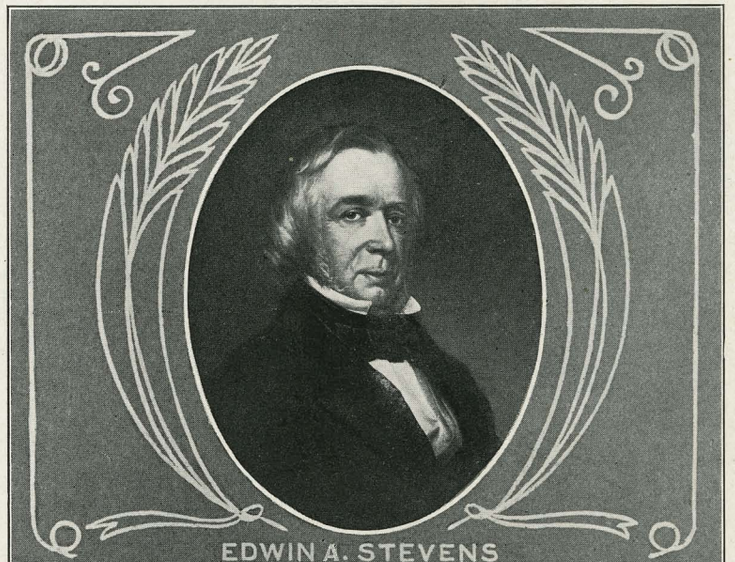
The following pages may serve to bring back to the minds of earlier members many thoughts forgotten, and to indicate the changes that have taken place.

Later members, familiar with Stevens during recent years, may be interested in the environment in which the earlier students worked.

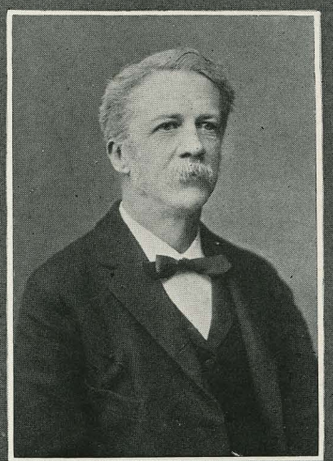
An effort has been made to show, as well as space would permit, the contrast wrought by the passing years.



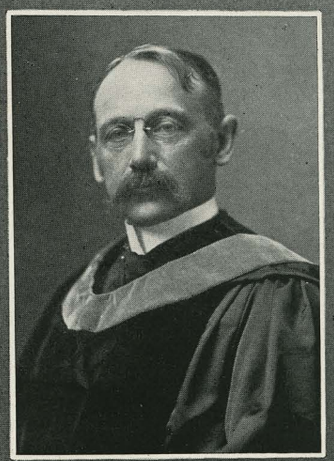
INSTITUTE AND GROUNDS



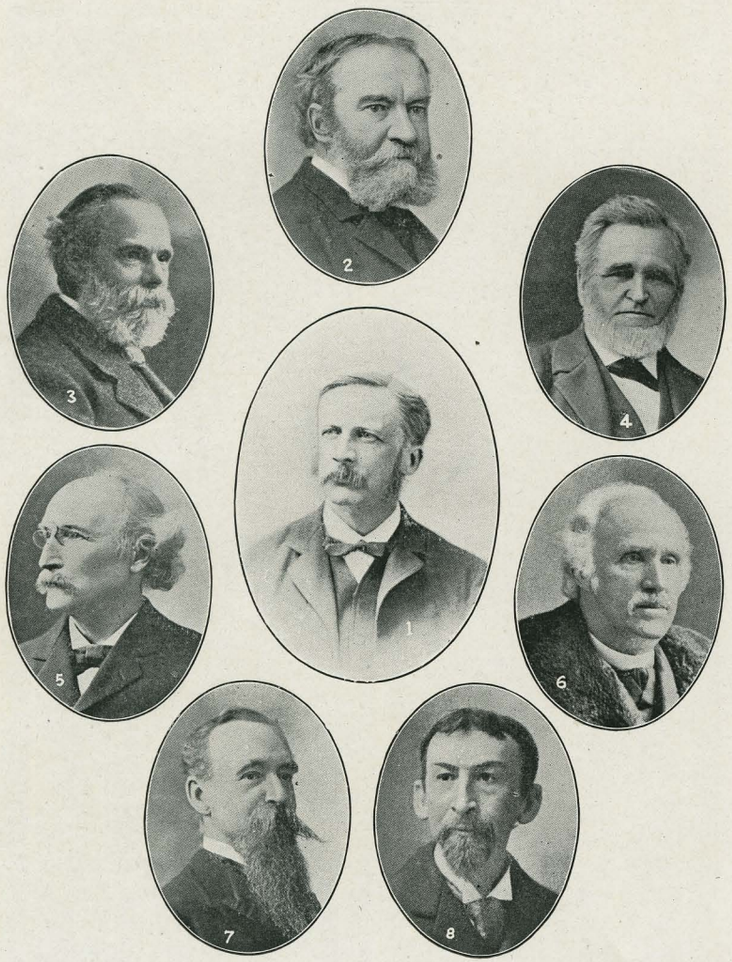
EDWIN A. STEVENS
FOUNDER
STEVENS INSTITUTE OF TECHNOLOGY
1870



HENRY MORTON
PRESIDENT UNTIL 1902



ALEXANDER C. HUMPHREYS
PRESIDENT SINCE 1902



FACULTY OF STEVENS INSTITUTE OF TECHNOLOGY, 1871

No. 1. President Henry Morton
No. 2. Prof. Alfred M. Mayer
No. 3. Prof. Robert Henry Thurston
No. 4. Prof. De Volson Wood
No. 5. Prof. Charles William MacCord
No. 6. Prof. Edward Wall
No. 7. Prof. Charles Frederick Kroeh
No. 8. Prof. Albert Ripley Leeds

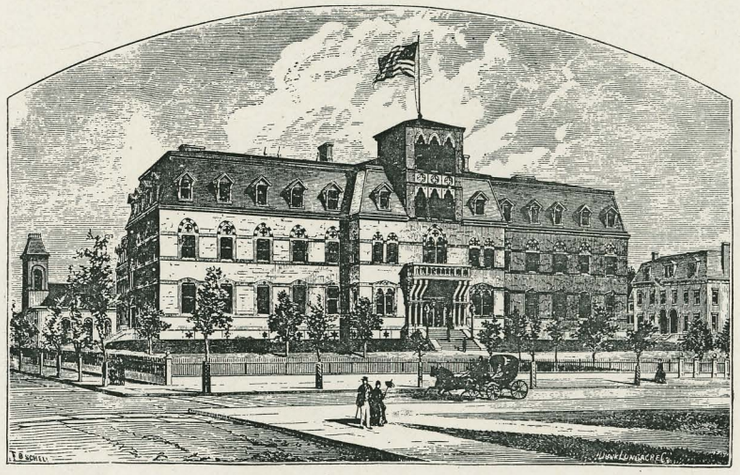
Stevens Institute of Technology

HISTORY OF THE INSTITUTE

THE official history of the Stevens Institute of Technology dates from April 15, 1867, when Edwin Augustus Stevens in his will bequeathed a block of land adjoining the family estate at Castle Point, Hoboken, N. J., $150,000 for the erection of a building and $500,000 as an endowment for an institute of learning.

Edwin A. Stevens, the founder, died in 1868, having made provision in his will for three trustees of the institution he had endowed.

These three trustees were his wife, Mrs. Edwin A. Stevens, his brother-in-law, Mr. Samuel Bayard Dod, in early life a minister of the gospel and later a financier devoted to the interests of the Stevens family, and Mr. William W. Shippen, Commander of the "Naugatuck" during the Civil War.



Old Print of Main Building, 1871

These trustees sought the assistance of Dr. Henry Morton, a young but prominent scientist, who was chosen as president of the newly created School. It was decided later by the Board of Trustees and President Morton that it should be a School of Mechanical Engineering, and that it should be known as the Stevens Institute of Technology.

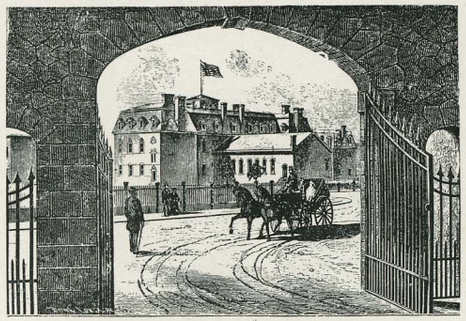
The first accession to the Board of Trustees was in 1885 when Dr. Henry Morton was elected a member. From then until the present time the number of permanent trustees has increased from three to a maximum of sixteen, there being twelve at the present time.

From the inception of the Institute until 1908, it was the practice to supervise scholarship through the heads of departments during the term and by

joint meeting of the entire teaching force at the end of the term. Discipline was also administered in the same general manner.

In 1908 President Humphreys appointed class Deans—one dean to each of the four classes—who were given special authority as to scholarship and discipline. During the past year the chairman of the Committee of Student Activities was appointed a member of the Scholarship and Discipline Committee.

In 1906 the Senior Class, deeply impressed with President Humphreys' oft expressed feelings in the matter of honesty in examinations, voluntarily requested an examination on honor without the presence of professor or instructor. The request was granted and the success of this trial led to the adoption of the Honor System in examinations for all classes, then to its adoption to all the study work of the students and finally in 1908 to the adoption of Student Self-government, which now prevails in the institution.



Main Building from Castle Gate, 1871

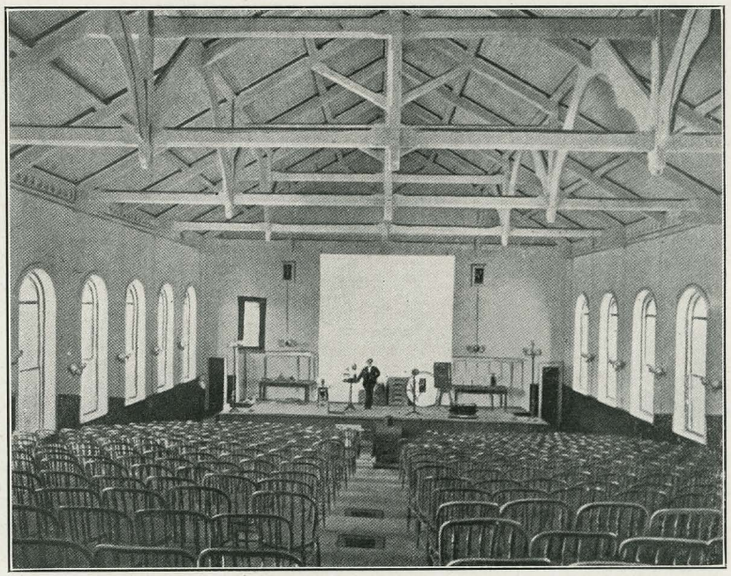
Buildings were erected and the school was opened in September 1871. The substantial single building in which the Institute began its educational work was built at a cost of about $150,000. It was erected on a city block of about two acres in the centre of the residential district of Hoboken adjoining the extensive grounds of the Stevens estate.

The remarkable growth of Stevens Institute will be appreciated when it is known that the grounds today occupy twenty-two acres, including nearly all of the original Stevens estate and an adjacent city block together with many buildings which have been erected since 1902.

As the growth of Stevens has been made possible only by the generosity of the many friends of the Institute, it seems fitting to set forth the sources from which the necessary funds were received and the original endowment fund increased.

The total amount contributed during the period from 1871 to 1902, as recorded in the Morton Memorial Volume, amounted to $420,000. $145,000 of this amount was contributed by President Morton, $165,000 by Andrew Carnegie, $60,000 by the Alumni, $30,000 by Mrs. E. A. Stevens, $11,000 by Dr. Jacob Vreeland and $8,000 by the American Railway Mechanics Association. These added to the original endowment of Edwin A. Stevens made an aggregate amount of $920,000 which does not include the value of the grounds and the building fund amounting to about $250,000 originally bequeathed by Mr. E. A. Stevens.

The record of subscriptions following those enumerated above begins with the Scholarship Endowment of $5000 in 1902 by Alexander C. Humphreys, in memory of his son Harold Humphreys, and two years later of a further scholarship fund of $5000 in memory of his younger son Crombie Humphreys. Further subscriptions of $60,000 were made by the Alumni in 1903 and 1904. Since 1912 the Alumni have contributed $25,000 for a special Graduate Fund, $40,000 for a War Memorial Scholarship Fund, $220,000 toward the campaign fund of 1915 and about $132,000 in 1919 and 1920 for an additional endowment fund to meet increased salaries and reconstruction necessary to take care of a growth of more than one hundred per cent in attendance which took place from 1915 to 1920. The total Alumni subscriptions to date have amounted to more than $507,000.

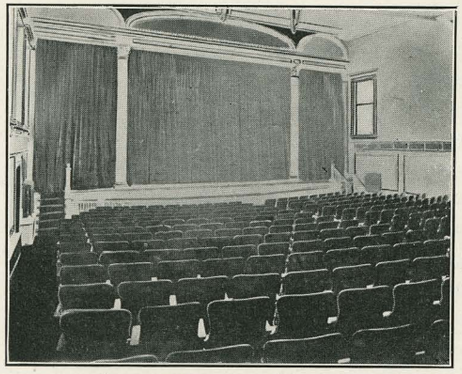


Old Lecture Hall, Looking South, 1871

In 1903 Mr. Andrew Carnegie gave $125,000; in 1905, $50,000 for endowment, and in 1911, $10,000 for a special purpose. In 1915 he gave $250,000 toward the campaign fund and at the time of his death bequeathed an additional sum of $100,000. Mr. Carnegie's total gifts to Stevens have amounted to $717,000.

In 1903 Mr. Edwin A. Stevens and Mr. Robert L. Stevens, sons of the founder, gave a valuable piece of land 196x100 feet to the college and in 1905 Robert L. Stevens gave an additional piece of land valued at $15,000.

Dr. Edward Weston, a trustee of the college, made several subscriptions aggregating $26,000. In 1910 and 1911 President Humphreys announced five gifts of $25,000 each, received from friends of the institution. In 1912 and 1913 miscellaneous gifts totaling $37,000 were made.



Auditorium, 1904
Previously Old Lecture Hall

In 1915 an intensive campaign to secure $1,385,000 was successfully carried through by President Humphreys and a committee of the Alumni headed by Mr. Walter Kidde of the Class of 1897. During this campaign $250,000 was contributed by the General Education Board, $100,000 by William Hall Walker, $565,000 by non-graduate friends of the college. These with other amounts previously mentioned in this outline made up the total of $1,385,000.

The total of all gifts during the era beginning with the year 1902 amounts to about $1,950,000, making a total received by the college when bequests of the founder are included of about $2,870,000. The generosity of friends of Stevens has not only enabled the institution to progress but has made it possible to maintain a reasonable rate for tuition.

The tuition fee paid by the student during the early years of the college was $150 for the youth of New Jersey and $225 a year for others. In 1911 it became necessary to increase the fee to all students to $225. In 1920 a further advance was necessary and the yearly fee was increased to $275.

Advancement in the Course of Study

A BRIEF REVIEW of the changes that have taken place in the course of study at Stevens should prove of especial interest.

The Stevens Institute of Technology was the first educational institution in America to give a course in mechanical engineering and to give a degree in that subject. The work done by President Morton and the strong corps of professors associated with him was pioneer work. The course of study was developed during the first quarter of a century to meet practical demands that grew out of the remarkable mechanical and power engineering developments that took place during the years following 1870.



Auditorium at Present
Looking South

The records of the graduates of Stevens show that they played no inconsiderable part in that development—the theories and the knowledge that they carried from their Alma Mater finding a wide and ready application in the practical industries.

The early technical studies were those of mathematics, mechanics, physics, chemistry common in the *mechanics arts courses* that existed in several colleges and universities then established. These courses, as taught at Stevens, were more specifically adapted to practical application in the industries, and shop, laboratory and drafting and designing courses were added at the start.

In the developments that followed, the wisdom of President Morton in directing the course was prophetic and stands out more and more prominently



Original Mechanical Engineering Lecture Room

as time goes on. He held rigorously to a broad basic course of study that would fit a graduate to enter and successfully develop in any branch of engineering that he might select. This policy of President Morton has been strictly adhered to by his successor who is still directing the course at Stevens. Stevens is today the only large institution, so far as is known, giving a single course in engineering—860 students during the past year all pursuing the same course leading to the degree of Mechanical Engineer. With this degree Stevens graduates have occupied the highest places in gas works engineering and management, electrical engineering, hydraulic engineering, heating and ventilating, chemistry, telephony and telegraphing, wireless work, marine engineering, railroad engineering, automobile engineering, aviation and scores of other specialties.

One of the notable developments in the course of study was that of Business

Engineering, inaugurated through the effort of Alexander C. Humphreys in 1896. This course has become a strong feature of Stevens work. Since 1903 it has been carried on by President Humphreys as professor. The course now named "Economics of Engineering" is recognized as having had its inception at Stevens and is an important part of most engineering courses in many colleges and universities.

The electrical engineering department started at Stevens in the early eighties has been an exceedingly strong one during the past fifteen years, and likewise the chemistry department has maintained the high standing of early years. Other departments devoted more particularly to mechanical subjects have had strong impetus under the encouragement of President Humphreys.



Present Junior Drafting Room, including Former Old Mechanical Engineering Lecture Room and Adjoining Room

In the mechanical departments the work of mathematics and mechanics has been separated. The independent courses of mechanical drawing and machine designing have been combined. These changes have been followed by marked increased efficiency in both instances.

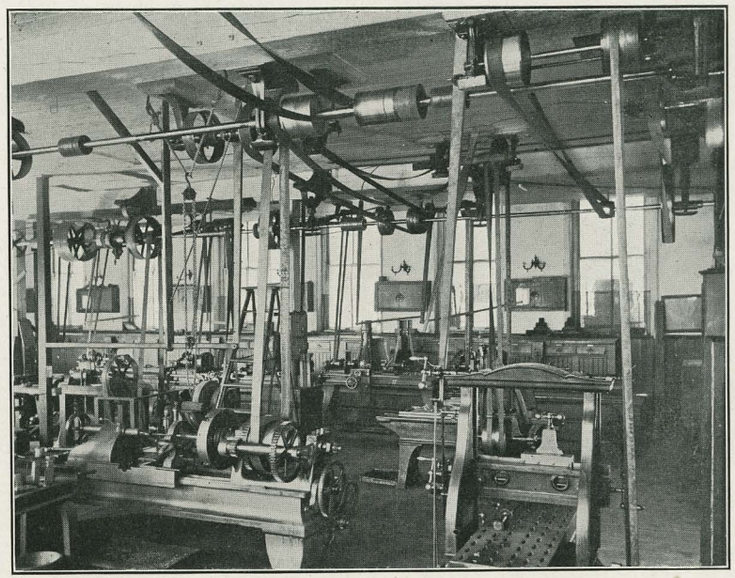
In 1907 a department of Structural Engineering was added with a structural engineer of wide experience at its head. In 1918 a course in Public Speaking was added in the department of English and Logic.

The library has been placed in charge of a professional librarian, thus increasing its usefulness to both students and faculty.

In 1915 a department of Physical Education was added. All students are now required to meet a regular schedule of exercises fitted to the students as classified and men physically defective are given special treatment.

Athletics, although encouraged, are subordinated to the physical well being of the participants. Athletics are pursued as a clean sport and are free from any taint of professionalism or commercialism. The Director of the gymnasium, Mr. John A. Davis, did much during the war for the Y. M. C. A. in connection with the Pershing Stadium in Paris. He has since introduced a physical education system in Rumania, having been granted a leave of absence from Stevens for that purpose.

The arrangement of the courses has been the subject of special consideration by President Humphreys and the faculty, and in 1908 a complete readjustment

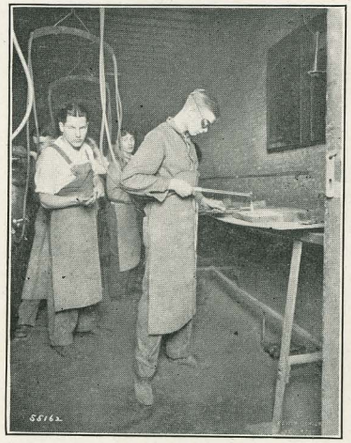


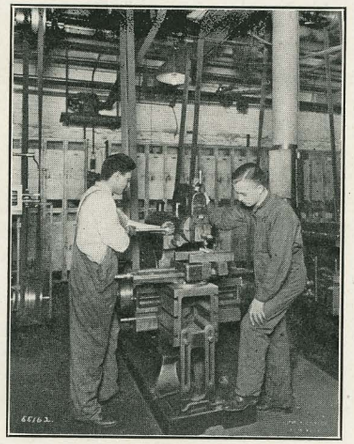
Old Machine Shop

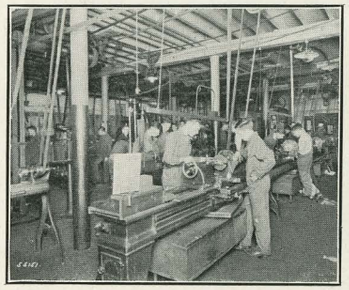
took place with a view to better co-ordination of the work of the several departments and a balanced scheme of study for the students. In making this readjustment the college year was divided into three terms each year instead of four terms. Saturday, which had heretofore been a free day, was scheduled for class work during the morning hours and Wednesday afternoon was left free.

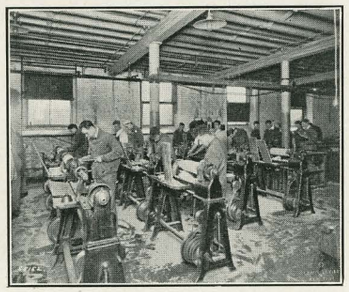
In the adding of several departments and courses and in introducing new subjects into established courses, the greatest care in elimination of old work, so as to preserve a well-balanced curriculum, has always been observed.

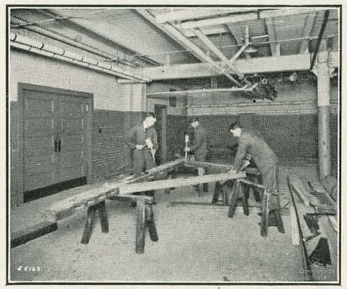
A feature of the work of recent years has been the introduction of moving pictures of a technical nature, at specially assigned periods, as suitable subjects presented themselves. These, together with special lectures and exhibitions on current engineering work, have been encouraged.

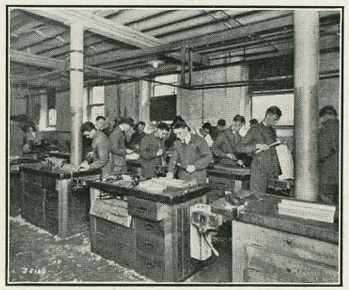




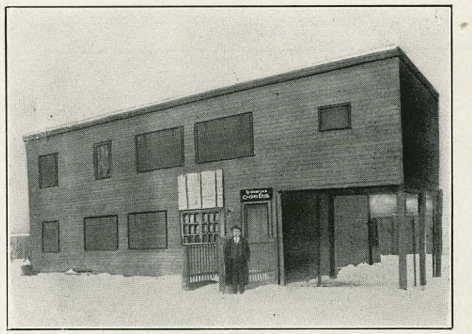








VIEWS IN SOME OF THE
STEVENS SHOPS, 1921

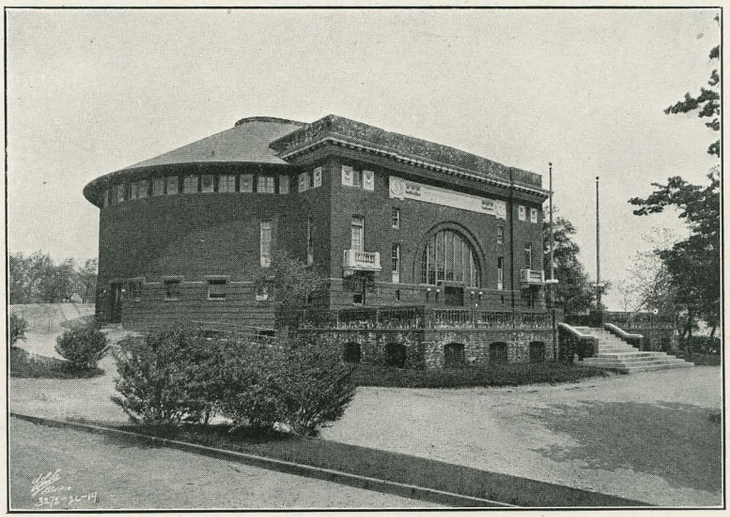


Old Field House—St. George Cricket Grounds

In order to carry on the work, the greatest possible latitude has been granted to the several departments in providing apparatus and equipment for suitably presenting technical and engineering information to the students. In this the students themselves have generously co-operated, the custom established many years ago of the graduating class giving its entrance deposit money at Commencement time to the college to purchase apparatus and equipment, having been continued with but few exceptions. The sums so presented by the classes range from a few hundred dollars to over a thousand dollars each year and in the aggregate they constitute a valuable addition to the college equipment. A large number of manufacturing and engineering firms and individuals have also made contributions of the same nature that have aided greatly in the classroom and laboratory teachings. An example in each case is that of a new switchboard for the electrical laboratory presented by one of the classes and a valuable electric continuous blue-printing machine presented by the manufacturer of the machine.

In 1914 the first class was admitted to Stevens on the certificate system.

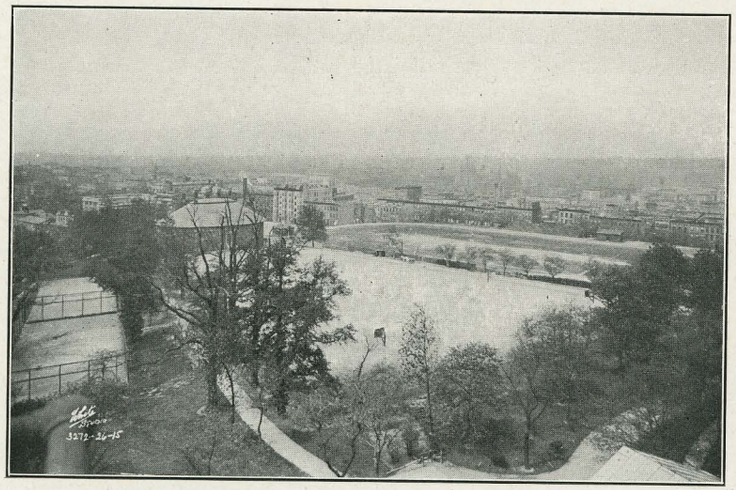
Previous to that year the certificate system had been generally adopted by the leading colleges in the United States, and it was found that applicants



William Hall Walker Gymnasium, 1916



View of Castle from Chemical Laboratory before Gymnasium was built. Large open space back of field stand now occupied by practice field



View from Castle showing Castle Point Field on right. Practice field in centre and faculty tennis courts on left. Gymnasium, part of students' tennis courts, roofs of Chemical Laboratory, large Navy Building and the original college building, now the Administration Building, may be seen in background

best qualified to enter Stevens often refused to pass entrance examinations to enter Stevens when it was possible for them to enter any of the other first-class colleges of engineering without passing examinations.

In adopting the system for Stevens, certificates were accepted only from such schools as it was determined offered educational advantages that insured students properly qualified to enter Stevens.

Certain difficulties have of late developed, and the system of admission by certificate is now being reinvestigated to determine the wisdom of its modification or abandonment.

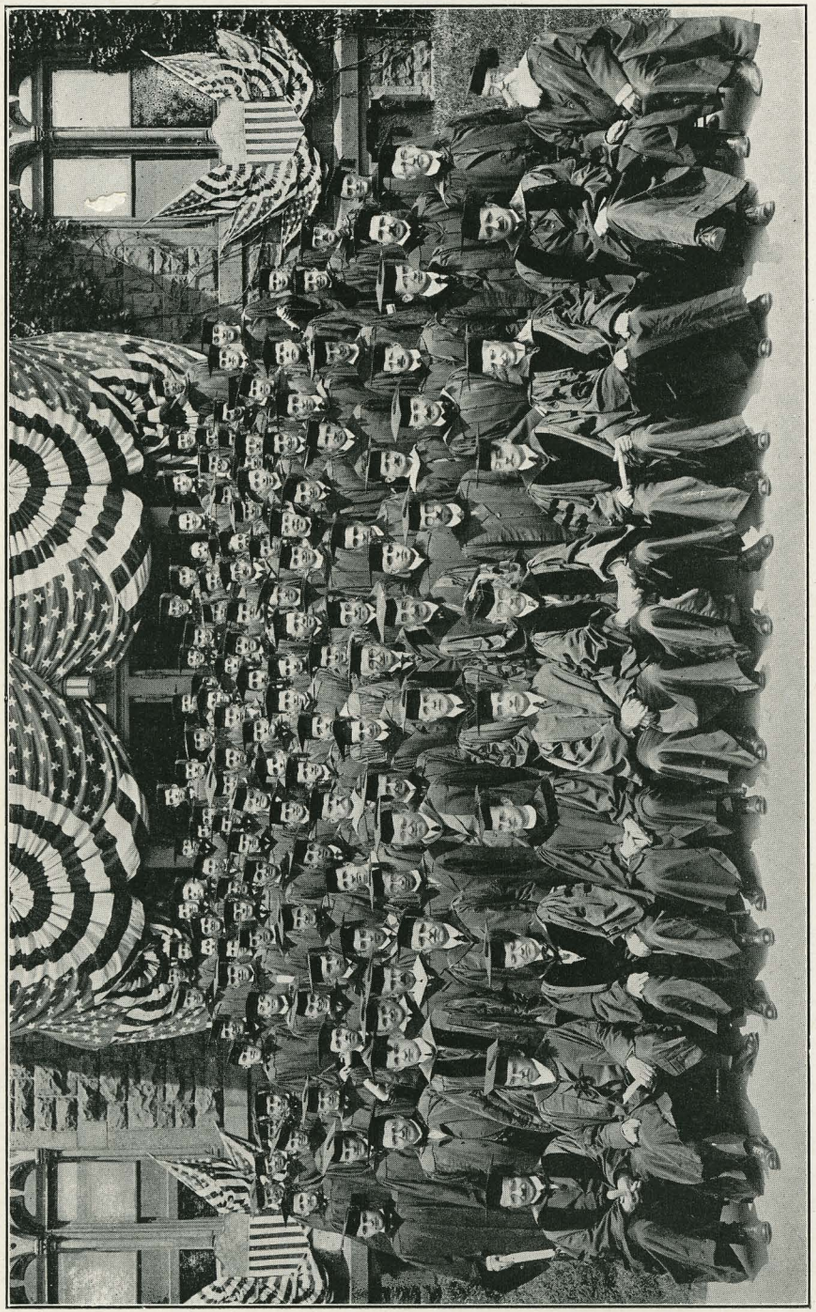
SCHOLARSHIP AND PRIZES

THE first scholarship at Stevens Institute was awarded by the college authorities in 1877, the Stevens Preparatory School being designated as the one whose graduates should be eligible. This school was founded in 1872 by the trustees of Stevens Institute and located on the Institute grounds. Its purpose was to facilitate the preparation of young men to meet the entrance requirements of the Institute which were in advance of the course of most of the preparatory schools from which the Institute drew its students at that time. A scholarship confers the privilege of attending the entire course for four years, free of all charge for tuition, provided, however, the students holding these scholarships keep up with the standard of proficiency and good conduct required. During each of the three years succeeding 1877, a scholarship was awarded graduates of the Stevens School so that a scholarship would be available each year. The Stevens Preparatory School was dissociated from the Institute a few years ago and the work of that school is now carried on under independent ownership and management, and in a building secured for the purpose not on the Institute grounds. An Advisory Board representing Stevens Institute still co-operates with the Stevens Preparatory School authorities in the matter of the continuance of the award of the four scholarships. Three other scholarships are awarded by the Institute to graduates of public and private schools and one to another private school, all located in Hudson County, New Jersey, making eight that are supported by the general Institute endowment.

The first scholarship awarded under a paid-in endowment fund was established in 1882 by President Henry Morton. Four other scholarships were endowed later making a total of five specially endowed scholarships in 1902, and eight unendowed.

In 1902 President Humphreys endowed a scholarship and in 1904 he gave funds for a second scholarship. Since then the William R. Beal Scholarship, the Cawley Scholarship and four Alumni Memorial Scholarships have been added, making a total of eight endowed scholarships awarded during this later period.

In connection with the establishment of scholarships, the trustees of the



COMMENCEMENT DAY, JUNE 8, 1920

Institute announced a few years ago that they were prepared to establish perpetual scholarships, to be known under the name of the donor, or such other title as may be suggested by the donor, and may be accepted by the trustees upon the basis of an endowment of $5000. This endowment covers the tuition fee of the student but does not cover the cost to the Institute in giving the student his education. In the preceding pages it was pointed out that the grand total of gifts to the college, including the bequests of the founder, amounted to $2,870,000. Assuming an obligation of five per cent per annum on this investment, a large part of which represents land and building values of many years ago, and adding this obligation to the present operating expenses, it is found that the cost to the college of educating each student is about $500 per year. With this in mind, the trustees have pointed out that a scholarship endowment may be increased above $5000, if the donor desires to meet a major part or all of the total cost of educating his beneficiary without the assistance from income from other endowments. A complete scholarship endowment fund would be $10,000.

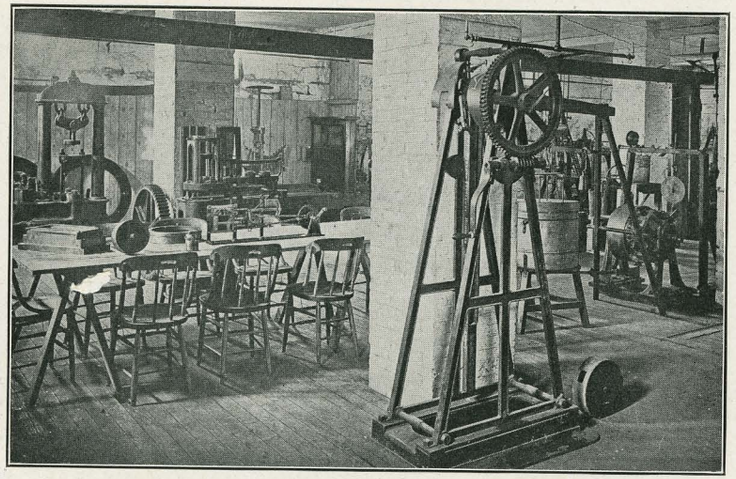
Prizes for excellence in scholarship are awarded each year. The first such prize amounting to $25, known as the Priestly Prize, was awarded in 1877. These prizes are paid from the income derived from permanent endowments made for the purpose or from specific gifts for the purpose made by friends of the Institute. Prizes awarded since the compilation of the Morton Memorial Volume are the Mary Starr Stillman Prize of $50 for the best paper pertaining to Applied Technology. This prize was discontinued on the death of Dr. Stillman.

The Cyrus J. Lawrence Prizes—one for $50 and one for $25—are awarded to students who are adjudged first and second "in influence promoting student activities, in fostering a spirit of co-operation between the faculty and the student body, and, in general, in contributing to the elevation of the ideals of student life."

In 1916 Mr. John Aspinwall permanently endowed two prizes—one of $30 and one of $20—to be awarded annually as the Alfred Marshall Mayer Prizes in Physics.

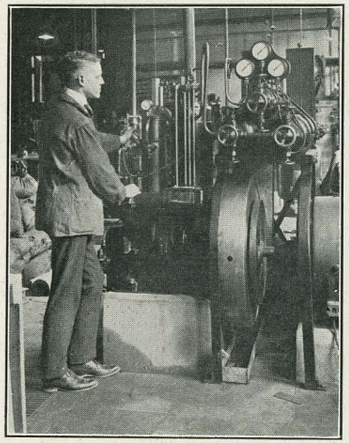
ATTENDANCE

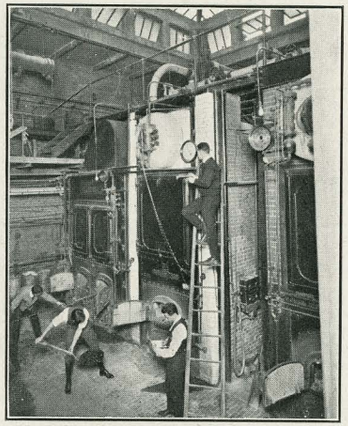
THE COLLEGE opened in September 1871 with a total enrollment of 21 students and two years later conferred the degree of Mechanical Engineer on its first graduate, J. Augustus Henderson, who was the sole member of the Class of 1873. During the college year of 1880-81, the attendance reached the 100 mark, and nine years later, the 200 mark. During the year 1902-03, the attendance reached a maximum, to that date, of 291 students. During the earlier years of the college it was difficult to find candidate-students who were sufficiently prepared to take up the training that President Morton and his associates were trying to give and which they felt was necessary to



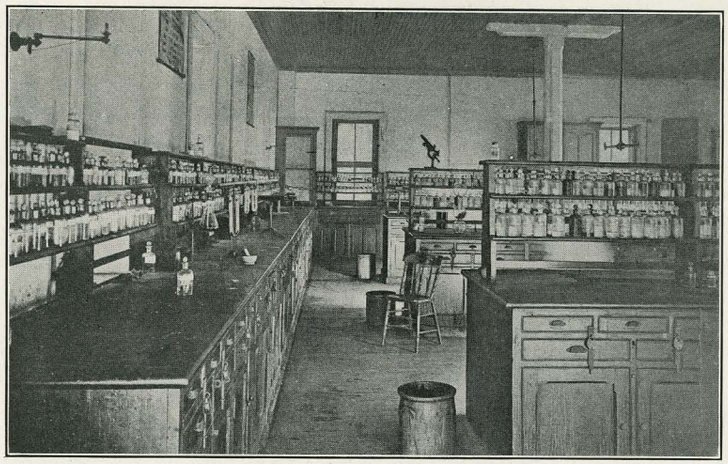
Old Experimental Laboratory in Basement of Main Building

equip young men for the places they were desired to take in practical engineering and manufacturing work. As a result, many of those who entered were dropped out and the graduating class of 1877 represented but 29 per cent of those who entered with that class. After the Stevens Preparatory School was established and well under way, conditions improved materially, and in 1880, when the Preparatory School contributed a notable proportion of those entering, the percentage of those graduating jumped from a previous maximum of 44 per cent to 56 per cent.





Student Exercises in Carnegie Laboratory of Engineering, 1921



Old Chemical Laboratory Formerly in West Wing of Main Building

There was a rapid increase in attendance during the four years following 1902, the totals rising from 291 in that year to 449 in 1906. In 1914 the attendance again developed a rapid growth, this time reaching the undreamed of figure of 862 in 1920—the more remarkable and significant when it is considered that all of these men were pursuing the single broad course in Mechanical Engineering without specialization of any kind.



Chemical Laboratory in Morton Memorial Laboratory of Chemistry

THE FACULTY

THE original faculty of Stevens Institute of Technology consisted of eight members, all selected while still very young men, and all reaching great and national eminence in their respective lines of work while associated with Stevens. One of this number, Professor Kroeh, is still living and is in active vigorous service at the college at the ripe age of seventy-five. With one exception, all of the original faculty died in the service of Stevens. The remarkable attainments of *all* of the members of this original faculty constitute, undoubtedly, the most brilliant page in the history of Stevens. The first of these men, selected by the original Board of Trustees, was Henry Morton, scientist and President of the college. The other members, selected through the unerring discernment of Mr. Dod of the Board of Trustees and

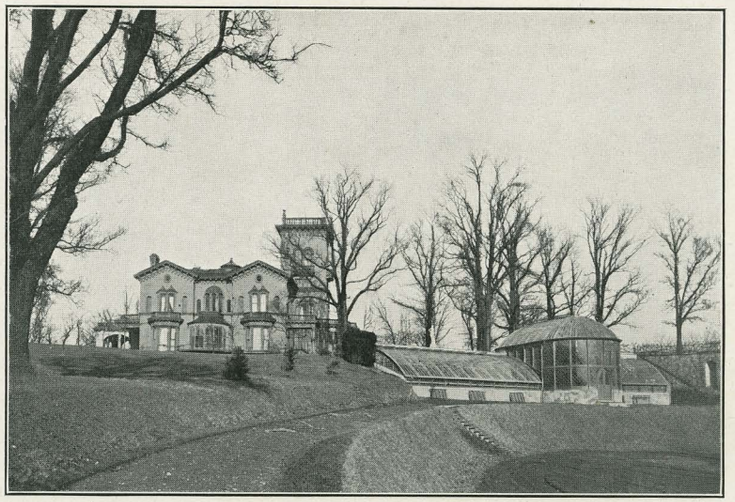


Stevens Tech with lower portion of Hudson Park in foreground. Portion of Park shown now occupied by Y. M. C. A. hut erected during war

President Morton, were Alfred Marshall Mayer, physicist; Robert Henry Thurston, engineer; Edward Wall, English scholar and logician; Charles William MacCord, engineer-draftsman, previously associated with John Ericsson; Albert Ripley Leeds, chemist; Charles Frederick Kroeh, philologist; De Volson Wood, mathematician and engineer. Lt.-Col. H. A. Hascall was the original appointee in the Department of Mathematics but when the college opened he was prevented from serving by ill health which continued to incapacitate him, and this work was carried on by a temporary instructor. The following year Professor De Volson Wood was appointed in Lt.-Col. Hascall's place.

The men of the original faculty carried on the work of the college single handed, that is, without the assistance of others of faculty rank, for eight years until 1879 when the faculty was increased by one member and again until 1882 when it was increased by one more member. From that date until 1902 the faculty grew to a maximum of 22 members in 1897 and had twenty members in 1902.

In 1903 the faculty was increased to 25 members, and to 50 at the present time. During all of the years from the beginning, there have been teaching assistants who have not ranked as faculty members. At the present there are fourteen such instructors.

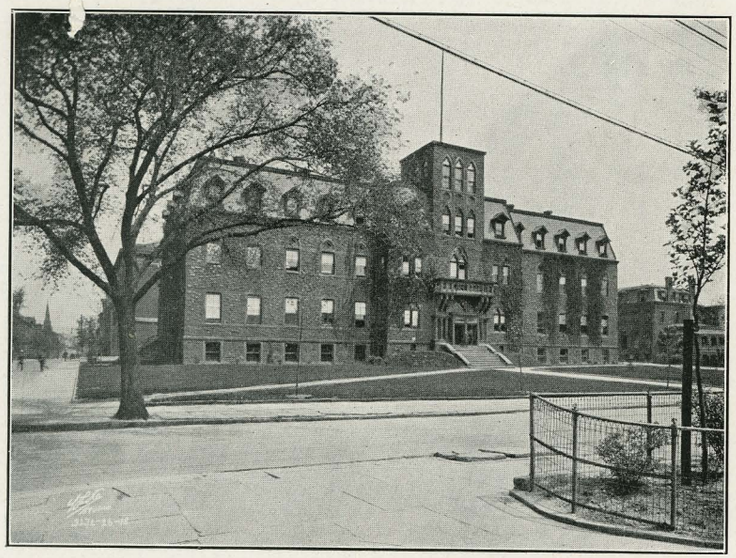


Stevens Castle Conservatory and Sunken Gardens in the Early '90's

BUILDINGS AND GROUNDS

DURING the year of 1870 and the early part of 1871, a single building, 180 feet long and 44 feet deep with a central rear wing 80 feet long and 50 feet wide and a west wing 80 feet long and 30 feet wide, was erected. Two years later an east wing, 60 feet long and 30 feet wide, was added. The building contains a light dry basement used at present for shop work, three floors and a square tower and floor over the front center of the building. This building with a small addition made to the central wing in 1889, accommodated all the departments until 1893 when the space between the central and east wings was walled in. When the Stevens Preparatory School was established in 1872, it was quartered in the east wing of the original building, but in 1888 the college needs became so pressing that it was necessary to construct a special building for the preparatory school. This was erected in the rear of the east wing, thus leaving the entire main building free for Institute work.

The first new college building was the Carnegie Laboratory of Engineering, the gift, with endowment of $225,000, of Mr. Andrew Carnegie in 1901 and 1902. The building is approximately 120 feet by 60 feet and is constructed on the original block of land immediately at the rear of the west wing of the main building. It was specially designed to meet the needs of the Department of Experimental Engineering which had greatly outgrown its accommodations in the basement of the main building. At the time of the construction of the Carnegie Laboratory, President Morton gave $15,000 for the construction of a boiler house which was then built adjoining the new laboratory. The dedication of the Carnegie building in February 1902 was one of the crowning events in President Morton's life. A few months later he became resigned to

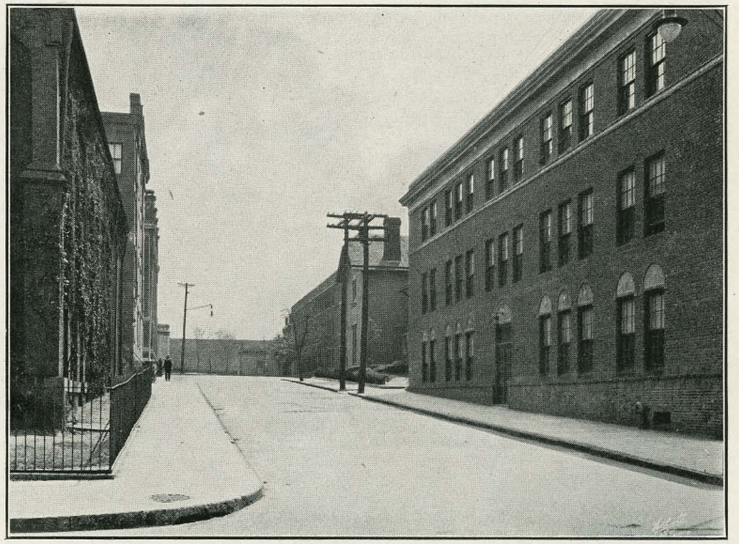


Main Building Showing Carnegie Laboratory in Rear on Left

an illness that had for some time caused him pain and anguish, and in May 1902 he passed away. He had given of his fortune with rare liberality and he had labored incessantly for Stevens. Through his final efforts, Mr. Carnegie had become deeply interested in the college—interested far beyond the knowledge of President Morton, for Mr. Carnegie continued his benefactions after President Morton's death until they totaled the magnificent sum of $717,000, as already mentioned in this outline. It will always be remembered at Stevens that Mr. Carnegie's last gift of $100,000 was one of very few bequests to colleges revealed in his will at the time of his death in 1919.

When President Humphreys took up the work of his close friend and predecessor in 1902, all but a relatively small corner plot of the original block of land was occupied by the buildings above described, with the addition of a residential building which occupied the fourth corner of the block. This land, together with a plot 100x196 feet on an adjoining block given by Mrs. Edwin A. Stevens at the time of the twenty-fifth anniversary celebration of the college, formed the then limited bounds with which President Humphreys had to deal in 1902. Even at this time the college had again outgrown its bounds and during the four years from 1902 to 1906, there was an additional growth of 54% in attendance, making imperative still further additions.

In 1904 the central wing of the main building was vacated by the machine shops, which were moved to the basement, and was reconstructed as an auditorium to accommodate the entire student body. Seven hundred seats



View from corner of Hudson and Sixth Streets, showing small Navy Building in right foreground and large Navy Building in background, both erected by United States Government during war for United States Navy Steam Engineering School. Small Navy Building has been extensively remodeled for use as a library and historical museum, and large Navy Building for use by the department of electrical engineering and for general lecture rooms.

were provided and this was thought to be far beyond future needs, but at this writing it falls short by 160 seats and alternating schedules are necessary to accommodate the student body. With the acquisition of the new Auditorium it became possible for the first time since 1880 to hold the Annual Commencement Exercises in the college building. For twenty-four years these functions had been held in various churches, halls and theatres in Hoboken. When the central wing was reconstructed in 1904 an addition was made to the north end of the wing to provide suitable place for the foundry and pipe

fitting courses. Also in 1904, the engineering lecture room was enlarged by including an adjacent hallway; the photometric room was reconstructed, and the dynamometer room was rearranged and renovated.

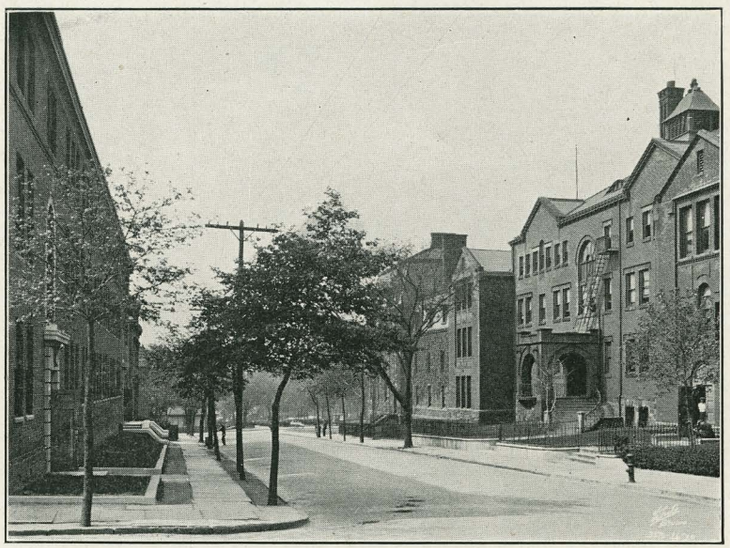
In the year 1905 the third large new building was erected on a newly acquired plot of ground purchased from the Stevens estate and diagonally opposite the original block of land. This building had for a number of years been the cherished hope of President Morton and the Alumni who had jointly contributed about $60,000 toward it in 1901—much the larger part by President Morton. Through the efforts of President Humphreys, the Alumni had increased this sum to about $150,000 in 1905 when the building was dedicated to the memory of President Morton as the "Morton Laboratory of Chemistry."



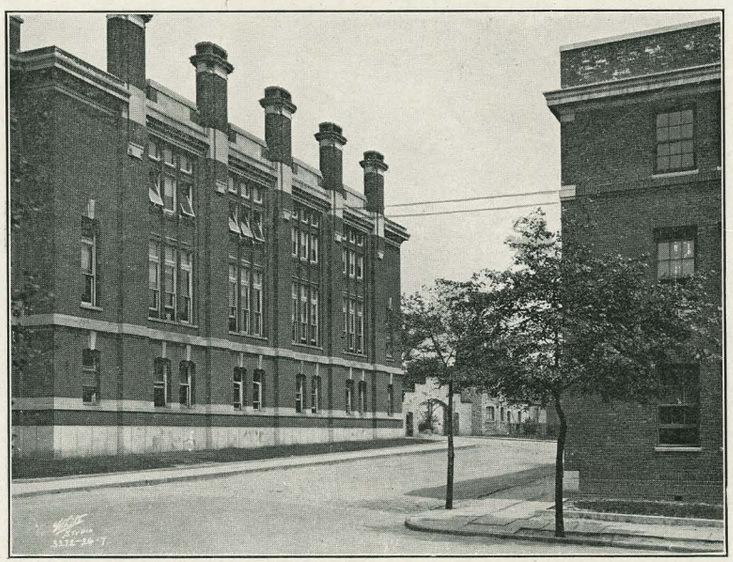
View from corner of Hudson and Sixth Streets looking south, showing end of small Navy Building, Carnegie Laboratory and Main Building

Although President Morton was a scientist in the broadest and highest sense of the word, his chief attainments were in the field of chemistry. The Morton Laboratory, substantial and ornate in architectural design, was pronounced to be the most completely and efficiently equipped college chemical laboratory of that time. It was built from plans laid down after a committee had inspected chemical laboratories in this country and in Europe, and it is no more than a fitting memorial to President Morton.

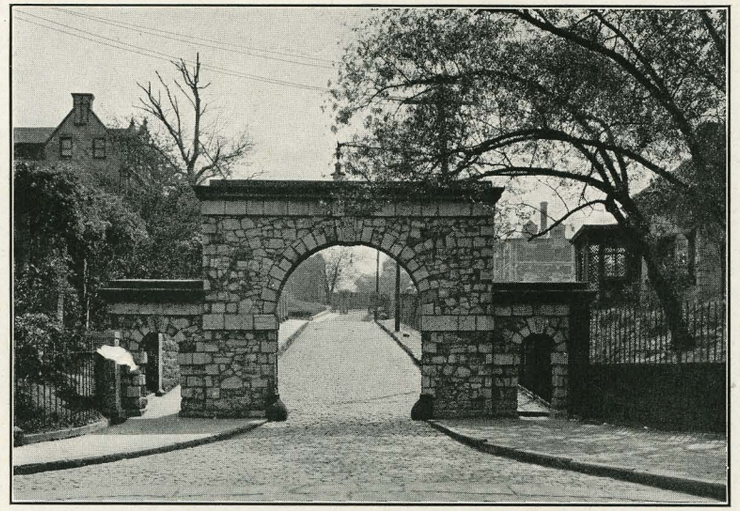
When the chemical department vacated its rooms in the west wing of the main building, in 1906, lecture rooms and a library reading room, much needed, were fitted up. In 1908, two wings, each containing three lecture rooms, were added to the Preparatory School building, one wing being devoted to Institute work and the other to Preparatory School work.



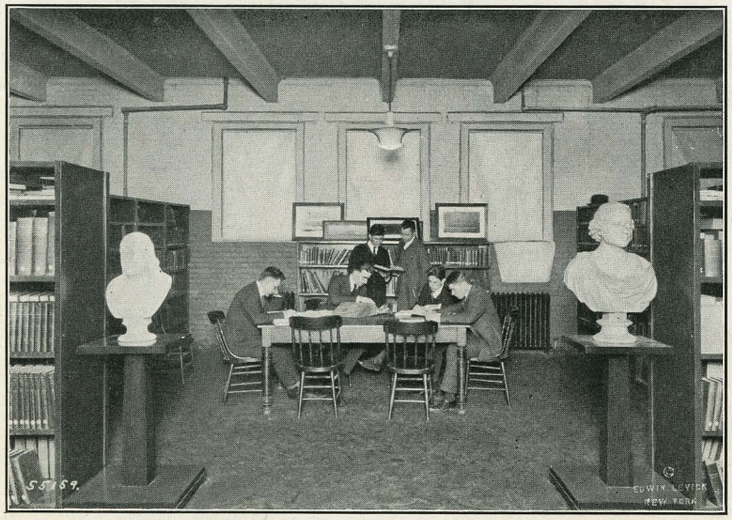
Corner of River and Sixth Streets looking south, showing large Navy Building on left and Recitation Hall, formerly Preparatory School, and Main Building on right



River and Sixth Streets looking east, showing Morton Memorial Laboratory of Chemistry and Castle Point Gate on left and corner of large Navy Building on right



Eighth Street Gate through which may be seen Drive leading to Castle Point Field and to Castle Stevens



A view in New Library recently removed from Main Building to second floor of small Navy Building



Castle Stevens—Showing Old English Elms in Foreground

About 1905 it became definitely known that the Athletic Field, heretofore used by the students for their outdoor exercises, owned by other interests and far removed from the college buildings, would shortly be taken over for building purposes and for a City Park. Through negotiations with the Stevens family and with the City of Hoboken, which reserved certain street rights on the grounds of the Castle Point property, President Humphreys was finally able to secure about eleven acres of the private Stevens grounds adjacent to the college building for the use of an Athletic Field. Notwithstanding that these eleven acres lay in the most favorable section of the property for the purpose, much grading and draining had to be done. Many difficulties, however, were over-



Campus Lawn—Castle Point



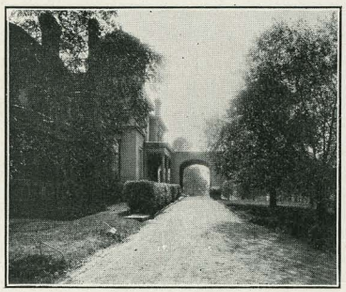
Main Drive—From Castle



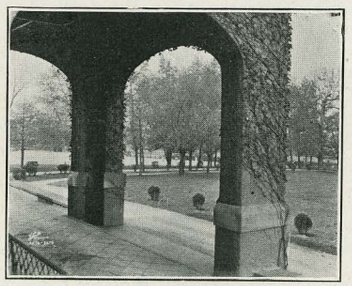
Castle Stevens—Western Exposure

come and in 1907 the new "Castle Point Athletic Field" was finished and a commodious grand stand, for that time, and a field house, erected. At the dedication of the new field, the Class of 1897 presented an elaborate wrought iron memorial gate located at the main entrance at the north end of the field. In 1909 the Class of 1899 presented a suitable flagpole situated near the main entrance and from which the Stars and Stripes may be viewed from nearly all points on the college grounds.

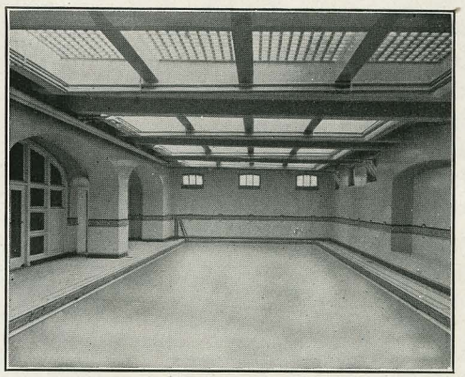
In 1910 President Humphreys announced at the annual Alumni meeting that he had taken option on the purchase of the estate of Col. Edwin A. Stevens, including the old historic Castle, and that this together with a previous option on the adjoining land of Robert L. Stevens, would give the entire Castle Point property to the college, up to the Richard Stevens land, in other words, all the Stevens property from Sixth to Eighth Streets and from Hudson Street to



Castle Stevens—View through Porte-cochère



Castle Stevens—Practice Field from Porte-cochère

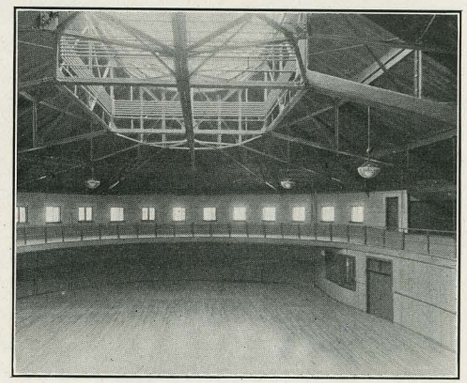


William Hall Walker Gymnasium—Swimming Pool

the River Road on the Hudson River shore. This property was purchased May 15, 1911, and at the annual "Alumni Reunion Day" gathering on May 27th, Edwin A. Stevens, Jr., on behalf of his father, turned over the keys of the Castle that had been the home of the Stevens family for nearly a century and a quarter. Extensive renovations were made and the Castle refitted to serve as a home for about forty-five students and as a gathering place for all under-graduates and for the Alumni and Faculty.

During 1915 and 1916 the William Hall Walker Gymnasium was built with funds given by Mr. Walker at the time of the $1,385,000 campaign already referred to. This building is of variegated deep-tone red brick and of unusual architectural design, being oval in form to provide a maximum of natural illumination for the running track in the balcony and for athletic events on the main floor which is 110 feet long and has an average width of 35 feet. A lower floor contains two large exercise rooms. Under a broad brick outdoor court leading to the main entrance of the gymnasium is an all-tiled swimming pool with natural illumination from side windows and from crystal flooring in the court above. The gymnasium was dedicated November 18, 1916.

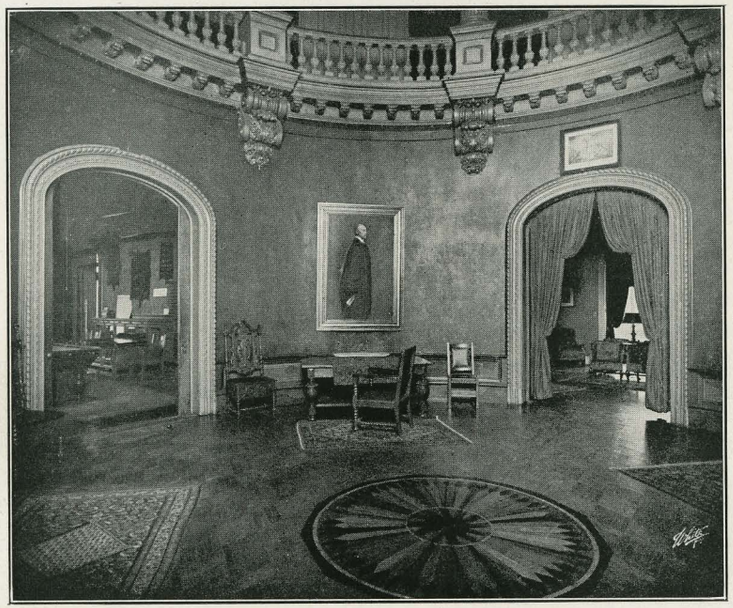
Extensive alterations were made to the original building in 1916 and 1917. Two of the lecture rooms on the second floor were converted into a drafting room 60x40 feet, by removing a partition and reinforcing the floors with steel beams. The same type of reconstruction had been involved in previous reconstruction of other rooms, notably the Physics lecture room, and the lecture rooms in the east and west wings. The new drafting room was later equipped with a remarkably efficient artificial lighting system which has since been installed in the two older drafting rooms, in the newly equipped library and in several offices. A covered second-floor passage-way about 120 feet long was constructed to connect the original building with the Preparatory School building.



William Hall Walker Gymnasium—Main Floor and Running Track

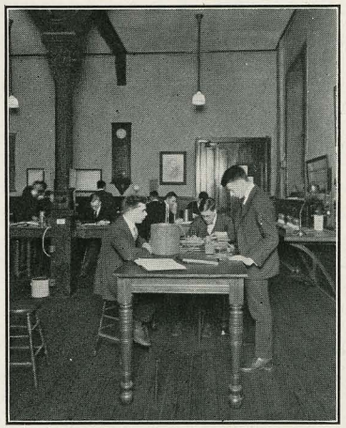
In 1917 the Stevens School was discontinued by the college trustees and the building formerly used by the School was converted into a Recitation Hall providing lecture rooms and offices for the Departments of Engineering Practice, English and Logic, Mathematics, Mechanics, Modern Languages and Structural Engineering. The basement of the building was converted into a locker room for the entire student body.

The large college enrollment of the past year, 1920-21, made it necessary to secure additional classroom and drafting-room space. This situation was met by purchasing from the United States Government two ordinary brick barracks buildings that had been erected on the college property during the



Castle Stevens Rotunda

World War for housing young men who were training for engineer ensigns. Although not suited to the college needs, one of these buildings, 56x100 feet, located at the corner of Hudson and Sixth Streets on the original block of land, has been refaced and window and door arches reconstructed. The interior has also been reconstructed and the second floor newly equipped for housing the college library which was cramped and disconnected in its old quarters in the main building. Furthermore, the space occupied by the old library offered the most satisfactory solution to the problem of securing necessary additional drafting room space. The first floor of the "barracks" is being fitted up as a museum, the exhibits of the early Ford car and of the car specially constructed in the course of the litigation involving the Selden Automobile Patents being already in place. A large amount of important historical engineering machinery



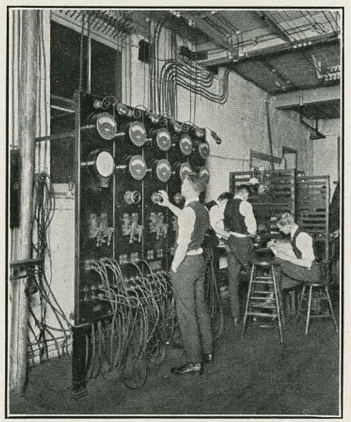
Physics Laboratory—Exercise in determination of mechanical equivalent to heat

and apparatus has accumulated at the college and has been scattered throughout the building in crowded spaces where it could not be appreciated. These exhibits are now being reassembled in the new museum and it is hoped they will afford interest and inspiration to the young men who come to Stevens. The third floor is devoted to offices for the large number of student societies and organizations whose activities offer healthful relaxation from the grind of technical study.

The second barracks building constructed by the United States Government is on the block of land directly east of the original college grounds. This new land comprises the plot of 196x100 feet given in 1897 by Mrs. Martha B. Stevens, the remainder having been purchased in 1916 for future college extensions. The larger barracks building here referred to is U-shaped and is 156x156x100 feet around the outside walls. Four lecture rooms with specially reconstructed soundproof walls have been constructed, and the basement is being used for the large truss-construction exercises in the carpentry course. The south wing of the building is being remodeled inside for use by the Electrical Department. This building was not quite finished at the time of the armistice but was nevertheless completed by the Government and sold to the college for a very nominal price. The purchase included a valuable boiler and heating equipment.

THE ALUMNI ASSOCIATION

THE Alumni Association of Stevens Institute of Technology was formed in 1876 and has always been active and energetic in promoting the interests of the college. It has made an enviable record of deeds accomplished, including: the establishment of a beneficiary fund for worthy and needy students from which twenty-one young men were assisted up to 1902 by amounts varying from $50 to $200; a library fund of over $900; a portrait fund for portraits of trustees and faculty including a life size portrait of President Morton for which more than $1000 was subscribed; a souvenir book descriptive of the life of President Morton; the raising of large sums at different



Electrical Laboratory—Exercise in measuring losses of induction motor

times for purchases of land and buildings as already told in the financial record; the establishment of an employment center for the graduates of Stevens; the publication of Alumni business directories, and publication of the Morton Memorial Volume, a large imperial octavo book of 640 pages giving a history of Stevens Institute of Technology, a record of the engineering achievements of the Stevens family of engineers and biographical records and photographs of trustees, faculty and alumni. At the time of the twenty-fifth anniversary celebration in 1897, the Alumni Association did yeomen work in co-operating with the faculty in bringing together a remarkable exhibition of the work done by the Alumni during the first quarter-century.



One of the Students' Rooms in Castle Stevens

Since 1902 the Alumni Association has maintained a loyalty to its Alma Mater that is believed to be unsurpassed. President Humphreys has had Herculean work to do in meeting the current demands of a remarkable and unexpected growth and at the same time has had to meet conditions that had to be taken advantage of at once, if the future expansion of the college were to be provided for. President Humphreys has frequently given voice to the feeling that he never could have accomplished the work he had to do had it not been for the intense loyalty of the Alumni in giving encouragement and funds at critical periods.

A custom inaugurated in 1912 was that of a theatre party in one of the New York theatres with a supper-dance afterward at the Hotel Astor. These parties bring out a goodly number of Alumni and their wives and friends, a large part of the theatre including the boxes, orchestra and balcony being reserved for the Stevens party, usually consisting of three hundred to one thousand people.

The tenth anniversary of Dr. Humphreys' administration was specially celebrated by the Alumni at the annual Stevens dinner held at the Hotel Astor, February 14, 1912. A large number of special guests including many men of note were present and the work accomplished by President Humphreys during his first ten years was reviewed and sincere acknowledgment was made of the high appreciation of what he had done for Stevens.

In 1914 the Association arranged a "Technical Conference" at the college in which "The Engineer's Part in the Regulation of Public Utilities" was discussed. This subject was of popular interest at that time and the discussions, widely quoted, were entirely by Stevens graduates: President Humphreys, '81, of the college; John W. Lieb, Jr., '80, Vice-President of the New York Edison Company; Newcomb Carlton, '90, then Vice-President, now President, of the Western Union Telegraph Company; James E. Sague, '83, then a member of the Public Service Commission, Second District, New York, and George Gibbs, '83, consulting engineer for the Pennsylvania Railroad.

During the World War the Alumni Association early took up the work of organizing for preparedness and later when the United States entered the war was ready to formally guide and place a large number of Stevens men in various engineering departments in the government war work. As early as 1916 a series of preparedness lectures were started at the college, inaugurated by General Leonard Wood, U. S. A. Over one hundred Stevens Alumni and students attended the Plattsburg Camp that summer. After the war the records of the Stevens men officially engaged was carefully compiled by the librarian of Stevens Institute of Technology, the results showing a total of 1264 which was the number finally placed on the Stevens Service Flag. Of these, thirteen died in action, ten of disease and six from accident. Ten were decorated for valor. The total of 1264 is made up of 567 in the Army, 217 in the Navy, 8 in the Marine Corps, 16 in Foreign Armies, 2 in Welfare Work and 452 in the Student Army Training Corps at the college. The Training Corps received from the United States Government special consideration due to the nature of the engineering course at Stevens, waiving the formulated ratio of the number of men in the Army and Navy Sections of the Students Training Corps, with the result that there were 212 in the Army Section and 240 in the Navy Section. To the credit of Stevens it should be added that very many of the Alumni served in a self-sacrificing way in a civil capacity, in speeding up the engineering side of the "great engineering war" in factories, power plants, structural yards, laboratories and in educational engineering work. The training of the Stevens Alumnus had been such that he was peculiarly fitted to give immediate aid in preparing this country for its great task in 1917 and it is estimated that more than 75% of the entire Alumni body were doing a specific work that aided directly or indirectly, in the very rapid progress that characterized the engineering war work of this nation.

MISCELLANEOUS

IN 1904 the college adopted the custom of wearing caps and gowns at the Commencement Exercises and at special academic functions. The following year Stevens adopted orange as the color to designate the engineer on the hoods of the academic costume. Previous to this, lemon color, which designated Science, was the nearest approach for engineering use. In 1906 President Humphreys took up the subject of having orange adopted as the academic color for the engineer with the presidents of a number of leading colleges and it was later adopted by the Society for the Promotion of Engineering Education as the color for engineers.

About ten years ago, friends of President Humphreys secured the service of Mr. John W. Alexander, the noted artist, to paint a full size portrait of Dr. Humphreys. The work was admirably executed and presented January 10, 1914, at the annual banquet of the Alumni Association at the Hotel Astor in New York City. This portrait now hangs in the Memorial Room of the Carnegie Laboratory of Engineering with that of the first president of Stevens and those of the trustees and faculty that have been presented from time to time.

UNITED STATES NAVY STEAM ENGINEERING SCHOOL

EARLY in 1918 the United States Navy established a steam engineering school at Stevens, the school being placed in the hands of Professor Frederick L. Pryor, M.E., Professor of Mechanical Engineering at Stevens, for organization and for development of a course of study specially designed to train young men as engineer ensigns to operate the large fleet of naval vessels then under construction at various ship and engine building plants throughout the country. In organizing the school, Professor Pryor had the co-operation of Navy officers specially detailed for the work, and in planning the course of study, the co-operation of several members of the college faculty who delivered the first series of lectures on their special subjects.

The candidates for the course were graduates of engineering schools throughout the country insofar as they could be obtained in the large numbers desired, and the least requirement was that the candidate should have had an equivalent engineering training and experience. The course of training for the engineer ensign required a period of several weeks at the Naval Training School at Pelham Bay, then several weeks at Stevens after which shop and shipboard engineering experience were required when the student again returned to the school for further study and examination. The complete course of training required about five months after which the successful student was commissioned as Engineer Ensign.

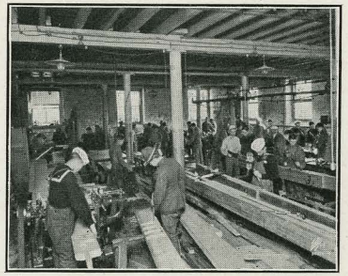
To facilitate the work of the school, the Government detailed a large corps of commissioned instructors who took over the instruction, under Professor



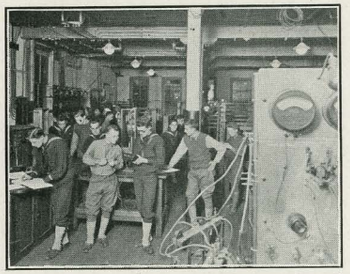
In the Class Room



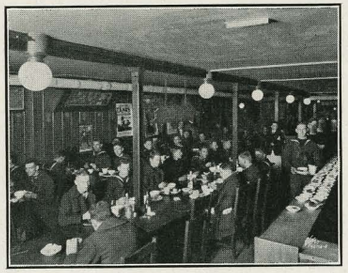
In the Drafting Room



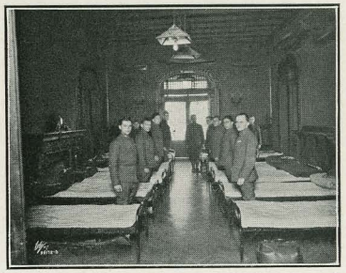
In Carpenter Shop



In Electrical Laboratory



In Mess Hall

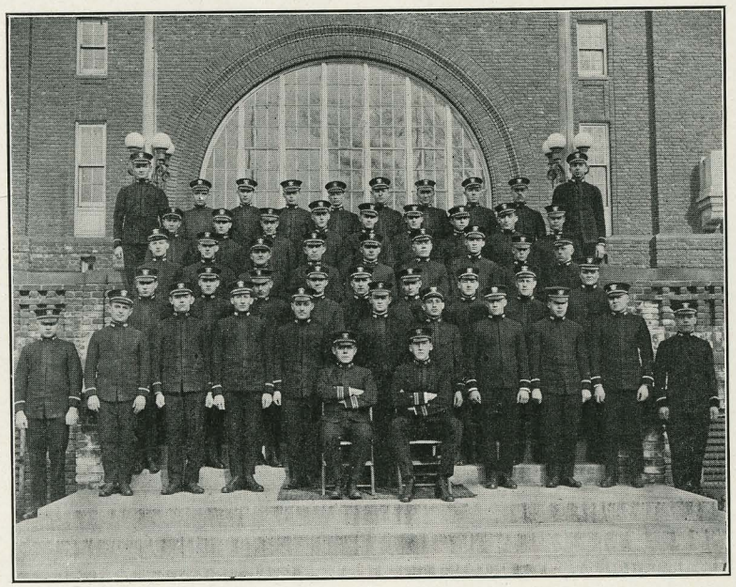


In Dormitory

STUDENTS TRAINING FOR WAR SERVICE

STEVENS INSTITUTE OF TECHNOLOGY

Pryor's direction, after the Stevens faculty members had given the first few lectures and were released for work with the large number of students taking the regular Stevens course as members of the Student Army Training Corps. The college buildings, being already crowded with students of the regular course, the Government erected a brick barracks building 56x100 feet on the Institute grounds. This, however, soon proved inadequate, as it was planned to train six thousand ensigns. Shortly after the first barracks was erected, a second one, three times as large, was started on nearby land belonging to



STEVENS INSTITUTE OF TECHNOLOGY

Graduation Day—Class No. 10—of United States Navy Steam Engineering School

the college and this was well on toward completion when the armistice was signed. Those men who had entered the school at that time were continued through and the school was closed June 28, 1919, after having enrolled a total of 1779 men and graduating 1465 as commissioned Engineer Ensigns. One of the residential buildings on the college grounds was placed at the disposal of the Government and used as a Naval Dispensary.

The work of this school, which was the only one established by the United States Navy for steam engineering, was specially commended by Franklin D. Roosevelt, then Assistant Secretary of the Navy, in the following letter addressed to Dr. Humphreys.

Navy Department, Washington, D. C.
June 5, 1919.

My dear Dr. Humphreys:

Before the United States Navy Steam Engineering School suspends operations, I wish to express to you the Navy Department's sincere appreciation of the magnitude and value of the work which it has accomplished.

One of the most serious problems which confronted the Navy almost from the entrance of the United States into the World War, and which increased in gravity as the war went on and the Navy's mission became more and more clearly defined, was the one of supplying engineer officers for the very large number of merchant-type vessels which the Navy was called upon to operate. As you know, there was no considerable surplus of skilled marine engineers available when all existing vessels were fully manned; consequently we were required literally to create them by thousands to man the great number of new vessels which the Shipping Board was building for the Navy to operate in the war zone.

When it became apparent that we must take advantage of existing educational facilities not under Government control, we naturally turned to Stevens for help. Your response was immediate and most generous. There were no preliminary negotiations—nothing but an expression of a sincere desire to help in every way in which you could be helpful; and the Steam Engineering was a going concern almost as soon as the matter was broached.

For reasons of policy during the war time the school was designated as a Navy School at Stevens Institute, and was ostensibly under the direction of the Department. As a matter of fact it was a special activity of the Institute itself, with the Navy assisting to some extent and directing hardly at all. The school could neither have been organized nor have been successful without the loyal support accorded by yourself and the trustees and faculty. That the school has been entirely successful is beyond question; and there is no doubt that had the war continued and the building program progressed as originally planned, the Navy would easily have met the demands for competent engineer officers as fast as the ships were ready for service.

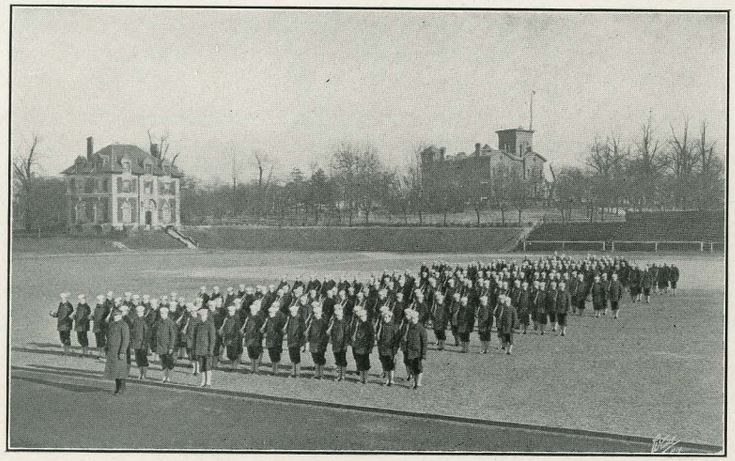
It would be superfluous for the Department to call your attention to the organizing and executive ability of Professor Pryor, or to the wholehearted enthusiasm with which he has thrown himself into the work as Director of the Navy School; but I wish him to know that the Department is deeply sensible of his contribution to the cause.

It would be extremely pleasing to the Department if you were to see fit to communicate the contents of this letter to all who have helped in this splendid successful endeavor, and perhaps to the Alumni. The latter have a right to take great pride in their Alma Mater's contribution to the Navy's share in winning the war.

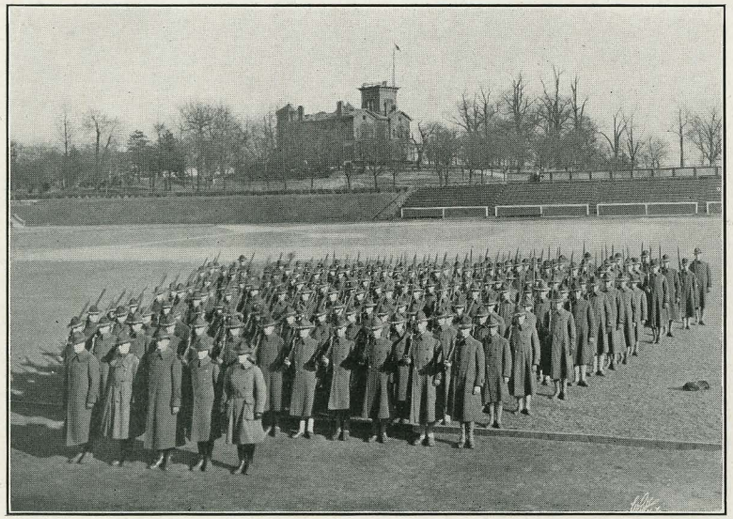
Again thanking you, I am

Very sincerely yours,

(Signed) FRANKLIN D. ROOSEVELT
Assistant Secretary of the Navy.



Stevens Institute of Technology—Students' Army Training Corps, Navy Section —Drill Formation



Stevens Institute of Technology—Students' Army Training Corps, Army Section —Drill Formation

THE ALUMNI

IT SEEMS fitting at the present time to briefly mention some of the many achievements of the Stevens Institute of Technology Alumni and to indicate the participation of its members in the progress of the world's affairs since the institution was founded in 1871.

An article entitled "Contributions of Stevens Tech to the Welfare and Progress of the Country" by Professor Furman appeared in *The Indicator* in 1915, in which was clearly outlined not only the influence exerted by Stevens Institute of Technology but also by its many graduates. It seems fitting to reprint at least a part of this article here.

"We are concerned with the mechanic arts and the wealth and comfort that have come to a great and unknown number of homes in our land as a result of the improvements in and the exercise of these arts. From the earliest fire-friction mechanisms of remote times there has been progress in the mechanic arts. But this progress ran slowly through the centuries, save only for such brilliant periods as those marking the time of Gutenberg with the printing press, of Leonardo da Vinci with his varied implements, of Watts and Whitworth with engines and mechanisms, of Stevens, Fulton and Ericsson with their achievements in power development, and of Goodyear, Morse, Howe, McCormick, Eli Whitney, Mergenthaler and others with their industrial inventions.

"It was without doubt the work of Watts and Whitworth that gave a new life and a new strength to the development of the mechanic arts and it was in their times during the latter part of the eighteenth century and the early part of the nineteenth that a much more rapid development set in. Industries began to spring up that depended more on factory manufacture rather than on home manufacture, and avenues of transportation were subsequently opened over increasing stretches of land and sea. But for more than threescore years the newly devised engines and machines and materials remained crude and wasteful, affording commercial profit over the old methods of accomplishing similar results to a comparative few.

"The developments outlined above were sufficient, however, to reveal to a few of the far-seeing men of the period of 1870 that the time was at hand for the training of a group of young men that would enable them at least to introduce scientific and methodical principles into the engines and machines of the day. Then was the profession of mechanical engineering first established in America and based on a specific course of study. There had been other technical courses such as civil engineering and mining engineering and the "Civils" and the "Miners" were the ones on whom had fallen the task of building scientific engines and machines. But their training had not equipped them for this specialized work. So after the first college of engineering had been established at Hoboken, N. J., through the most generous gifts of Edwin A. Stevens, other courses in mechanical engineering were established in other colleges and universities. What was the result? An immediate acceleration in the progress of the mechanic arts that has no parallel in history, not even in painting,

sculpture, or literature, where development had been carried to the highest points of human enjoyment. But none of these, in a brief period of about forty years, had developed so swiftly, so universally as have the mechanic arts since 1870.

"Since that time unnumbered improvements, small to large, have come to benefit mankind and no one can fail to enumerate for himself a great many of these from his own general knowledge and from even his business and home surroundings. Of the greater achievements in engineering we have only to recall that the real economic use of coal and a full scientific understanding of the steam engine began only in 1874 with the introduction of the triple-expansion steam engine; and that permanent and trustworthy service by cable and the use of the reversible dynamo as a motor came in the two preceding years. The gas engine and the telephone were both patented in 1876 and the electric lamp became a commercial success in 1879. Since that date have come the great and far-reaching inventions and developments in gas-works engineering, in the electric railway, in the electrical industries, in machine shop improvement, in the building of automatic machinery, in structural engineering, in refrigerating engineering and more specifically in the introduction of the steam turbine, the gas engine, the automobile and the flying machine.

"Considering such evidences of the progress and welfare of the country as have just been stated, we again ask, what have been the contributions of the colleges of mechanical engineering to it all? and what, if any, claims may be made in common and in particular for our Alma Mater?

"What bearing did the action of Henry Morton have when in 1869 and 1870 he, as the first president of the Stevens Institute of Technology, assembled a faculty of men who were to teach the application of scientific principles and methods to the mechanic arts? These men had no precedents to follow. They had to hew their way by research and by experiment through unknown paths to hidden laws. How well they did their work is recorded and universally acknowledged.

"Who can gainsay that the repeated popular and striking lectures of Henry Morton on the application of the principles of light, heat and sound delivered at the Academy of Music in Philadelphia did not open up visions for other minds and lead to useful accomplishments? These lectures filled the Academy with its more than 3500 seats and some of them, notwithstanding an admission fee, were repeated on succeeding evenings by public request. Popular and technical evening lectures on kindred topics showing the applications of the laws of science to mechanical engineering were given by President Morton and other members of the Stevens faculty at the college buildings in Hoboken for a number of years after the opening of the college. The public as well as the students of the college were invited and mechanics and manufacturers came long distances in those early days to attend these lectures. It was not uncommon to crowd the college hall which then had a capacity of 600. To this day the writer receives direct testimony of the great educational and practical value that visitors received on these occasions. The lectures in Philadelphia and in Hoboken were largely quoted in the public press, thereby greatly extending their influence. How far has this influence extended in these forty years?

"To the other members of that pioneer Stevens faculty the country is also greatly indebted. The research work of Professor Alfred M. Mayer in physics, particularly in optics, sound and magnetization led to the adoption of hitherto unknown principles in the development of the mechanic arts. He was a leader without a peer among his contemporaries in his line of work and all that he did during a long and intensely active period was freely contributed almost entirely to technical society papers with practically no financial reward whatever. To these same papers the great commercial houses of the day had to resort for a solid and sure foundation for progress.

"The work of Robert H. Thurston, the first great teacher of Mechanical Engineering as a specific department of study, is still well known to engineers the world over. Probably no greater or more important mechanical detail of progress has ever been made in mechanical engineering or more widely adopted than that which resulted from his investigations and conclusions on the binary and ternary compositions of copper, tin and zinc for use as bearing surfaces and for the reduction of friction in engines and machines. His researches in the physical properties of iron and steel and in the "quality" of steam from boilers were scarcely less important. He was probably the most prolific mechanical engineering writer of history. He was an inspiring writer as well, able to put his work in popular language if occasion required, and he has been read and quoted perhaps more than any other American engineer, especially during the early days when information on the necessities of mechanical engineering for rapid progress was so much desired and sought for, and so difficult to obtain.

"There were others of that first faculty of Mechanical Engineering who labored indefatigably to lift the profession from chaos to order, and among them in the technical departments was Professor Charles W. MacCord, whose writings, principally in the popular technical papers of the day, led the way for thousands of young men and mechanics in the subjects of mechanical drawing and mechanical movements. His investigations of the subject of toothed gear-wheels resulted in one of the largest single contributions in furthering the manufacture of smooth-running machinery and his text books still remain unsurpassed for thoroughness and for basic reference work in these subjects. A striking example of improvement in welfare of our people is afforded by the research work of Professor Albert R. Leeds in sanitary chemistry, where his scientific investigation of water supply in more than a dozen large American cities led to improved hygienic conditions for literally hundreds of thousands of persons. He carried the same character of work into the milk supply of cities, adulteration of food, hygienic conditions of schools, disinfection of railroad cars and steamships. The last of the technical group of the original faculty was Professor De Volson Wood whose genius as a practical mathematician enabled him to carry innumerable theoretical investigations of engineering materials, engines and structures to the highest point of development,

and from his advanced position he sent forth new ideas and new thoughts that were to guide others in engineering advancement.

"This brief record of the gifts of the original faculty in Mechanical Engineering to the welfare and progress of the country, would be incomplete indeed without including two essential attributes in the development of culture in the profession. A most deserving tribute is due to Professors Wall and Kroeh, who have labored from the beginning to instill the refining influences of the home and foreign languages into the character of the graduate mechanical engineer. With mention of these names and of these works we close a period in the development of the welfare and the progress of our country. What has grown from the seeds that have been planted in tilled soil and that have been carried by the winds, and that have multiplied, can never be known. Of the original faculty, three are still living, Professors MacCord and Wall in retirement looking down the vista of the years to the time when the comforts and enjoyments that are bestowed on the present active generation were unknown, and Professor Kroeh of the Department of Languages who is still regularly engaged in his teaching work at the college.

"The results of the works of great leaders in the teaching of mechanical engineering have been separately considered in the foregoing paragraphs, but to give a full measure of justice we must refer briefly to their work as a whole. Nearly a thousand young men were graduated under their seal. They went forth to put the science of their teachers and of their own originality into the commercial development of materials and processes, and into the building and improving of engines, machines and structures. Here we enter into a field of development and progress so rich and so vast that even such fragmentary personal knowledge as a single individual may have been able to obtain is sufficient literally to fill volumes. But we are writing of what Stevens has contributed to the welfare of our country and this we do know of that whole vast field of human endeavor: That that first generation of graduates went forth into a cold business world and that there was little sympathy and small pay. Materials were being made, processes were being carried out, engines and machines were running, industries were making money. Was not that enough? But gradually here and there a manufacturer could sell his products cheaper than his competitor. Why? To give an actual case, because he engaged a graduate mechanical engineer and set him to work in the boiler room. Coal was being burned in great quantities and the young graduate actually begged for an opportunity to change the boiler conditions to a more scientific basis. He finally got permission and $12,000 per year was saved on coal alone! Another graduate soon developed an automatic machine which turned out a heretofore slowly-manufactured product in large quantities, and so reduced the cost and finally the selling price per unit. It took years to overcome the prejudices to technical graduates and it was forced only after innumerable instances such as we have quoted above, but under varying conditions and surroundings. The day is now arrived, however, when the trained mechanical engineer is almost universally received with a welcome. The day might have arrived sooner had it not been that the possibilities and advantages of the services of the trade engineer were hidden from the employer because he doubtless thought he had as good as could be obtained; that the co-worker of the young graduate was suspicious of his ability to pass him in the race for increased rewards; and that the young graduate was inexperienced because of his youth and could not carry assurance to his employer, and that his years had not yet developed the tact to deal successfully with his co-workers on the floor.

"With a thousand young mechanical engineers of the first generation at work, and all contributing to the marvelous developments since 1870 as outlined in the early part of the article, we need only to cite a few examples in some specific cases to illustrate just what these graduates have contributed to our welfare and progress. Alexander C. Humphreys graduated in 1881 at the age of thirty and thirteen years later it was said of him by one of the publications in the gas industry: 'An impartial history of the progress of water-gas (illuminating gas) during the past twenty years must place in the foremost rank three names: Lowe, Granger and Humphreys.' In his work with the United Gas Improvement Company of Philadelphia he built up an organization for the central management of a large number of widely distributed properties such as the world had not seen before, and which still remains the great landmark in the development of large industrial enterprises. The services which he was fitted to render to the progress of mechanical engineering outgrew the bounds of any one industry and at the age of forty-three he established an engineering partnership in New York City and the rewards of his industry and ability were immediate and bountiful. But these he sacrificed in a very great measure to give to Stevens and to the progress and welfare of the country such service as Stevens knew he could give and which was unanimously asked of him. He was thus called to succeed Henry Morton as president of Stevens Institute of Technology in 1902."

In the article from which the above is quoted, the writer enumerates from data at hand at the time, the achievements of various Stevens men, but as since that article was written some six hundred Stevens graduates have gone into the field, and older graduates have added to their work, it seems wise here, rather than to attempt with insufficient information to record personal achievements, to relate in a less specific way some of the many things Stevens Alumni have accomplished.

The Stevens Alumni may be credited with pioneer work on the steam engine and pumping engine and the refrigerating machine; with the development of original apparatus for the illustration of physical laws and for testing various mechanical devices and for investigations and tests of engines and boilers; with inventions in continuously-recording pressure gages for water, gas, electricity and temperature; with original work in investigating the causes and preventing the great financial losses due to the disintegration of gas and water pipes through the action of electrolysis from stray electric railway currents; with the discovery of the value of using cheese cloth or other thin material over extended areas of growing crops—this discovery has revolutionized the

methods of raising certain crops in certain localities; with the invention of the "reaction" brush holder for dynamos; with pioneer work in establishing standards in manufacturing leading to a practical solution of interchangeability in machine construction in this country; with one of the earliest examples of electric train lighting in the United States; with designing an integrating and registering instrument forming part of the well-known Venturi water-meter for large mains; with designing the "pull to stop" and "pull to start" belt-shifts now so widely used; with the discovery of the value of the Selden gas-mobile patent which resulted in wonderfully steadying the rapid development of the automobile; with the designing of large coal handling stations for rapidly loading and unloading large vessels and cars; with a large number of patents for the bettering of railroad operation, and the design of the first all-steel incombustible passenger car ever built; with the design of an automatic machine for making wire rope wherein was accomplished in one operation what by the common method had acquired two; with important contributions to the development of wire-rope tramways, haulage plants and power transmission; with work in the development of the electric lamp; with scientific work on electrical machinery leading to some of the most important and far-reaching developments in the electrical field; with the invention of the first round-door burglar-proof vault; with the production of "The Mechanical Engineer's Pocket-Book" which has had a wider circulation and a greater field of specific application than any American book ever issued in mechanical engineering work; with designing a new system of electric furnaces for the manufacturing of calcium carbide; with the introduction of the Whitehead torpedo into the United States Navy; with having installed the first electric trolley line in Italy, at Milan; with the invention of a water meter which practically superseded all other forms of displacement water meters; with patents on gas engines; with designs for fire boats and for incinerating plants for burning rubbish; with the invention of a furnace for using heavy crude oil for fuel; with designing and constructing automatic machinery for working metal and wire goods; with the production of the first drop cabinets for typewriting machines; with patents and developments in calendar, program, self-winding and "time" clocks.

With the invention of a screw pump specially adapted for direct connection to an electric motor; with designs of heavy locomotives, baggage cars and crane cars; with the invention of a new form of tank for the electrolytic separation of metals; with improvements in the Corliss type of steam engine and inventions in connection with the Curtiss steam turbine.

With being first to advance the application of X-rays in this country; with designing and superintending the construction of one of the first steam car heating systems on a large railroad; with improvements in the design of the locomotive; with designing tools for the manufacture of hard rubber goods and designing a hard rubber pump to convey a solution of iron and nitric acid; with the designing and installing of an electric light plant in Colorado which, under the conditions of altitude and service, made it the first of its kind; with the installation of what was at the time the largest mine-pumping plant in the country.

With having introduced oval balanced turrets in the United States Navy; with the development of high-speed cutting tools; with the installation of long-distance high-power electric transmission lines; with intensive work in the science of forestry; with the invention of pig-iron moulding and conveying apparatus which supersedes the old sand-bed system and which in various forms has become a necessity in blast-furnace plants the world over; with the invention of the gas-composimeter and the pneumatic pyrometer; with the development of a system of telephones for centralizing battery service in use in large hotels; with inventions widely used in cable-road work before the time of the electric trolley.

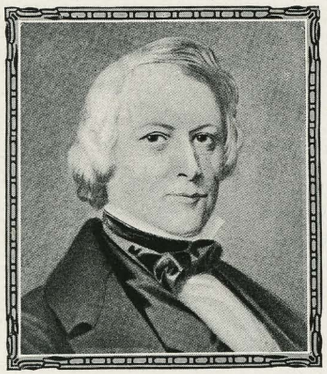
With the invention of a new type of detector for electric waves permitting the transmission of messages at the highest speed obtainable by telegraph operators; with patents on various devices connected with alternating-current transformers and motors; with patents on apparatus for water-gas plants.

With designs of apparatus for the manufacturing and refining of brimstone; with the design for a combined evaporation cooler and surface condenser; with patents on an improved planimeter for determining areas, mean pressures, horse-power, etc.; with intensive work in heating and ventilating in large factories, office buildings and homes; with the development of the Nernst lamp in America.

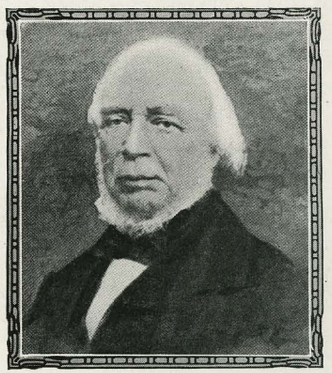
These are but a few of the achievements that may be credited to the Stevens Institute of Technology Alumni. Those whose particular work is not recorded above may be found at the head of great industries or building others—drawing upon the fund of knowledge acquired at their Alma Mater.



JOHN STEVENS
1749 - 1838



ROBERT L. STEVENS
1787 - 1856



EDWIN A. STEVENS
1795 - 1868

The Stevens Family

A FAMILY OF ENGINEERS

Article written by T. C. Martin, E.E., at the instance of President Morton, for use in connection with the exercises of the Twenty-fifth Anniversary. It was published in the "Cosmopolitan Magazine" for May 1898

THERE is a chapter in the history of this country during the century now closing which has never been presented to the general public, but which contains matter of the greatest interest both in relation to the development of our interior resources by means of steam transportation on land and water, and also as to the protection of our great commercial centre in and about New York from the possible attack of any foreign power. This chapter might well be entitled, "John Stevens and His Sons as Engineers and Naval Constructors."

On a recent public occasion Mr. Abram S. Hewitt, referring to one of these men, said: "That was the greatest mechanical engineer, the greatest naval engineer, and the greatest railroad engineer which the nineteenth century has produced." When to this testimony I add the statements that the Camden and Amboy Railroad was built and operated by these men; that for twenty years or more they were substantially the only builders and operators of steamboats on the Hudson and Delaware Rivers; and that from 1840 to 1860 the harbor of New York was potentially protected from any possible attack of a foreign navy by a shot-proof steam ram (far more powerful than the famous "Merrimac") which during all these years lay under construction in a dry dock belonging to the Stevens family at Hoboken, and which at any time could have been finished and could have destroyed an entire fleet of the vessels of that day —then there is reason enough evident why the chapter mentioned should be written and presented to the public.

The facts to which I have referred above are so little known among the public at large that many, no doubt, will find themselves hardly able to accept them at first; but the evidence available is abundant, as I shall make clear presently. The main reason why the work of John Stevens and his sons has not been prominent in the public eye is that all these men were disposed rather to avoid than to seek notoriety, and were, moreover, possessed of such considerable wealth that they could carry out their projects with little or no outside financial assistance, and thus had no reason for bringing their plans before the public.

The close of February, 1897, beginning with the 18th of that month, witnessed the celebrations attendant upon the Twenty-fifth Anniversary of

the Stevens Institute of Technology at Hoboken, N. J., created by the generosity of Mr. Edwin A. Stevens. The initial feature of this celebration was a banquet of three hundred covers at the Hotel Waldorf, at which the speakers and their topics brought out in sequence the history of the institution as well as the great work of the three engineers to whom for more than a century was due no small part of American advance in the arts of peace and war. That work is the object of this paper to set forth.

Col. John Stevens was born in New York, in 1749, of English lineage. He was a graduate of King's College (now Columbia University) in 1768; a member of the New York bar in 1771; treasurer of New Jersey during the perilous days of the Revolution; and a pioneer citizen alike of New York City and Hoboken, where he located his family estate. He was not forty years of age when he saw John Fitch's steamboat making headway against the tide on the Delaware, off Burlington, N. J., and was at once seized with enthusiasm as to the new means of locomotion. He examined the boat and her mechanism, and in 1792, under the new patent system he had himself petitioned into existence, he took out patents for steam propulsion. Experiments were hotly pushed, and in 1798, nearly a decade before Fulton ran his "Clermont," Col. Stevens had a steamboat on the Hudson, as builder, owner and captain. Six years later he equipped with double screws another predecessor of Fulton's craft. The short four-bladed screw which he designed has shown great vitality as against later comers; and Mr. Abram Hewitt's father, who remembered being a passenger on the first Stevens boat, built for her at the Soho Works at Belleville, N. J., the first condensing double-acting engine made on this continent. Col. John Stevens continued prolific in invention and enterprise. He patented the multitubular boiler in the United States in 1803, and in England in 1805; established in 1811, between Hoboken and New York, the first steam ferry in the world; in 1812, before work began on the Erie Canal, he urged on the State authorities of New York the superiority of a railroad; before 1812 he made steam navigation on the Delaware a commercial success, with his son Robert; in 1813 he designed an ironclad ship which fully embodied the "Monitor" type, and was the first ironclad ever worked out for construction; in 1813 also he put into operation the first of numerous double-hull ferry-boats carrying a paddle-wheel driven by circling horses; in 1817 he obtained a charter, the first in America, for a railroad from the Delaware to the Raritan; in 1823 he secured acts of legislature for the incorporation of the Pennsylvania Railroad; and in 1826 he built a steam locomotive with multitubular boiler, which he operated on a circular track at twelve miles an hour, carrying passengers, at his own expense, on his own property in Hoboken. This was the first engine and train that ever ran on a railroad in America—built by a man verging on his eightieth year!

Such a record as this, very few men are permitted to make. The engineering events it includes are of wonderful magnitude; their effect on the development of the United States is still working itself out in widening rings. To have forewarned us of the collapse of the popular canal system, in which $214,000,000 of public money is now well-nigh hopelessly sunk, reveals prescience of exceptional character. To have set on foot vast transportation enterprises required quite different capacities, but here again, like Vanderbilt, he was successful; for, aside from his own work, other schemes, like that of the South Carolina Railroad in 1829, were based on his plans and recommendations. Then to have turned from all these victories of peaceful commerce and to have laid down the lines on which the naval warfare of the world was to be completely revolutionized, was to round out a figure of heroic proportions.

Bred a lawyer and always a man of affairs, John Stevens had in him also the qualities that distinguish the great engineers. These were markedly perpetuated in his son, Robert Livingston Stevens; just as in the other son, Edwin A. Stevens, his financial acumen and business sagacity were so signally exemplified on the broader plan of larger times. Robert was born in the very year when his father saw that tiny, primitive paddle-wheeler of Fitch struggling up the Delaware, and as a lad of seventeen he assisted in 1804 in the construction of the first screw steamboat. Five years later, barely of age, he took the side-wheeler "Phoenix" from New York to Philadelphia by sea in June, in spite of a storm which rendered welcome the temporary shelter of Barnegat Inlet. This was the first sea trip of a steam-propelled craft. Col. Stevens and his son had been barred from navigation on the Hudson by the monopoly accorded to Fulton and their powerful relative Livingston. Many men would have accepted defeat, but they determined simply to take their boat around to the Delaware, and therefore pushed boldly out into the Atlantic; thus out of their deep discouragement snatching immortal honors.

It was now as a builder of steamships that Robert Stevens made himself famous, each successive boat being faster until in 1832, with the handsome "North America," using forced draft, he attained a speed of fifteen miles an hour. For a quarter of a century, and while he gave his chief attention to that line of work, he stood at the head of the naval engineering profession in this country; and his inventions and improvements up to 1840 were so valuable and numerous that a bare catalogue would fill pages. We may specify, for example, the invention, as early as 1818, of the cam-board cut-off, being the first use of steam expansively for navigation purposes; the universally prevalent forms of ferry-boat and ferry-slip, the overhanging guards, the fenders, the spring piling; the adoption of the walking-beam in 1821; the invention of the split water-wheel in 1826; the invention of the balance valve for beam engines in 1831; the location of the steamboat boilers on the wheel-guards; the increase of strength in the boilers until they could stand fifty pounds to the square inch, although English naval engineers had got no further than five pounds as late as 1848.

Nothing could be sharper than the ordinary contrast between the lines of a steamboat and those of a fine clipper, yet it was Robert L. Stevens who designed and built in 1844 the "Maria," a yacht literally as fast as his steamers. She was the conqueror of the "America" just before the latter went across the Atlantic to capture, in the Solent, the famous cup which now gleams on Uncle

Sam's sideboard, for the British an object of, apparently, as hopeless a quest as that for the Holy Grail. In 1860 Commodore Stevens, on the "Maria," overhauled and sailed around the fast revenue-cutter "Harriet Lane," carrying the Prince of Wales; and she remained the fleetest of her school on the Atlantic coast until 1869, when she made a poetically mysterious disappearance off the face of the waters, no one knowing to this hour whither she went or what became of her.

Before dealing with another and even more exciting chapter of naval history in the life of the younger Stevenses, we must go back a few years to pick up the thread of their pioneer work in railroad construction and operation. As a result of its steamboat enterprises the family had become deeply interested in the traveling facilities between New York and Philadelphia, their three-linked water and land route between the two cities covering 101 miles. Col. John Stevens, convinced by his own success with steam in boats, was early satisfied that he could do even better with it on tracks. He had applied for charters, had operated experimentally his own locomotive, and had done all that was possible to educate public opinion on the subject. And now in 1830 came the incorporation of the famous Camden and Amboy Railroad, with Robert L. Stevens as its president and chief engineer, and Edwin A. Stevens as its treasurer. Its object was in reality to take over the enormous stage-coach traffic already built up by the celebrated Union Line, with its steamboats on the Raritan and Delaware, and its scores of four-horse lightning coaches that shuttled to and fro on the Trenton and New Brunswick turnpike. But while the business was ready, all the crude problems of steam railway locomotion had to be squarely met, and the first step was taken by Robert Stevens in his trip to England the same year, which had seen also the opening of the Liverpool and Manchester Railway as a great national event. Before leaving he had obtained permission from his directors to buy an all-iron rail in preference to wooden rail or the stone stringer thinly plated with strap iron. In those days there were no rolling-mills in America to make T-rails, and as labor and metal in this country were scarce and dear, he wished to get a rail that would dispense with the chair to hold it in place. During the long voyage to Liverpool, in good Yankee fashion he whittled bits of wood into various shapes, and finally selected the form in which a suitable base was added to the T-rail, making a continuous foot or flange and dispensing with the chair. The moment he landed on the Mersey shore he asked for bids on five hundred tons of this form, since known universally as the Stevens or American rail, and now the general form used by every road in the United States. Concurrently Mr. Stevens designed the hook-headed spike, which is the ordinary railroad spike of the present day, the "iron tongue" or tie-piece which has grown into the fish-plate, and the bolts and nuts required to give integrity to the track construction.

Shortly after his arrival in England Mr. Stevens saw the "Planet" of the Stephensons at work on the Liverpool line, and at once ordered a locomotive of the same character for his own road. This purchase, the "John Bull," was landed in August, 1831, and was put together immediately. She weighed ten tons, with a boiler thirteen feet long by three and a half feet in diameter; cylinders, nine inches by twenty; a fire-box surface of thirty-six feet; four driving-wheels; and a rail gauge of five feet between centres. There was no tender. The fuel and water were carried on a rough four-wheeled flat-car; the tank consisted of a whiskey-barrel from a Bordentown storekeeper; and the hose leading to the boiler was made of leather by a local shoemaker. When fired up with pine wood, and with steam reading on a scale at thirty pound pressure, this august combination moved off, to the relief and intense delight of those who were staking their fortunes heavily on her success. Just as nowadays we see fixtures to give either gas or electric light, so two coaches were built to be hauled either by the locomotive or by horses; and thus the road settled down to business, not, however, without appropriate ceremonies, a vast amount of newspaper talk, and the beginning of a series of improvements which have done much to give us the distinctive American railroad of today with all its remarkable differentiations and adjustments to the needs and conditions of this country. The record of the road reveals the trial or adoption of many things now familiar to every schoolboy—the first pilot, planned in 1832 by Robert L. Stevens; spiking the rail directly to the cross-tie; the bogie truck and forms of the vestibuled car; methods of wood-preservation; and a host of other features whose permanence depended largely on approval by this foremost among the pioneer railroads of America.

Among illustrations of the primitive apprehension of such subjects as railway management at the outset, it may be mentioned that during the early days of the running with steam on the Camden and Amboy railroad a man on a fast racehorse was sent ahead of the train by Mr. Stevens to clear the road and warn away possible intruders from the line. This was the more easy of accomplishment as one of the Stevens brothers, who had previously superintended the supply of horses for the stage route, possessed a fine stud.

It is also recorded that on one of the earliest trial trips the locomotive, coming upon a curve in the track at considerable speed, as the necessity of raising the grade of the outer rail had not been realized, left the track and took its way down an embankment into a neighboring field, where some men were employed cradling wheat. These men, in not unnatural alarm, fled with prompt alacrity; and did not come to a pause until they had placed two fields between themselves and the seemingly pursuing monster.

Complex and difficult beyond most institutions to manage, the railroad may be said to have called into existence a new type of "captains of industry." In the earlier days, functions in railroad management now discharged by several responsible heads at large salaries were faintly distinguished, and were all left to the care of some one man whose success became an immediate test of his wide ability. The world was born anew when steam was hitched to its wheels; and with new powers of locomotion the human race began its career all over again at a faster gait than of old. The railroad managers who first grappled with the conditions of the work, while without our experience of fifty years in its novel developments and relationships, had also but poor adum-

brations and sketchy outlines of the actual gigantic problems confronting them in politics, in financial affairs, in the changes of life and custom due to travel, in the jealousies of great commonwealths and cities, in the passion against monopoly, in the needs of a growing population, in the handling of multitudinous armies of employees, in meeting competition wisely, and in maintaining the health of the intangible but very real corporation which is itself the great underlying power and cause. When Mr. Edwin Augustus Stevens became the active business manager of the Camden and Amboy Railroad, all the intricate fundamental principles and methods just hinted at had to be discovered or worked out; but his genius and training were all in the line of harmonious predisposition for the great task. A seventh son, he was born at Castle Point, Hoboken, in 1795. At the age of twenty-five, by family agreement, he became trustee of the bulk of the paternal estate. At the age of thirty he took charge of the huge transportation system known as the Union Line. At thirty-five he became the treasurer and manager of its offspring, this pioneer steam railroad; and at once there sprang into light and full vigor his splendid qualities of initiative, executive and diplomacy. Merely to state that during the thirty-five years of his management of the Camden and Amboy Road its stock appreciated steadily in value and never passed a dividend, would be sufficient indication of masterly skill; but it tells a very significant part of the story. Not only had the "property" to be created, but it had to be conserved amid all the storms of political intrigue and commercial rivalry; through all the stress of financial disaster and national trouble; despite all the vicissitudes due to the redistribution of population and the shifting of industries. Mr. Stevens was a keen discerner of ability in other men. He allied with himself the best engineers of the time. He enlisted in the company's service the best legal talent of the State. He combated political onslaught and conciliated public sentiment; he saw the first compacts made between the conflicting railroad and canal interests, assisted in successive extensions or consolidations, and was quick to begin again new railroad work in New Jersey when released from earlier responsibilities.

The magnificent bequest of Mr. Edwin A. Stevens, endowing the Stevens Institute, will be referred to later, and in succeeding paragraphs reference will be made to the other great national work in which he was associated with his brother. But this epitome of a noble life would not be complete without mention of his engineering talent, which apparently takes place below that of his brother chiefly because he gave his energies to business. While still a young man he invented the Stevens plough, which was long made and sold in large quantities under his patent, and which brought him into very close touch with the agricultural interests of the country. But even more noteworthy was his invention, patented in April, 1842, of the airtight fire-room, one of the important features to be found in the warships of every modern navy for their forced draft. He may, in fact, be said to have taken up steamship improvement at the point where his elder brother Robert left it as age came on.

While assiduously devoted to the arts of peace, none of the three Stevenses could altogether forget the scriptural fact that spears were a prerequisite to pruning-hooks. In 1812 Col. John Stevens had projected his interesting circular fort, rotated by steam, for the defense of New York harbor; and before the year of Waterloo, young Edwin, under guidance of his father, was hard at work experimenting with a six-pounder bronze cannon against some iron plating, and anticipating the prolonged savage contest between projectile and armor whose end is not yet. Later again, in 1841, Mr. Edwin A. Stevens, at an anxious period when hostilities with England threatened, took up the subject, with laminated plates, just as during the previous troubles with the same country Robert had experimented with bombs to be fired from cannon and had sold to the government the secret for a percussion shell. From tests made at Bordentown, N. J., in 1841, Mr. Edwin A. Stevens reached the conclusion that four and a half inches of iron sheathing would withstand sixty-four-pound shot at thirty yards from the marine guns of the day; and eighteen years later the first English iron-clad, as well as a French frigate, donned an armor of exactly that thickness. The brothers Edwin A. and John C. submitted to a board appointed by President Tyler their views and data on the subject, in a document full of accurate forecasts on the coming principles in naval warfare; and after the armor tests had been repeated at Sandy Hook before the official authorities, Congress, in 1842, voted $250,000 to Robert L. Stevens for the construction of a war steamer, shot and shell proof. Robert and Edwin dug a dry dock at Hoboken immediately and began work on the steamer. A little later, however, the terms of the contract were changed, to make the armor superior to newer penetrating powers; and this process of interruption and delay was kept up until 1856, when Robert died, leaving the Stevens Battery in the basin at Hoboken, partially finished, with twin-screw engines and boiler in position. She was then four hundred and ten feet long; forty-five feet inside the armor shelf, with two feet of freeboard, and with a square immovable turret enclosing depressible guns. She was similar to the boats of the "Monitor" class built six years after by Ericsson, except that the latter had circular turrets embodying the idea of revolution, as suggested for the whole ship by Col. John Stevens at the beginning of the century, and for the individual guns by Robert L. Stevens about 1840. That the Stevens Battery would have been irresistible as a ram and invulnerable as a fort is easy to be seen; but the Stevenses were condemned in this case, by official obstruction, to undeserved failure; while Ericsson, with happier conditions, was able to seize the supreme moment, and by a conclusive demonstration do much to determine the fortunes of our country. It is among the memorable links between events that one of the present faculty of the Stevens Institute was able, as the draughtsman and representative of Ericsson, by his energetic and intelligent action, to send the rather erratic "Monitor" off upon her memorable trip to Hampton Roads in time to render never-to-be-forgotten service on the seventh of March, 1862.

Robert L. Stevens left to Edwin A., somewhat in the nature of a sacred trust, the floating battery which his fancy had depicted doing such valiant service for his country. Preceding in conception and construction by more than

ten years the little French ironclads seen at Kinburn in 1854, she was still a highly available vessel, and in 1861 Edwin A. and John C. offered to complete her at their own expense if the government would simply reimburse them after her utility had been proved. But the fates were against her, and she lay undisturbed until after the death of Mr. Edwin A. Stevens, who bequeathed her, with a million of dollars for completion, to the State of New Jersey. This sum was expended in 1869 and 1870, but the vessel was not launched, and in 1881 she was torn to pieces and her materials were disposed of. The family had not, however, wanted in courage—or in patriotism, either, for that matter—while the war was raging, but at their own expense built and fitted out the "Naugatuck." This craft, accepted by the government, was one of the fleet that attacked the "Merrimac." She was propelled by twin screws; carried a single gun of heavy calibre; could turn from end to end in seventy-five seconds; could be immersed three feet below her load-line, and could come again to full visibility in eight minutes by pumping. And so, having, against much injustice, prejudice, and discrimination, done their part when national perils were greatest, the Stevens family closed with credit and honor this chapter of their history. Might it not be suggested that here were noble deeds and a lofty intent still awaiting proper recognition?

It is worthy of note, moreover, that although the Stevens Battery was never launched, and of course, therefore, was never in actual conflict, yet for the twenty years which intervened between 1840 and 1860 she was potentially effective for the protection of New York and its harbor from any attack which might have been made by a foreign fleet.

During these years, though constantly undergoing alteration and reconstruction, she was at all times in a condition which would have admitted of her rapid completion, had an emergency arisen, on the plans which were for the moment being carried out, and these plans were always so far in advance of general naval construction that if so finished she would have been a match for a fleet of the best vessels of the world at the same date. Thus, while the naval armament of the world was light, her original armor of four and a half inches would have rendered her invulnerable to the shot of an enemy, while her shell-guns would have meant certain destruction to any vessel not provided, like herself, with an armor capable of keeping out all such shells. As the size and penetrating power of cannon-shot were increased, so was the provision for heavier armor made in the Stevens Battery, and her own guns were at the same time enlarged in the successive designs.

It is interesting to know that the utility of a marine ram in naval warfare was brought home to the mind of Mr. Stevens by an accident which occurred on the Hudson River at an early period. One of the swift wooden steamboats, by reason of some derangement of her steering-gear, ran into a "crib" dock, cutting through the massive timbers of the crib and penetrating the body of stone with which the crib was filled for a distance of twenty feet. After this performance she backed out and went on her way, having suffered no material injury. If, argued Mr. Stevens, a frail wooden hull could accomplish this, how irresistible must be the blow delivered by an iron steamer specially constructed with a view to such work, and armed with an immense steel prow shaped like the blade of an axe and solidly attached to and supported by the entire framework of the vessel.

Turning now to those paths of peace fuller of pleasantness than the grim arena of war, we may tell briefly how the Stevens Institute of Technology took root and grew as a seat of scientific and technical culture. Here we have the best, the most lasting monument of the Stevens family; for while steamboats and railroads and warships may disappear from the earth, the intellectual and spiritual work of such a place can never fade away. Mr. Edwin A. Stevens, dying in 1868, left by will land in Hoboken, a building fund, and an endowment fund, so that his executors might create the Institute. This was done, and, the nature of the college having been left for their decision, they wisely resolved to make it a centre for hitherto neglected mechanical engineering study, so that the wealth which had been derived largely from steam and transportation might return to fructify its origin. Thus the work began which up to 1895 had sent out from the Institute no fewer than five hundred and fifty-one graduates, of whom nearly five hundred today are occupying positions of honor and responsibility in the fields of work for which it was the special aim to educate them.

In no respect has failed the ambition to establish firmly one more place for the preservation of ancient knowledge, one more fountain for the refreshment and stimulus of studious youth, one more quiet asylum for the patient, devoted investigator. Nor has the growth of the foundation ceased. With the celebration of February, 1897, came the announcement that Mrs. E. A. Stevens, widow of the founder and a trustee under his will, had added to its resources real estate valued at $30,000; with the further news that Dr. Morton had added to his previous donations, aggregating $50,000, railroad securities worth $10,000, and that other members of the Faculty and friends were contributing toward the proposed new building and the equipment of various departments of instruction.

The exhibit made at the celebration by the graduates constituted in itself an ample justification for the existence of the Institute. Twenty-five years ago the mechanical engineering professions had barely suggested their present prominence, and many of the mechanical inventions that have rendered the age memorable had not been born. This display, comprehensive and compact, could not then have been made, but it now signalized the readiness with which young men well trained had gone out into the world and had adapted themselves to the later conditions or had shaped the newer environment of the race. Plant for power generation, transmission, or conversion; electricity in its varied work; apparatus to gratify the civilized passion for utmost accuracy in measurements; invention in its latest reaches; journalism in its most authoritative technical organs; literature in its standard technical books—these, in suggestive contrast to the Stevens relics with their records of pioneer triumph, formed an exhibition that summed up felicitously the glory of a great benefaction and all the marvelous progress of the century.

STEVENS INSTITUTE
OF TECHNOLOGY
1871 1921

Archives 2014.013.0051

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Enclosure, presentation pamphlet, Humphreys tribute:

[photo portrait]
ALEXANDER CROMBIE HUMPHREYS
M.E., E.D., Sc.D., LL.D.

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AS A RESULT of nearly two decades of untiring labor and remarkable achievement the name of Humphreys today stands beside those of Stevens and Morton in the eternal gratitude of the men of Stevens Institute of Technology. Just forty years ago Alexander C. Humphreys was graduated from Stevens. While carrying the course of studies at the College he was superintendent of a gas company in a nearby town and was married and maintaining his home. The great energy, the high character and the marked ability which enabled him to carry these responsibilities led him in the next twenty years to the highest place in the gas industry of this country. From this high station he was unanimously called in 1902 by his old professors and his brother alumni and by many friends of Stevens to take the presidency of the College, and he accepted!

Witness today the phenomenal progress of Stevens under President Humphreys: Increased attendance came without seeking and is more than trebled. Teaching methods have been advanced to new and original standards that are at the forefront of educational work, including student self-government and physical training. The college grounds have been extended in the face of trying circumstances and are enlarged by nearly twenty acres; five new buildings have been constructed or acquired excluding the Castle and several other buildings which have been adapted for general use.

The same characteristics that carried Dr. Humphreys to the top of his branch of the engineering profession and to the leadership of Stevens have led to his being drafted in other great works of national scope. He has been called to serve as president of the American Society of Mechanical Engineers, The Engineers' Club, the American Gas Institute, and the International Congress. He was a member of the Engineering Council and has done active work in a score or more of engineering or technical societies. He is Chairman of the Board of Trustees and member of the Executive Committee of the Carnegie Foundation for the Advancement of Teaching, etc. He has also served as president of the St. Andrews Society and the Canadian Society, and is now treasurer of the American Committee on Devastated France and a member of the Executive Committee of the Field Service Fellowship in French Universities. He has received honorary degrees from Rensselaer, Rutgers, University of Pennsylvania and Columbia, New York, Brown and Princeton Universities.

President Humphreys bears the love and admiration of the men of Stevens, who pray that for many years to come their Alma Mater may have the benefit of his experience and wisdom—to continue his present honored leadership.

On the occasion of the Fiftieth Anniversary of Stevens Institute of Technology Castle Point, Hoboken, New Jersey June, 1921

[end enclosure text]

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Text of booklet, cover title: Stevens Institute of Technology 1871 -1921

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[page 1]

1871 -1921

Fifty Years
of Progress
and Service

Stevens Institute of Technology
Castle Point Hoboken, N.J.

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THIS BROCHURE was compiled and arranged under the direction of a committee of the Alumni from photographs and text supplied by Professor Franklin DeR. Furman, M.E., head of Department of Machine Design and Dean of the Junior Class, Stevens Institute of Technology, Castle Point, Hoboken, N. J., June 3, 1921.

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THE YEARS spent at Stevens mark such an interesting period in the lives
of many of the alumni that it seemed fitting on this the fiftieth anniversary of the Institute, to prepare a brief story of Stevens of growth and progress.

The following pages may serve to bring back to the minds of earlier members many thoughts forgotten, and to indicate the changes that have taken place.

Later members, familiar with Stevens during recent years, may be interested in the environment in which the earlier students worked.

An effort has been made to show, as well as space would permit, the contrast wrought by the passing years.

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[full page illustration - artist's bird's-eye view] Institute and Grounds

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[portrait top]
EDWIN A. STEVENS
FOUNDER
STEVENS INSTITUTE OF TECHNOLOGY
1870

[portrait bottom left]
HENRY MORTON
PRESIDENT UNTIL 1902

[portrait bottom right]
ALEXANDER C. HUMPHREYS
PRESIDENT SINCE 1902

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[photo portraits]

Faculty of Stevens Institute of Technology, 1871

No. 1. President Henry Morton
No. 2. Prof. Alfred M. Mayer
No. 8. Prof. Robert Henry Thurston
No. 4. Prof. De VolsonWood
No. 5. Prof. Charles William MacCord
No. 6. Prof. Edward Wall
No. 7. Prof. Charles Frederick Kroeh
No. 8. Prof. Albert Ripley Leeds

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Stevens Institute of Technology

HISTORY OF THE INSTITUTE

THE official history of the Stevens Institute of Technology dates from April 15, 1867, when Edwin Augustus Stevens in his will bequeathed a block of land adjoining the family estate at Castle Point, Hoboken, N. J., $150,000 for the erection of a building and $500,000 as an endowment for an institute of learning.

Edwin A. Stevens, the founder, died in 1868, having made provision in his will for three trustees of the institution he had endowed.

These three trustees were his wife, Mrs. Edwin A. Stevens, his brother-in-law, Mr. Samuel Bayard Dod, in early life a minister of the gospel and later a financier devoted to the interests of the Stevens family, and Mr. William W. Shippen, Commander of the "Naugatuck" during the Civil War.

[illustration] Old Print of Main Building, 1871

These trustees sought the assistance of Dr. Henry Morton, a young but prominent scientist, who was chosen as president of the newly created School. It was decided later by the Board of Trustees and President Morton that it should be a School of Mechanical Engineering, and that it should be known as the Stevens Institute of Technology.

The first accession to the Board of Trustees was in 1885 when Dr. Henry Morton was elected a member. From then until the present time the number of permanent trustees has increased from three to a maximum of sixteen, there being twelve at the present time.

From the inception of the Institute until 1908, it was the practice to supervise scholarship through the heads of departments during the term and by

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joint meeting of the entire teaching force at the end of the term. Discipline was also administered in the same general manner.

In 1908 President Humphreys appointed class Deans—one dean to each of the four classes—who were given special authority as to scholarship and discipline. During the past year the chairman of the Committee of Student Activities was appointed a member of the Scholarship and Discipline Committee.

In 1906 the Senior Class, deeply impressed with President Humphreys' oft expressed feelings in the matter of honesty in examinations, voluntarily requested an examination on honor without the presence of professor or instructor. The request was granted and the success of this trial led to the adoption of the Honor System in examinations for all classes, then to its adoption to all the study work of the students and finally in 1908 to the adoption of Student Self-government, which now prevails in the institution.

Buildings were erected and the school was opened in September 1871. The substantial single building in which the Institute began its educational work was built at a cost of about $150,000. It was erected on a city block of about two acres in the centre of the residential district of Hoboken adjoining the extensive grounds of the Stevens estate.

The remarkable growth of Stevens Institute will be appreciated when it is known that the grounds today occupy twenty-two acres, including nearly all of the original Stevens estate and an adjacent city block together with many buildings which have been erected since 1902.

As the growth of Stevens has been made possible only by the generosity of the many friends of the Institute, it seems fitting to set forth the sources from which the necessary funds were received and the original endowment fund increased.

The total amount contributed during the period from 1871 to 1902, as recorded in the Morton Memorial Volume, amounted to $420,000. $145,000 of this amount was contributed by President Morton, $165,000 by Andrew Carnegie, $60,000 by the Alumni, $30,000 by Mrs. E. A. Stevens, $11,000 by Dr. Jacob Vreeland and $8,000 by the American Railway Mechanics Association. These added to the original endowment of Edwin A. Stevens made an aggregate amount of $920,000 which does not include the value of the grounds and the building fund amounting to about $250,000 originally bequeathed by Mr. E. A. Stevens.

The record of subscriptions following those enumerated above begins with

[illustration] Main Building from Castle Gate, 1871

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the Scholarship Endowment of $5000 in 1902 by Alexander C. Humphreys, in memory of his son Harold Humphreys, and two years later of a further scholarship fund of $5000 in memory of his younger son Crombie Humphreys. Further subscriptions of $60,000 were made by the Alumni in 1903 and 1904. Since 1912 the Alumni have contributed $25,000 for a special Graduate Fund, $40,000 for a War Memorial Scholarship Fund, $220,000 toward the campaign

fund of 1915 and about $132,000 in 1919 and 1920 for an additional endowment fund to meet increased salaries and reconstruction necessary to take care of a growth of more than one hundred per cent in attendance which took place from 1915 to 1920. The total Alumni subscriptions to date have amounted to more than $507,000.

[photo illustration] Old Lecture Hall, Looking South, 1871

In 1903 Mr. Andrew Carnegie gave $125,000; in 1905, $50,000 for endowment, and in 1911, $10,000 for a special purpose. In 1915 he gave $250,000 I toward the campaign fund and at the time of his death bequeathed an additional sum of $100,000. Mr. Carnegie's total gifts to Stevens have amounted to $717,000.

In 1903 Mr. Edwin A. Stevens and Mr. Robert L. Stevens, sons of the founder, gave a valuable piece of land 196x100 feet to the college and in 1905 Robert L. Stevens gave an additional piece of land valued at $15,000.

Dr. Edward Weston, a trustee of the college, made several subscriptions aggregating $26,000. In 1910 and 1911 President Humphreys announced five gifts of $25,000 each, received from friends of the institution. In 1912 and I 1913 miscellaneous gifts totaling $37,000 were made.

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[photo illustration] Auditorium, 1904 Previously Old Lecture Hall

In 1915 an intensive campaign to secure $1,385,000 was successfully carried through by President Humphreys and a committee of the Alumni headed by Mr. Walter Kidde of the Class of 1897. During this campaign $250,000 was contributed by the General Education Board, $100,000 by William Hall Walker, $565,000 by non-graduate friends of the college. These with other amounts previously mentioned in this outline made up the total of $1,385,000.

The total of all gifts during the era beginning with the year 1902 amounts to about $1,950,000, making a total received by the college when bequests of the founder are included of about $2,870,000. The generosity of friends of Stevens has not only enabled the institution to progress but has made it possible to maintain a reasonable rate for tuition.

The tuition fee paid by the student during the early years of the college was $150 for the youth of New Jersey and $225 a year for others. In 1911 it became necessary to increase the fee to all students to $225. In 1920 a further advance was necessary and the yearly fee was increased to $275.

Advancement in The course of Study

A BRIEF REVIEW of the changes that have taken place in the course of study at Stevens should prove of especial interest.

The Stevens Institute of Technology was the first educational institution in America to give a course in mechanical engineering and to give a degree in that subject. The work done by President Morton and the strong corps of professors associated with him was pioneer work. The course of study was developed during the first quarter of a century to meet practical demands that grew out of the remarkable mechanical and power engineering developments that took place during the years following 1870.

[photo illustration] Auditorium at Present Looking South

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The records of the graduates of Stevens show that they played no inconsiderable part in that development—the theories and the knowledge that they carried from their Alma Mater finding a wide and ready application in the practical industries.

The early technical studies were those of mathematics, mechanics, physics, chemistry common in the mechanics arts courses that existed in several colleges and universities then established. These courses, as taught at Stevens, were more specifically adapted to practical application in the industries, and shop, laboratory and drafting and designing courses were added at the start.

In the developments that followed, the wisdom of President Morton in directing the course was prophetic and stands out more and more prominently

[photo illustration] Original Mechanical Engineering Lecture Room

as time goes on. He held rigorously to a broad basic course of study that would fit a graduate to enter and successfully develop in any branch of engineering that he might select. This policy of President Morton has been strictly adhered to by his successor who is still directing the course at Stevens. Stevens is today the only large institution, so far as is known, giving a single course in engineering—860 students during the past year all pursuing the same course leading to the degree of Mechanical Engineer. With this degree Stevens graduates have occupied the highest places in gas works engineering and management, electrical engineering, hydraulic engineering, heating and ventilating, chemistry, telephony and telegraphing, wireless work, marine engineering, railroad engineering, automobile engineering, aviation and scores of other specialties.

One of the notable developments in the course of study was that of Business

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Engineering, inaugurated through the effort of Alexander C. Humphreys in 1896. This course has become a strong feature of Stevens work. Since 1903 it has been carried on by President Humphreys as professor. The course now named Economics of Engineering is recognized as having had its inception at Stevens and is an important part of most engineering courses in many colleges and universities.

The electrical engineering department started at Stevens in the early eighties has been an exceedingly strong one during the past fifteen years, and likewise the chemistry department has maintained the high standing of early years. Other departments devoted more particularly to mechanical subjects have had strong impetus under the encouragement of President Humphreys.

[photo illustration] Present Junior Drafting Room, including Former Old Mechanical Engineering Lecture Room and Adjoining Room

In the mechanical departments the work of mathematics and mechanics j has been separated. The independent courses of mechanical drawing and machine designing have been combined. These changes have been followed by marked increased efficiency in both instances.

In 1907 a department of Structural Engineering was added with a structural engineer of wide experience at its head. In 1918 a course in Public Speaking was added in the department of English and Logic.

The library has been placed in charge of a professional librarian, thus increasing its usefulness to both students and faculty.

In 1915 a department of Physical Education was added. All students are

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now required to meet a regular schedule of exercises fitted to the students as classified and men physically defective are given special treatment.

Athletics, although encouraged, are subordinated to the physical well being of the participants. Athletics are pursued as a clean sport and are free -from any taint of professionalism or commercialism. The Director of the gymnasium, Mr. John A. Davis, did much during the war for the Y. M. C. A. in connection with the Pershing Stadium in Paris. He has since introduced a physical education system in Rumania, having been granted a leave of absence from Stevens for that purpose.

The arrangement of the courses has been the subject of special consideration by President Humphreys and the faculty, and in 1908 a complete readjustment

[photo illustration] Old Machine Shop

took place with a view to better co-ordination of the work of the several departments and a balanced scheme of study for the students. In making this readjustment the college year was divided into three terms each year instead of four terms. Saturday, which had heretofore been a free day, was scheduled for class work during the morning hours and Wednesday afternoon was left free.

In the adding of several departments and courses and in introducing new subjects into established courses, the greatest care in elimination of old work, so as to preserve a well-balanced curriculum, has always been observed.

A feature of the work of recent years has been the introduction of moving pictures of a technical nature, at specially assigned periods, as suitable subjects presented themselves. These, together with special lectures and exhibitions on current engineering work, have been encouraged.

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[six photo illustrations] Views in Some of the STEVENS SHOPS, 1921

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[photo illustration] Old Field House—St. George Cricket Grounds

In order to carry on the work, the greatest possible latitude has been granted to the several departments in providing apparatus and equipment for suitably presenting technical and engineering information to the students. In this the students themselves have generously co-operated, the custom established many years ago of the graduating class giving its entrance deposit money at Commencement time to the college to purchase apparatus and equipment, having been continued with but few exceptions. The sums so presented by the classes range from a few hundred dollars to over a thousand dollars each year and in the aggregate they constitute a valuable addition to the college equipment. A large number of manufacturing and engineering firms and individuals have also made contributions of the same nature that have aided greatly in the classroom and laboratory teachings. An

example in each case is that of a new switchboard for the electrical laboratory presented by one of the classes and a valuable electric continuous blue-printing machine presented by the manufacturer of the machine.

In 1914 the first class was admitted to Stevens on the certificate system.

Previous to that year the certificate system had been generally adopted by the leading colleges in the United States, and it was found that applicants

[photo illustration] William Hall Walker Gymnasium, 1916

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[photo illustration top]
View of Castle from Chemical Laboratory before Gymnasium was built. Large open space back of field stand now occupied by practice field

[photo illustration bottom]
View from Castle showing Castle Point Field on right. Practice field in centre and faculty tennis courts on left. Gymnasium, part of students' tennis courts, roofs of Chemical Laboratory, large Navy Building and the original college building, now the Administration Building, may be seen in background

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best qualified to enter Stevens often refused to pass entrance examinations to enter Stevens when it was possible for them to enter any of the other first-class colleges of engineering without passing examinations.

In adopting the system for Stevens, certificates were accepted only from such schools as it was determined offered educational advantages that insured students properly qualified to enter Stevens.

Certain difficulties have of late developed, and the system of admission by certificate is now being reinvestigated to determine the wisdom of its modification or abandonment.

SCHOLARSHIP AND PRIZES

THE first scholarship at Stevens Institute was awarded by the college authorities in 1877, the Stevens Preparatory School being designated as the one whose graduates should be eligible. This school was founded in 1872 by the trustees of Stevens Institute and located on the Institute grounds. Its purpose was to facilitate the preparation of young men to meet the entrance requirements of the Institute which were in advance of the course of most of the preparatory schools from which the Institute drew its students at that time. A scholarship confers the privilege of attending the entire course for four years, free of all charge for tuition, provided, however, the students holding these scholarships keep up with the standard of proficiency and good conduct required. During each of the three years succeeding 1877,

a scholarship was awarded graduates of the Stevens School so that a scholarship would be available each year. The Stevens Preparatory School was dissociated from the Institute a few years ago and the work of that school is now carried on under independent ownership and management, and in a building secured for the purpose not on the Institute grounds. An Advisory Board representing Stevens Institute still co-operates with the Stevens Preparatory School authorities in the matter of the continuance of the award of the four scholarships. Three other scholarships are awarded by the Institute to graduates of public and private schools and one to another private school, all located in Hudson County, New Jersey, making eight that are supported by the general Institute endowment.

The first scholarship awarded under a paid-in endowment fund was established in 1882 by President Henry Morton. Four other scholarships were endowed later making a total of five specially endowed scholarships in 1902, and eight unendowed.

In 1902 President Humphreys endowed a scholarship and in 1904 he gave funds for a second scholarship. Since then the William R. Beal Scholarship, the Cawley Scholarship and four Alumni Memorial Scholarships have been added, making a total of eight endowed scholarships awarded during this later period.

In connection with the establishment of scholarships, the trustees of the

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[photo illustration] Commencement Day, June 8, 1920

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Institute announced a few years ago that they were prepared to establish perpetual scholarships, to be known under the name of the donor, or such other title as may be suggested by the donor, and may be accepted by the trustees upon the basis of an endowment of $5000. This endowment covers the tuition fee of the student but does not cover the cost to the Institute in giving the student his education. In the preceding pages it was pointed out that the grand total of gifts to the college, including the bequests of the founder, amounted to $2,870,000. Assuming an obligation of five per cent per annum on this investment, a large part of which represents land and building values of many years ago, and adding this obligation to the present operating expenses, it is found that the cost to the college of educating each student is about $500 per year. With this in mind, the trustees have pointed out that a scholarship endowment may be increased above $5000, if the donor desires to meet a major part or all of the total cost of educating his beneficiary without the assistance from income from other endowments. A complete scholarship endowment fund would be $10,000.

Prizes for excellence in scholarship are awarded each year. The first such prize amounting to $25, known as the Priestly Prize, was awarded in 1877. These prizes are paid from the income derived from permanent endowments made for the purpose or from specific gifts for the purpose made by friends of the Institute. Prizes awarded since the compilation of the Morton Memorial Volume are the Mary Starr

Stillman Prize of $50 for the best paper pertaining to Applied Technology. This prize was discontinued on the death of Dr. Stillman.

The Cyrus J. Lawrence Prizes—one for $50 and one for $25—are awarded to students who are adjudged first and second "in influence promoting student activities, in fostering a spirit of co-operation between the faculty and the student body, and, in general, in contributing to the elevation of the ideals of student life."

In 1916 Mr. John Aspinwall permanently endowed two prizes—one of $30 and one of $20—to be awarded annually as the Alfred Marshall Mayer Prizes in Physics.

Attendance

THE COLLEGE opened in September 1871 with a total enrollment of 21 students and two years later conferred the degree of Mechanical Engineer on its first graduate, J. Augustus Henderson, who was the sole member of the Class of 1873. During the college year of 1880-81, the attendance reached the 100 mark, and nine years later, the 200 mark. During the year 1902-03, the attendance reached a maximum, to that date, of 291 students. During the earlier years of the college it was difficult to find Candidate-students who were sufficiently prepared to take up the training that President Morton and his associates were trying to give and which they felt was necessary to

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[photo illustration] Old Experimental Laboratory in Basement of Main Building

equip young men for the places they were desired to take in practical engineering and manufacturing work. As a result, many of those who entered were dropped out and the graduating class of 1877 represented but 29 per cent of those who entered with that class. After the Stevens Preparatory School was established and well under way, conditions improved materially, and in 1880, when the Preparatory School contributed a notable proportion of those entering, the percentage of those graduating jumped from a previous maximum of 44 per cent to 56 per cent.

[two photo illustrations] Student Exercises in Carnegie Laboratory of Engineering, 1921

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[photo illustration] Old Chemical Laboratory Formerly in West Wing of Main Building

There was a rapid increase in attendance during the four years following 1902, the totals rising from 291 in that year to 449 in 1906. In 1914 the attendance again developed a rapid growth, this time reaching the undreamed of figure of 862 in 1920—the more remarkable and significant when it is considered that all of these men were pursuing the single broad course in Mechanical Engineering without specialization of any kind.

[photo illustration] Chemical Laboratory in Morton Memorial Laboratory of Chemistry

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THE FACULTY

THE original faculty of Stevens Institute of Technology consisted of eight members, all selected while still very young men, and all reaching great and national eminence in their respective lines of work while associated with Stevens. One of this number, Professor Kroeh, is still living and is in active vigorous service at the college at the ripe age of seventy-five. With one exception, all of the original faculty died in the service of Stevens. The remarkable attainments of all of the members of this original faculty constitute, undoubtedly, the most brilliant page in the history of Stevens. The first of these men, selected by the original Board of Trustees, was Henry Morton, scientist and President of the college. The other members, selected through the unerring discernment of Mr. Dod of the Board of Trustees and

[photo illustration] Stevens Tech with lower portion of Hudson Park in foreground. Portion of Park shown now occupied by Y. M. C. A. hut erected during war

President Morton, were Alfred Marshall Mayer, physicist; Robert Henry Thurston, engineer; Edward Wall, English scholar and logician; Charles William MacCord, engineer-draftsman, previously associated with John Ericsson; Albert Ripley Leeds, chemist; Charles Frederick Kroeh, philologist; De Volson Wood, mathematician and engineer. Lt.-Col. H. A. Hascall was the original appointee in the Department of Mathematics but when the college opened he was prevented from serving by ill health which continued to incapacitate him, and this work was carried on by a temporary instructor. The following year Professor De Volson Wood was appointed in Lt.-Col. Hascall's place.

The men of the original faculty carried on the work of the college single handed, that is, without the assistance of others of faculty rank, for eight years until 1879 when the faculty was increased by one member and again

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until 1882 when it was increased by one more member. From that date until 1902 the faculty grew to a maximum of 22 members in 1897 and had twenty members in 1902.

In 1903 the faculty was increased to 25 members, and to 50 at the present time. During all of the years from the beginning, there have been teaching assistants who have not ranked as faculty members. At the present there are fourteen such instructors.

[photo illustration] Stevens Castle Conservatory and Sunken Gardens in the Early '90's

BUILDINGS AND GROUNDS

DURING the year of 1870 and the early part of 1871, a single building, 180 feet long and 44 feet deep with a central rear wing 80 feet long and 50 feet wide and a west wing 80 feet long and 30 feet wide, was erected. Two years later an east wing, 60 feet long and 30 feet wide, was added. The building contains a light dry basement used at present for shop work, three floors and a square tower and floor over the front center of the building. This building with a small addition made to the central wing in 1889, accommodated all the departments until 1893 when the space between the central and east wings was walled in. When the Stevens Preparatory School was established in 1872, it was quartered in the east wing of the original building, but in 1888 the college needs became so pressing that it was necessary to construct a special building for the preparatory school. This was erected in the rear of the east wing, thus leaving the entire main building free for Institute work.

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The first new college building was the Carnegie Laboratory of Engineering, the gift, with endowment of $225,000, of Mr. Andrew Carnegie in 1901 and 1902. The building is approximately 120 feet by 60 feet and is constructed on the original block of land immediately at the rear of the west wing of the main building. It was specially designed to meet the needs of the Department of Experimental Engineering which had greatly outgrown its accommodations in the basement of the main building. At the time of the construction of the Carnegie Laboratory, President Morton gave $15,000 for the construction of a boiler house which was then built adjoining the new laboratory. The dedication of the Carnegie building in February 1902 was one of the crowning events in President Morton's life. A few months later he became resigned to

[photo illustration] Main Building Showing Carnegie Laboratory in Rear on Left

an illness that had for some time caused him pain and anguish, and in May 1902 he passed away. He had given of his fortune with rare liberality and he had labored incessantly for Stevens. Through his final efforts, Mr. Carnegie had become deeply interested in the college—interested far beyond the knowledge of President Morton, for Mr. Carnegie continued his benefactions after President Morton's death until they totaled the magnificent sum of $717,000, as already mentioned in this outline. It will always be remembered at Stevens that Mr. Carnegie's last gift of $100,000 was one of very few bequests to colleges revealed in his will at the time of his death in 1919.

When President Humphreys took up the work of his close friend and predecessor in 1902, all but a relatively small comer plot of the original block of land was occupied by the buildings above described, with the addition of a

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residential building which occupied the fourth corner of the block. This land, together with a plot 100x196 feet on an adjoining block given by Mrs. Edwin A. Stevens at the time of the twenty-fifth anniversary celebration of the college, formed the then limited bounds with which President Humphreys had to deal in 1902. Even at this time the college had again outgrown its bounds and during the four

years from 1902 to 1906, there was an additional growth of 54% in attendance, making imperative still further additions.

In 1904 the central wing of the main building was vacated by the machine shops, which were moved to the basement, and was reconstructed as an auditorium to accommodate the entire student body. Seven hundred seats

[photo illustration] View from corner of Hudson and Sixth Streets, showing small Navy Building in right foreground and large Navy Building in background, both erected by United States Government during war for United States Navy Steam Engineering School. Small Navy Building has been extensively remodeled for use as a library and historical museum, and large Navy Building for use by the department of electrical engineering and for general lecture rooms.

were provided and this was thought to be far beyond future needs, but at this writing it falls short by 160 seats and alternating schedules are necessary to accommodate the student body. With the acquisition of the new Auditorium it became possible for the first time since 1880 to hold the Annual Commencement Exercises in the college building. For twenty-four years these functions had been held in various churches, halls and theatres in Hoboken. When the central wing was reconstructed in 1904 an addition was made to the north end of the wing to provide suitable place for the foundry and pipe

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fitting courses. Also in 1904, the engineering lecture room was enlarged by including an adjacent hallway; the photometric room was reconstructed, and the dynamometer room was rearranged and renovated.

In the year 1905 the third large new building was erected on a newly acquired plot of ground purchased from the Stevens estate and diagonally opposite the original block of land. This building had for a number of years been the cherished hope of President Morton and the Alumni who had jointly contributed about $60,000 toward it in 1901—much the larger part by President Morton. Through the efforts of President Humphreys, the Alumni had increased this sum to about $150,000 in 1905 when the building was dedicated to the memory of President Morton as the “Morton Laboratory of Chemistry.”

[photo illustration] View from corner of Hudson and Sixth Streets looking south, showing end of small Navy Building, Carnegie Laboratory and Main Building

Although President Morton was a scientist in the broadest and highest sense of the word, his chief attainments were in the field of chemistry. The Morton Laboratory, substantial and ornate in architectural design, was pronounced to be the most completely and efficiently equipped college chemical laboratory of that time. It was built from plans laid down after a committee had inspected chemical laboratories in this country and in Europe, and it is no more than a fitting memorial to President Morton.

When the chemical department vacated its rooms in the west wing of the main building, in 1906, lecture rooms and a library reading room, much needed, were fitted up. In 1908, two wings, each containing

three lecture rooms, were added to the Preparatory School building, one wing being devoted to Institute work and the other to Preparatory School work.

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[photo illustration top] Corner of River and Sixth Streets looking south, showing large Navy Building on left and Recitation Hall, formerly Preparatory School, and Main Building on right

[photo illustration bottom] River and Sixth Streets looking east, showing Morton Memorial Laboratory of Chemistry and Castle Point Gate on left and corner of large Navy Building on right

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[photo illustration top] Eighth Street. Gate through which may be seen Drive leading to Castle Point Field and to Castle Stevens

[photo illustration bottom] A view in New Library recently removed from Main Building to second floor of small Navy Building

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[photo illustration top] Castle Stevens Showing Old English Elms in Foreground

About 1905 it became definitely known that the Athletic Field, heretofore used by the students for their outdoor exercises, owned by other interests and far removed from the college buildings, would shortly be taken over for building purposes and for a City Park. Through negotiations with the Stevens family and with the City of Hoboken, which reserved certain street rights on the grounds of the Castle Point property, President Humphreys was finally able to secure about eleven acres of the private Stevens grounds adjacent to the college building for the use of an Athletic Field. Notwithstanding that these eleven acres lay in the most favorable section of the property for the purpose, much grading and draining had to be done. Many difficulties, however, were over-

[photo illustration lower left] Campus Lawn—Castle Point

[photo illustration lower right] Main Drive—From Castle

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[photo illustration top] Castle Stevens—Western Exposure

come and in 1907 the new “Castle Point Athletic Field” was finished and a commodious grand stand, for that time, and a field house, erected. At the dedication of the new field, the Class of 1897 presented an elaborate wrought iron memorial gate located at the main entrance at the north end of the field. In 1909 the Class of 1899 presented a suitable flagpole situated near the main entrance and from which the Stars and Stripes may be viewed from nearly all points on the college grounds.

In 1910 President Humphreys announced at the annual Alumni meeting that he had taken option on the purchase of the estate of Col. Edwin A. Stevens, including the old historic Castle, and that this together with a previous option on the adjoining land of Robert L. Stevens, would give the entire Castle Point property to the college, up to the Richard Stevens land, in other words, all the Stevens property from Sixth to Eighth Streets and from Hudson Street to

[photo illustration lower left] Castle Stevens—View through Porte-cochere

[photo illustration lower right] Castle Stevens—Practice Field from Porte-cochere

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[photo illustration] William Hall Walker Gymnasium-Swimming Pool

the River Road on the Hudson River shore. This property was purchased May 15, 1911, and at the annual “Alumni Reunion Day” gathering on May 27th, Edwin A. Stevens, Jr., on behalf of his father, turned over the keys of the Castle that had been the home of the Stevens family for nearly a century and a quarter. Extensive renovations were made and the Castle refitted to serve as a home for about forty-five students and as a gathering place for all under-graduates and for the Alumni and Faculty.

During 1915 and 1916 the William Hall Walker Gymnasium was built with funds given by Mr. Walker at the time of the $1,385,000 campaign already referred to. This building is of variegated deep-tone red brick and of unusual architectural design, being oval in form to provide a maximum of natural illumination for the running track in the balcony and for athletic events on the main floor which is 110 feet long and has an average width of 35 feet. A lower floor contains two large exercise rooms. Under a broad brick outdoor court leading to the main entrance of the gymnasium is an all-tiled swimming pool with natural illumination from side windows and from crystal flooring in the court above. The gymnasium was dedicated November 18, 1916.

Extensive alterations were made to the original building in 1916 and 1917. Two of the lecture rooms on the second floor were converted into a drafting room 60x40 feet, by removing a partition and reinforcing the floors with steel beams. The same type of reconstruction had been involved in previous reconstruction of other rooms, notably the Physics lecture room, and the lecture rooms in the east and west wings. The new drafting room was later equipped with a remarkably efficient artificial lighting system which has since been installed in the two older drafting rooms, in the newly equipped library and in several offices. A covered second-floor passage-way about 120 feet long was constructed to connect the original building with the Preparatory School building.

[photo illustration] William Hall Walker Gymnasium—Main Floor and Running Track

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In 1917 the Stevens School was discontinued by the college trustees and the building formerly used by the School was converted into a Recitation Hall providing lecture rooms and offices for the Departments of Engineering Practice, English and Logic, Mathematics, Mechanics, Modern Languages and Structural Engineering. The basement of the building was converted into a locker room for the entire student body.

The large college enrollment of the past year, 1920-21, made it necessary to secure additional classroom and drafting-room space. This situation was met by purchasing from the United States Government two ordinary brick barracks buildings that had been erected on the college property during the

[photo illustration] Castle Stevens Rotunda

World War for housing, young men who were training for engineer ensigns. Although not suited to the college needs, one of these buildings, 56x100 feet, located at the corner of Hudson and Sixth Streets on the original block of land, has been refaced and window and door arches reconstructed. The interior has also been reconstructed and the second floor newly equipped for housing the college library which was cramped and disconnected in its old quarters in the main building. Furthermore, the space occupied by the old library offered the most satisfactory solution to the problem of securing necessary additional drafting room space. The first floor of the “barracks” is being fitted up as a museum, the exhibits of the early Ford car and of the car specially constructed in the course of the litigation involving the Selden Automobile Patents being already in place. A large amount of important historical engineering machinery

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[photo illustration] Physics Laboratory—Exercise in determination of mechanical equivalent to heat

and apparatus has accumulated at the college and has been scattered throughout the building in crowded spaces where it could not be appreciated. These exhibits are now being reassembled in the new museum and it is hoped they will afford interest and inspiration to the young men who come to Stevens. The third floor is devoted to offices for the large number of student societies and organizations whose activities offer healthful relaxation from the grind of technical study.

The second barracks building constructed by the United States Government is on the block of land directly east of the original college grounds. This new land comprises the plot of 196x100 feet given in 1897 by Mrs. Martha B. Stevens, the remainder having been purchased in 1916 for future college extensions. The larger barracks building here referred to is U-shaped and is 156x156x100 feet around the outside walls. Four lecture rooms with specially reconstructed soundproof walls have been constructed, and the basement is being used for the large truss-construction exercises in the carpentry course. The south wing of the building is being remodeled inside for use by the Electrical Department. This building was not quite finished at the time of the armistice but was nevertheless completed by the

Government and sold to the college for a very nominal price. The purchase included a valuable boiler and heating equipment.

THE ALUMNI ASSOCIATION

THE Alumni Association of Stevens Institute of Technology was formed in 1876 and has always been active and energetic in promoting the interests of the college. It has made an enviable record of deeds accomplished, including: the establishment of a beneficiary fund for worthy and needy students from which twenty-one young men were assisted up to 1902 by amounts varying from $50 to $200; a library fund of over $900; a portrait fund for portraits of trustees and faculty including a life size portrait of President Morton for which more than $1000 was subscribed; a souvenir book descriptive of the life of President Morton; the raising of large sums at different

[photo illustration] Electrical Laboratory—Exercise in measuring losses of induction motor

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times for purchases of land and buildings as already told in the financial record; the establishment of an employment center for the graduates of Stevens; the publication of Alumni business directories, and publication of the Morton Memorial Volume, a large imperial octavo book of 640 pages giving a history of Stevens Institute of Technology, a record of the engineering achievements of the Stevens family of engineers and biographical records and photographs of trustees, faculty and alumni. At the time of the twenty-fifth anniversary celebration in 1897, the Alumni Association did yeomen work in co-operating with the faculty in bringing together a remarkable exhibition of the work done by the Alumni during the first quarter-century.

[photo illustration] One of the Students' Rooms in Castle Stevens

Since 1902 the Alumni Association has maintained a loyalty to its Alma Mater that is believed to be unsurpassed. President Humphreys has had Herculean work to do in meeting the current demands of a remarkable and unexpected growth and at the same time has had to meet conditions that had to be taken advantage of at once, if the future expansion of the college were to be provided for. President Humphreys has frequently given voice to the feeling that he never could have accomplished the work he had to do had it not been for the intense loyalty of the Alumni in giving encouragement and funds at critical periods.

A custom inaugurated in 1912 was that of a theatre party in one of the New York theatres with a supper-dance afterward at the Hotel Astor. These parties bring out a goodly number of Alumni and their wives and friends, a

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large part of the theatre including the boxes, orchestra and balcony being reserved for the Stevens party, usually consisting of three hundred to one thousand people.

The tenth anniversary of Dr. Humphreys' administration was specially celebrated by the Alumni at the annual Stevens dinner held at the Hotel Astor, February 14, 1912. A large number of special guests including many men of note were present and the work accomplished by President Humphreys during his first ten years was reviewed and sincere acknowledgment was made of the high appreciation of what he had done for Stevens.

In 1914 the Association arranged a "Technical Conference" at the college in which "The Engineer's Part in the Regulation of Public. Utilities" was discussed. This subject was of popular interest at that time and the discussions, widely quoted, were entirely by Stevens graduates: President Humphreys, '81, of the college; John W. Lieb, Jr., '80, Vice-President of the New York Edison Company; Newcomb Carlton, '90, then Vice-President, now President, of the Western Union Telegraph Company; James E. Sague, '83, then a member of the Public Service Commission, Second District, New York, and George Gibbs, '83, consulting engineer for the Pennsylvania Railroad.

During the World War the Alumni Association early took up the work of organizing for preparedness and later when the United States entered the war was ready to formally guide and place a large number of Stevens men in various engineering departments in the government war work. As early as 1916 a series of preparedness lectures were started at the college, inaugurated by General Leonard Wood, U. S. A. Over one hundred Stevens Alumni and students attended the Plattsburg Camp that summer. After the war the records of the Stevens men officially engaged was carefully compiled by the librarian of Stevens Institute of Technology, the results showing a total of 1264 which was the number finally placed on the Stevens Service Flag. Of these, thirteen died in action, ten of disease and six from accident. Ten were decorated for valor. The total of 1264 is made up of 567 in the Army, 217 in the Navy, 8 in the Marine Corps, 16 in Foreign Armies, 2 in Welfare Work and 452 in the Student Army Training Corps at the college. The Training Corps received from the United States Government special consideration due to the nature of the engineering course at Stevens, waiving the formulated ratio of the number of men in the Army and Navy Sections of the Students Training Corps, with the result that there were 212 in the Army Section and 240 in the Navy Section. To the credit of Stevens it should be added that very many of the Alumni served in a self-sacrificing way in a civil capacity, in speeding up the engineering side of the "great engineering war" in factories, power plants, structural yards, laboratories and in educational engineering work. The training of the Stevens Alumnus had been such that he was peculiarly fitted to give immediate aid in preparing this country for its great task in 1917 and it is estimated that more than 75% of the entire Alumni body were doing a specific work that aided directly or indirectly, in the very rapid progress that characterized the engineering war work of this nation.

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Miscellaneous

IN 1904 the college adopted the custom of wearing caps and gowns at the Commencement Exercises and at special academic functions. The following year Stevens adopted orange as the color to designate the engineer on the hoods of the academic costume. Previous to this, lemon color, which designated Science, was the nearest approach for engineering use. In 1906 President Humphreys took up the subject of having orange adopted as the academic color for the engineer with the presidents of a

number of leading colleges and it was later adopted by the Society for the Promotion of Engineering Education as the color for engineers.

About ten years ago, friends of President Humphreys secured the service of Mr. John W. Alexander, the noted artist, to paint a full size portrait of Dr. Humphreys. The work was admirably executed and presented January 10, 1914, at the annual banquet of the Alumni Association at the Hotel Astor in New York City. This portrait now hangs in the Memorial Room of the Carnegie Laboratory of Engineering with that of the first president of Stevens and those of the trustees and faculty that have been presented from time to time.

UNITED STATES NAVY STEAM ENGINEERING SCHOOL

EARLY in 1918 the United States Navy established a steam engineering school at Stevens, the school being placed in the hands of Professor Frederick L. Pryor, M.E., Professor of Mechanical Engineering at Stevens, for organization and for development of a course of study specially designed to train young men as engineer ensigns to operate the large fleet of naval vessels then under construction at various ship and engine building plants throughout the country. In organizing the school, Professor Pryor had the co-operation of Navy officers specially detailed for the work, and in planning the course of study, the co-operation of several members of the college faculty who delivered the first series of lectures on their special subjects.

The candidates for the course were graduates of engineering schools throughout the country insofar as they could be obtained in the large numbers desired, and the least requirement was that the candidate should have had an equivalent engineering training and experience. The course of training for the engineer ensign required a period of several weeks at the Naval Training School at Pelham Bay, then several weeks at Stevens after which shop and shipboard engineering experience were required when the student again returned to the school for further study and examination. The complete course of training required about five months after which the successful student was commissioned as Engineer Ensign.

To facilitate the work of the school, the Government detailed a large corps of commissioned instructors who took over the instruction, under Professor

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[six photo illustrations]
In the Class Room
In the Drafting Room
In Carpenter Shop
In Electrical Laboratory
In Mess Hall
In Dormitory

Students Training for War Service Stevens Institute of Technology

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Pryor's direction, after the Stevens faculty members had given the first few lectures and were released for work with the large number of students taking the regular Stevens course as members of the Student Army Training Corps. The college buildings, being already crowded with students of the regular course, the Government erected a brick barracks building 56x100 feet on the Institute grounds. This, however, soon proved inadequate, as it was planned to train six thousand ensigns. Shortly after the first barracks was erected, a second one, three times as large, was started on nearby land belonging to

[photo illustration] Stevens Institute of Technology
Graduation Day - Class No. 10 - of United States Navy Steam Engineering School

the college and this was well on toward completion when the armistice was signed. Those men who had entered the school at that time were continued through and the school was closed June 28, 1919, after having enrolled a total of 1779 men and graduating 1465 as commissioned Engineer Ensigns. One of the residential buildings on the college grounds was placed at the disposal of the Government and used as a Naval Dispensary.

The work of this school, which was the only one established by the United States Navy for steam engineering, was specially commended by Franklin D. Roosevelt, then Assistant Secretary of the Navy, in the following letter addressed to Dr. Humphreys.

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Navy Department, Washington, D. C.

June 5, 1919.

My dear Dr.Humphreys:

Before the United States Navy Steam Engineering School suspends operations, I wish to express to you the Navy Department’s sincere appreciation of the magnitude and value of the work which it has accomplished.

One of the most serious problems which confronted the Navy almost from the entrance of the United States into the World War, and which increased in gravity as the war went on and the Navy’s mission became more and more clearly defined, was the one of supplying engineer officers for the very large number of merchant-type vessels which the Navy was called upon to operate. As you know, there was no considerable surplus of skilled marine engineers available when all existing vessels were fully manned; consequently we were required literally to create them by thousands to man the great number of new vessels which the Shipping Board was building for the Navy to operate in the war zone.

When it became apparent that we must take advantage of existing educational facilities not under Government control, we naturally turned to Stevens for help. Your response was immediate and most generous. There were no preliminary negotiations—nothing but an expression of a sincere desire to

help in every way in which you could be helpful; and the Steam Engineering was a going concern almost as soon as the matter was broached.

For reasons of policy during the war time the school was designated as a Navy School at Stevens Institute, and was ostensibly under the direction of the Department. As a matter of fact it was a special activity of the Institute itself, with the Navy assisting to some extent and directing hardly at all. The school could neither have been organized nor have been successful without the loyal support accorded by yourself and the trustees and faculty. That the school has been entirely successful is beyond question; and there is no doubt that had the war continued and the building program progressed as originally planned, the Navy would easily have met the demands for competent engineer officers as fast as the ships were ready for service.

It would be superfluous for the Department to call your attention to the organizing and executive ability of Professor Pryor, or to the wholehearted enthusiasm with which he has thrown himself into the work as Director of the Navy School; but I wish him to know that the Department is deeply sensible of his contribution to the cause.

It would be extremely pleasing to the Department if you were to see fit to communicate the contents of this letter to all who have helped in this splendid successful endeavor, and perhaps to the Alumni. The latter have a right to take great pride in their Alma Mater's contribution to the Navy's share in winning the war.

Again thanking you, I am

Very sincerely yours,

(Signed) FRANKLIN D. ROOSEVELT

Assistant Secretary of the Navy.

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[photo illustration top] Stevens Institute of Technology—Students' Army Training Corps, Navy Section —Drill Formation

[photo illustration bottom] Stevens Institute of Technology—Students' Army Training Corps, Army Section —Drill Formation

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THE ALUMNI

IT SEEMS fitting at the present time to briefly mention some of the many achievements of the Stevens Institute of Technology Alumni and to indicate the participation of its members in the progress of the world's affairs since the institution was founded in 1871.

An article entitled "Contributions of Stevens Tech to the Welfare and Progress of the Country" by Professor Furman appeared in The Indicator in 1915, in which was clearly outlined not only the influence exerted by Stevens Institute of Technology but also by its many graduates. It seems fitting to reprint at least a part of this article here.

"We are concerned with the mechanic arts and the wealth and comfort that have come to a great and unknown number of homes in our land as a result of the improvements in and the exercise of these arts. From the earliest fire-friction mechanisms of remote times there has been progress in the mechanic arts. But this progress ran slowly through the centuries, save only for such brilliant periods as those marking the time of Gutenberg with the printing press, of Leonardo da Vinci with his varied implements, of Watts and Whitworth with engines and mechanisms, of Stevens, Fulton and Ericsson with their achievements in power development, and of Goodyear, Morse, Howe, McCormick, Eli Whitney, Mergenthaler and others with their industrial inventions.

"It was without doubt the work of Watts and Whitworth that gave a new life and a new strength to the development of the mechanic arts and it was in their times during the latter part of the eighteenth century and the early part of the nineteenth that a much more rapid development set in. Industries began to spring up that depended more on factory manufacture rather than on home manufacture, and avenues of transportation were subsequently opened over increasing stretches of land and sea. But for more than threescore years the newly devised engines and machines and materials remained crude and wasteful, affording commercial profit over the old methods of accomplishing similar results to a comparative few.

"The developments outlined above were sufficient, however, to reveal to a few of the far-seeing men of the period of 1870 that the time was at hand for the training of a group of young men that would enable them at least to introduce scientific and methodical principles into the engines and machines of the day. Then was the profession of mechanical engineering first established in America and based on a specific course of study. There had been other technical courses such as civil engineering and mining engineering and the "Civils" and the "Miners" were the ones on whom had fallen the task of building scientific engines and machines. But their training had not equipped them for this specialized work. So after the first college of engineering had been established at Hoboken, N. J., through the most generous gifts of Edwin A. Stevens, other courses in mechanical engineering were established in other colleges and universities. What was the result? An immediate acceleration in the progress of the mechanic arts that has no parallel in history, not even in painting,

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sculpture, or literature, where development had been carried to the highest points of human enjoyment. But none of these, in a brief period of about forty years, had developed so swiftly, so universally as have the mechanic arts since 1870.

"Since that time unnumbered improvements, small to large, have come to benefit mankind and no one can fail to enumerate for himself a great many of these from his own general knowledge and from even

his business and home surroundings. Of the greater achievements in engineering we have only to recall that the real economic use of coal and a full scientific understanding of the steam engine began only in 1874 with the introduction of the triple-expansion steam engine; and that permanent and trustworthy service by cable and the use of the reversible dynamo as a motor came in the two preceding years. The gas engine and the telephone were both patented in 1876 and the electric lamp became a commercial success in 1879. Since that date have come the great and far-reaching inventions and developments in gas-works engineering, in the electric railway, in the electrical industries, in machine shop improvement, in the building of automatic machinery, in structural engineering, in refrigerating engineering and more specifically in the introduction of the steam turbine, the gas engine, the automobile and the flying machine.

"Considering such evidences of the progress and welfare of the country as have just been stated, we again ask, what have been the contributions of the colleges of mechanical engineering to it all? and what, if any, claims may be made in common and in particular for our Alma Mater?

"What bearing did the action of Henry Morton have when in 1869 and 1870 he, as the first president of the Stevens Institute of Technology, assembled a faculty of men who were to teach the application of scientific principles and methods to the mechanic arts? These men had no precedents to follow. They had to hew their way by research and by experiment through unknown paths to hidden laws. How well they did their work is recorded and universally acknowledged.

"Who can gainsay that the repeated popular and striking lectures of Henry Morton on the application of the principles of light, heat and sound delivered at the Academy of Music in Philadelphia did not open up visions for other minds and lead to useful accomplishments? These lectures filled the Academy with its more than 3500 seats and some of them, notwithstanding an admission fee, were repeated on succeeding evenings by public request. Popular and technical evening lectures on kindred topics showing the applications of the laws of science to mechanical engineering were given by President Morton and other members of the Stevens faculty at the college buildings in Hoboken for a number of years after the opening of the college. The public as well as the students of the college were invited and mechanics and manufacturers came long distances in those early days to attend these lectures. It was not uncommon to crowd the college hall which then had a capacity of 600. To this day the writer receives direct testimony of the great educational and practical value that visitors received on these occasions. The lectures in Philadelphia and in Hoboken were largely quoted in the public press, thereby greatly ex-

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tending their influence. How far has this influence extended in these forty years?

"To the other members of that pioneer Stevens faculty the country is also greatly indebted. The research work of Professor Alfred M. Mayer in physics, particularly in optics, sound and magnetization led to the adoption of hitherto unknown principles in the development of the mechanic arts. He was a leader without a peer among his contemporaries in his line of work and all that he did during a long and intensely active period was freely contributed almost entirely to technical society papers with practically no financial reward whatever. To these same papers the great commercial houses of the day had to resort for a solid and sure foundation for progress.

“The work of Robert H. Thurston, the first great teacher of Mechanical Engineering as a specific department of study, is still well known to engineers the world over. Probably no greater or more important mechanical detail of progress has ever been made in mechanical engineering or more widely adopted than that which resulted from his investigations and conclusions on the binary and ternary compositions of copper, tin and zinc for use as bearing surfaces and for the reduction of friction in engines and machines. His researches in the physical properties of iron and steel and in the “quality” of steam from boilers were scarcely less important. He was probably the most prolific mechanical engineering writer of history. He was an inspiring writer as well, able to put his work in popular language if occasion required, and he has been read and quoted perhaps more than any other American engineer, especially during the early days when information on the necessities of mechanical engineering for rapid progress was so much desired and sought for, and so difficult to obtain.

“There were others of that first faculty of Mechanical Engineering who labored indefatigably to lift the profession from chaos to order, and among them in the technical departments was Professor Charles W. MacCord, whose writings, principally in the popular technical papers of the day, led the way for thousands of young men and mechanics in the subjects of mechanical drawing and mechanical movements. His investigations of the subject of toothed gear-wheels resulted in one of the largest single contributions in furthering the manufacture of smooth-running machinery and his text books still remain unsurpassed for thoroughness and for basic reference work in these subjects. A striking example of improvement in welfare of our people is afforded by the research work of Professor Albert R. Leeds in sanitary chemistry, where his scientific investigation of water supply in more than a dozen large American cities led to improved hygienic conditions for literally hundreds of thousands of persons. He carried the same character of work into the milk supply of cities, adulteration of food, hygienic conditions of schools, disinfection of railroad cars and steamships. The last of the technical group of the original faculty was Professor De Volson Wood whose genius as a practical mathematician enabled him to carry innumerable theoretical investigations of engineering materials, engines and structures to the highest point of development,

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and from his advanced position he sent forth new ideas and new thoughts that were to guide others in engineering advancement.

“This brief record of the gifts of the original faculty in Mechanical Engineering to the welfare and progress of the country, would be incomplete indeed without including two essential attributes in the development of culture in the profession. A most deserving tribute is due to Professors Wall and Kroeh, who have labored from the beginning to instill the refining influences of the home and foreign languages into the character of the graduate mechanical engineer. With mention of these names and of these works we close a period in the development of the welfare and the progress of our country. What has grown from the seeds that have been planted in tilled soil and that have been carried by the winds, and that have multiplied, can never be known. Of the original faculty, three are still living, Professors MacCord and Wall in retirement looking down the vista of the years to the time when the comforts and enjoyments that are bestowed on the present active generation were unknown, and Professor Kroeh of the Department of Languages who is still regularly engaged in his teaching work at the college.

“The results of the works of great leaders in the teaching of mechanical engineering have been separately considered in the foregoing paragraphs, but to give a full measure of justice we must refer briefly to their work as a whole. Nearly a thousand young men were graduated under their seal. They went forth to put the science of their teachers and of their own originality into the commercial development of materials and processes, and into the building and improving of engines, machines and structures. Here we enter into a field of development and progress so rich and so vast that even such fragmentary personal knowledge as a single individual may have been able to obtain is sufficient literally to fill volumes. But we are writing of what Stevens has contributed to the welfare of our country and this we do know of that whole vast field of human endeavor: That that first generation of graduates went forth into a cold business world and that there was little sympathy and small pay. Materials were being made, processes were being carried out, engines and machines were running, industries were making money. Was not that enough? But gradually here and there a manufacturer could sell his products cheaper than his competitor. Why? To give an actual case, because he engaged a graduate mechanical engineer and set him to work in the boiler room. Coal was being burned in great quantities and the young graduate actually begged for an opportunity to change the boiler conditions to a more scientific basis. He finally got permission and $12,000 per year was saved on coal alone! Another graduate soon developed an automatic machine which turned out a heretofore slowly-manufactured product in large quantities, and so reduced the cost and finally the selling price per unit. It took years to overcome the prejudices to technical graduates and it was forced only after innumerable instances such as we have quoted above, but under varying conditions and surroundings. The day is now arrived, however, when the trained mechanical engineer is almost universally received with a welcome. The day might have arrived

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sooner had it not been that the possibilities and advantages of the services of the trade engineer were hidden from the employer because he doubtless thought he had as good as could be obtained; that the co-worker of the young graduate was suspicious of his ability to pass him in the race for increased rewards; and that the young graduate was inexperienced because of his youth and could not carry assurance to his employer, and that his years had not yet developed the tact to deal successfully with his co-workers on the floor.

“With a thousand young mechanical engineers of the first generation at work, and all contributing to the marvelous developments since 1870 as outlined in the early part of the article, we need only to cite a few examples in some specific cases to illustrate just what these graduates have contributed to our welfare and progress. Alexander C. Humphreys graduated in 1881 at the age of thirty and thirteen years later it was said of him by one of the publications in the gas industry: ‘An impartial history of the progress of water-gas (illuminating gas) during the past twenty years must place in the foremost rank three names: Lowe, Granger and Humphreys.’ In his work with the United Gas Improvement Company of Philadelphia he built up an organization for the central management of a large number of widely distributed properties such as the world had not seen before, and which still remains the great landmark in the development of large industrial enterprises. The services which he was fitted to render to the progress of mechanical engineering outgrew the bounds of any one industry and at the age of forty-three he established an engineering partnership in New York City and the rewards of his industry and ability were immediate and bountiful. But these he sacrificed in a very great measure to give to Stevens and to the progress and welfare of the country such service as Stevens knew he could give and which

was unanimously asked of him. He was thus called to succeed Henry Morton as president of Stevens Institute of Technology in 1902."

In the article from which the above is quoted, the writer enumerates from data at hand at the time, the achievements of various Stevens men, but as since that article was written some six hundred Stevens graduates have gone into the field, and older graduates have added to their work, it seems wise here, rather than to attempt with insufficient information to record personal achievements, to relate in a less specific way some of the many things Stevens Alumni have accomplished.

The Stevens Alumni may be credited with pioneer work on the steam engine and pumping engine and the refrigerating machine; with the development of original apparatus for the illustration of physical laws and for testing various mechanical devices and for investigations and tests of engines and boilers; with inventions in continuously-recording pressure gages for water, gas, electricity and temperature; with original work in investigating the causes and preventing the great financial losses due to the disintegration of gas and water pipes through the action of electrolysis from stray electric railway currents; with the discovery of the value of using cheese cloth or other thin material over extended areas of growing crops—this discovery has revolutionized the

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methods of raising certain crops in certain localities; with the invention of the "reaction" brush holder for dynamos; with pioneer work in establishing standards in manufacturing leading to a practical solution of interchangeability in machine construction in this country; with one of the earliest examples of electric train lighting in the United States; with designing an integrating and registering instrument forming part of the well-known Venturi water-meter for large mains; with designing the "pull to stop" and "pull to start" belt-shifts now so widely used; with the discovery of the value of the Selden gas-mobile patent which resulted in wonderfully steadying the rapid development of the automobile; with the designing of large coal handling stations for rapidly loading and unloading large vessels and cars; with a large number of patents for the bettering of railroad operation, and the design of the first all-steel incombustible passenger car ever built; with the design of an automatic machine for making wire rope wherein was accomplished in one operation what by the common method had acquired two; with important contributions to the development of wire-rope tramways, haulage plants and power transmission; with work in the development of the electric lamp; with scientific work on electrical machinery leading to some of the most important and far-reaching developments in the electrical field; with the invention of the first round-door burglar-proof vault; with the production of "The Mechanical Engineer's Pocket-Book" which has had a wider circulation and a greater field of specific application than any American book ever issued in mechanical engineering work; with designing a new system of electric furnaces for the manufacturing of calcium carbide; with the introduction of the Whitehead torpedo into the United States Navy; with having installed the first electric trolley line in Italy, at Milan; with the invention of a water meter which practically superseded all other forms of displacement water meters; with patents on gas engines; with designs for fire boats and for incinerating plants for burning rubbish; with the invention of a furnace for using heavy crude oil for fuel; with designing and constructing automatic machinery for working metal and wire goods; with the production of the first drop cabinets for typewriting machines; with patents and developments in calendar, program, self-winding and "time" clocks.

With the invention of a screw pump specially adapted for direct connection to an electric motor; with designs of heavy locomotives, baggage cars and crane cars; with the invention of a new form of tank for the electrolytic separation of metals; with improvements in the Corliss type of steam engine and inventions in connection with the Curtiss steam turbine.

With being first to advance the application of X-rays in this country; with designing and superintending the construction of one of the first steam car heating systems on a large railroad; with improvements in the design of the locomotive; with designing tools for the manufacture of hard rubber goods and designing a hard rubber pump to convey a solution of iron and nitric acid; with the designing and installing of an electric light plant in Colorado which, under the conditions of altitude and service, made it the first of its

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kind; with the installation of what was at the time the largest mine-pumping plant in the country.

With having introduced oval balanced turrets in the United States Navy; with the development of high-speed cutting tools; with the installation of long-distance high-power electric transmission lines; with intensive work in the science of forestry; with the invention of pig-iron moulding and conveying apparatus which supersedes the old sand-bed system and which in various forms has become a necessity in blast-furnace plants the world over; with the invention of the gas-composimeter and the pneumatic pyrometer; with the development of a system of telephones for centralizing battery service in use in large hotels; with inventions widely used in cable-road work before the time of the electric trolley.

With the invention of a new type of detector for electric waves permitting the transmission of messages at the highest speed obtainable by telegraph operators; with patents on various devices connected with alternating-current transformers and motors; with patents on apparatus for water-gas plants.

With designs of apparatus for the manufacturing and refining of brimstone; with the design for a combined evaporation cooler and surface condenser; with patents on an improved planimeter for determining areas, mean pressures, horse-power, etc.; with intensive work in heating and ventilating in large factories, office buildings and homes; with the development of the Nernst lamp in America.

These are but a few of the achievements that may be credited to the Stevens Institute of Technology Alumni. Those whose particular work is not recorded above may be found at the head of great industries or building others—drawing upon the fund of knowledge acquired at their Alma Mater.

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[illustration top - portrait]
John Stevens
1749 - 1838

[illustration bottom left - portrait]
Robert L. Stevens
1787 - 1856

[illustration bottom right - portrait]
Edwin A. Stevens
1795 - 1868

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The Stevens Family

A FAMILY OF ENGINEERS

Article written by T. C. Martin, E.E., at the instance of President Morton, for use in connection with the exercises of the Twenty-fifth Anniversary. It was published in the “Cosmopolitan Magazine” for May 1898

THERE is a chapter in the history of this country during the century now closing which has never been presented to the general public, but which contains matter of the greatest interest both in relation to the development of our interior resources by means of steam transportation on land and water, and also as to the protection of our great commercial centre in and about New York from the possible attack of any foreign power. This chapter might well be entitled, “John Stevens and His Sons as Engineers and Naval Constructors.”

On a recent public occasion Mr. Abram S. Hewitt, referring to one of these men, said: “That was the greatest mechanical engineer, the greatest naval engineer, and the greatest railroad engineer which the nineteenth century has produced.” When to this testimony I add the statements that the Camden and Amboy Railroad was built and operated by these men; that for twenty years or more they were substantially the only builders and operators of steamboats on the Hudson and Delaware Rivers; and that from 1840 to 1860 the harbor of New York was potentially protected from any possible attack of a foreign navy by a shot-proof steam ram (far more powerful than the famous “Merrimac”) which during all these years lay under construction in a dry dock belonging to the Stevens family at Hoboken, and which at any time could have been finished and could have destroyed an entire fleet of the vessels of that day — then there is reason enough evident why the chapter mentioned should be written and presented to the public.

The facts to which I have referred above are so little known among the public at large that many, no doubt, will find themselves hardly able to accept them at first; but the evidence available is abundant, as I shall make clear presently. The main reason why the work of John Stevens and his sons has not been prominent in the public eye is that all these men were disposed rather to avoid than to seek notoriety, and were, moreover, possessed of such considerable wealth that they could carry out their projects with little or no outside financial assistance, and thus had no reason for bringing their plans before the public.

The close of February, 1897, beginning with the 18th of that month, witnessed the celebrations attendant upon the Twenty-fifth Anniversary of

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the Stevens Institute of Technology at Hoboken, N. J., created by the generosity of Mr. Edwin A. Stevens. The initial feature of this celebration was a banquet of three hundred covers at the Hotel Waldorf, at which the speakers and their topics brought out in sequence the history of the institution as well as the great work of the three engineers to whom for more than a century was due no small part of American advance in the arts of peace and war. That work is the object of this paper to set forth.

Col. John Stevens was born in New York, in 1749, of English lineage. He was a graduate of King's College (now Columbia University) in 1768; a member of the New York bar in 1771; treasurer of New Jersey during the perilous days of the Revolution; and a pioneer citizen alike of New York City and Hoboken, where he located his family estate. He was not forty years of age when he saw John Fitch's steamboat making headway against the tide on the Delaware, off Burlington, N. J., and was at once seized with enthusiasm as to the new means of locomotion. He examined the boat and her mechanism, and in 1792, under the new patent system he had himself petitioned into existence, he took out patents for steam propulsion. Experiments were hotly pushed, and in 1798, nearly a decade before Fulton ran his "Clermont," Col. Stevens had a steamboat on the Hudson, as builder, owner and captain. Six years later he equipped with double screws another predecessor of Fulton's craft. The short four-bladed screw which he designed has shown great vitality as against later comers; and Mr. Abram Hewitt's father, who remembered being a passenger on the first Stevens boat, built for her at the Soho Works at Belleville, N. J., the first condensing double-acting engine made on this continent. Col. John Stevens continued prolific in invention and enterprise. He patented the multitubular boiler in the United States in 1803, and in England in 1805; established in 1811, between Hoboken and New York, the first steam ferry in the world; in 1812, before work began on the Erie Canal, he urged on the State authorities of New York the superiority of a railroad; before 1812 he made steam navigation on the Delaware a commercial success, with his son Robert; in 1813 he designed an ironclad ship which fully embodied the "Monitor" type, and was the first ironclad ever worked out for construction; in 1813 also he put into operation the first of numerous double-hull ferry-boats carrying a paddle-wheel driven by circling horses; in 1817 he obtained a charter, the first in America, for a railroad from the Delaware to the Raritan; in 1823 he secured acts of legislature for the incorporation of the Pennsylvania Railroad; and in 1826 he built a steam locomotive with multitubular boiler, which he operated on a circular track at twelve miles an hour, carrying passengers, at his own expense, on his own property in Hoboken. This was the first engine and train that ever ran on a railroad in America— built by a man verging on his eightieth year!

Such a record as this, very few men are permitted to make. The engineering events it includes are of wonderful magnitude; their effect on the development of the United States is still working itself out in widening rings. To have forewarned us of the collapse of the popular canal system, in which $214,000,000

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of public money is now well-nigh hopelessly sunk, reveals prescience of exceptional character. To have set on foot vast transportation enterprises required quite different capacities, but here again, like

Vanderbilt, he was successful; for, aside from his own work, other schemes, like that of the South Carolina Railroad in 1829, were based on his plans and recommendations. Then to have turned from all these victories of peaceful commerce and to have laid down the lines on which the naval warfare of the world was to be completely revolutionized, was to round out a figure of heroic proportions.

Bred a lawyer and always a man of affairs, John Stevens had in him also the qualities that distinguish the great engineers. These were markedly perpetuated in his son, Robert Livingston Stevens; just as in the other son, Edwin A. Stevens, his financial acumen and business sagacity were so signally exemplified on the broader plan of larger times. Robert was born in the very year when his father saw that tiny, primitive paddle-wheeler of Fitch struggling up the Delaware, and as a lad of seventeen he assisted in 1804 in the construction of the first screw steamboat. Five years later, barely of age, he took the side-wheeler "Phoenix" from New York to Philadelphia by sea in June, in spite of a storm which rendered welcome the temporary shelter of Barnegat Inlet. This was the first sea trip of a steam-propelled craft. Col. Stevens and his son had been barred from navigation on the Hudson by the monopoly accorded to Fulton and their powerful relative Livingston. Many men would have accepted defeat, but they determined simply to take their boat around to the Delaware, and therefore pushed boldly out into the Atlantic; thus out of their deep discouragement snatching immortal honors.

It was now as a builder of steamships that Robert Stevens made himself famous, each successive boat being faster until in 1832, with the handsome "North America," using forced draft, he attained a speed of fifteen miles an hour. For a quarter of a century, and while he gave his chief attention to that line of work, he stood at the head of the naval engineering profession in this country; and his inventions and improvements up to 1840 were so valuable and numerous that a bare catalogue would fill pages. We may specify, for example, the invention, as early as 1818, of the cam-board cut-off, being the first use of steam expansively for navigation purposes; the universally prevalent forms of ferry-boat and ferry-slip, the overhanging guards, the fenders, the spring piling; the adoption of the walking-beam in 1821; the invention of the split water-wheel in 1826; the invention of the balance valve for beam engines in 1831; the location of the steamboat boilers on the wheel-guards; the increase of strength in the boilers until they could stand fifty pounds to the square inch, although English naval engineers had got no further than five pounds as late as 1848.

Nothing could be sharper than the ordinary contrast between the lines of a steamboat and those of a fine clipper, yet it was Robert L. Stevens who designed and built in 1844 the "Maria," a yacht literally as fast as his steamers. She was the conqueror of the "America" just before the latter went across the Atlantic to capture, in the Solent, the famous cup which now gleams on Uncle

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Sam's sideboard, for the British an object of, apparently, as hopeless a quest as that for the Holy Grail. In 1860 Commodore Stevens, on the "Maria," overhauled and sailed around the fast revenue-cutter "Harriet Lane," carrying the Prince of Wales; and she remained the fleetest of her school on the Atlantic coast until 1869, when she made a poetically mysterious disappearance off the face of the waters, no one knowing to this hour whither she went or what became of her.

Before dealing with another and even more exciting chapter of naval history in the life of the younger Stevenses, we must go back a few years to pick up the thread of their pioneer work in railroad

construction and operation. As a result of its steamboat enterprises the family had become deeply interested in the traveling facilities between New York and Philadelphia, their three-linked water and land route between the two cities covering 101 miles. Col. John Stevens, convinced by his own success with steam in boats, was early satisfied that he could do even better with it on tracks. He had applied for charters, had operated experimentally his own locomotive, and had done all that was possible to educate public opinion on the subject. And now in 1830 came the incorporation of the famous Camden and Amboy Railroad, with Robert L. Stevens as its president and chief engineer, and Edwin A. Stevens as its treasurer. Its object was in reality to take over the enormous stage-coach traffic already built up by the celebrated Union Line, with its steamboats on the Raritan and Delaware, and its scores of four-horse lightning coaches that shuttled to and fro on the Trenton and New Brunswick turnpike. But while the business was ready, all the crude problems of steam railway locomotion had to be squarely met, and the first step was taken by Robert Stevens in his trip to England the same year, which had seen also the opening of the Liverpool and Manchester Railway as a great national event. Before leaving he had obtained permission from his directors to buy an all-iron rail in preference to wooden rail or the stone stringer thinly plated with strap iron. In those days there were no rolling-mills in America to make T-rails, and as labor and metal in this country were scarce and dear, he wished to get a rail that would dispense with the chair to hold it in place. During the long voyage to Liverpool, in good Yankee fashion he whittled bits of wood into various shapes, and finally selected the form in which a suitable base was added to the T-rail, making a continuous foot or flange and dispensing with the chair. The moment he landed on the Mersey shore he asked for bids on five hundred tons of this form, since known universally as the Stevens or American rail, and now the general form used by every road in the United States. Concurrently Mr. Stevens designed the hook-headed spike, which is the ordinary railroad spike of the present day, the “iron tongue” or tie-piece which has grown into the fishplate, and the bolts and nuts required to give integrity to the track construction.

Shortly after his arrival in England Mr. Stevens saw the “Planet” of the Stephensons at work on the Liverpool line, and at once ordered a locomotive of the same character for his own road. This purchase, the “John Bull,” was landed in August, 1831, and was put together immediately. She weighed ten

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tons, with a boiler thirteen feet long by three and a half feet in diameter; cylinders, nine inches by twenty; a fire-box surface of thirty-six feet; four driving-wheels; and a rail gauge of five feet between centres. There was no tender. The fuel and water were carried on a rough four-wheeled flat-car; the tank consisted of a whiskey-barrel from a Borden town storekeeper; and the hose leading to the boiler was made of leather by a local shoemaker. When fired up with pine wood, and with steam reading on a scale at thirty pound pressure, this august combination moved off, to the relief and intense delight of those who were staking their fortunes heavily on her success. Just as nowadays we see fixtures to give either gas or electric light, so two coaches were built to be hauled either by the locomotive or by horses; and thus the road settled down to business, not, however, without appropriate ceremonies, a vast amount of newspaper talk, and the beginning of a series of improvements which have done much to give us the distinctive American railroad of today with all its remarkable differentiations and adjustments to the needs and conditions of this country. The record of the road reveals the trial or adoption of many things now familiar to every schoolboy—the first pilot, planned in 1832 by Robert L. Stevens; spiking the rail directly to the cross-tie; the bogie truck and forms of the vestibuled car;

methods of wood-preservation; and a host of other features whose permanence depended largely on approval by this foremost among the pioneer railroads of America.

Among illustrations of the primitive apprehension of such subjects as railway management at the outset, it may be mentioned that during the early days of the running with steam on the Camden and Amboy railroad a man on a fast racehorse was sent ahead of the train by Mr. Stevens to clear the road and warn away possible intruders from the line. This was the more easy of accomplishment as one of the Stevens brothers, who had previously superintended the supply of horses for the stage route, possessed a fine stud.

It is also recorded that on one of the earliest trial trips the locomotive, coming upon a curve in the track at considerable speed, as the necessity of raising the grade of the outer rail had not been realized, left the track and took its way down an embankment into a neighboring field, where some men were employed cradling wheat. These men, in not unnatural alarm, fled with prompt alacrity; and did not come to a pause until they had placed two fields between themselves and the seemingly pursuing monster.

Complex and difficult beyond most institutions to manage, the railroad may be said to have called into existence a new type of “captains of industry.” In the earlier days, functions in railroad management now discharged by several responsible heads at large salaries were faintly distinguished, and were all left to the care of some one man whose success became an immediate test of his wide ability. The world was born anew when steam was hitched to its wheels; and with new powers of locomotion the human race began its career all over again at a faster gait than of old. The railroad managers who first grappled with the conditions of the work, while without our experience of fifty years in its novel developments and relationships, had also but poor adumbrations

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and sketchy outlines of the actual gigantic problems confronting them in politics, in financial affairs, in the changes of life and custom due to travel, in the jealousies of great commonwealths and cities, in the passion against monopoly, in the needs of a growing population, in the handling of multitudinous armies of employees, in meeting competition wisely, and in maintaining the health of the intangible but very real corporation which is itself the great underlying power and cause. When Mr. Edwin Augustus Stevens became the active business manager of the Camden and Amboy Railroad, all the intricate fundamental principles and methods just hinted at had to be discovered or worked out; but his genius and training were all in the line of harmonious predisposition for the great task. A seventh son, he was born at Castle Point, Hoboken, in 1795. At the age of twenty-five, by family agreement, he became trustee of the bulk of the paternal estate. At the age of thirty he took charge of the huge transportation system known as the Union Line. At thirty-five he became the treasurer and manager of its offspring, this pioneer steam railroad; and at once there sprang into light and full vigor his splendid qualities of initiative, executive and diplomacy. Merely to state that during the thirty-five years of his management of the Camden and Amboy Road its stock appreciated steadily in value and never passed a dividend, would be sufficient indication of masterly skill; but it tells a very significant part of the story. Not only had the “property” to be created, but it had to be conserved amid all the storms of political intrigue and commercial rivalry; through all the stress of financial disaster and national trouble; despite all the vicissitudes due to the redistribution of population and the shifting of industries. Mr. Stevens was a keen

discerner of ability in other men. He allied with himself the best engineers of the time. He enlisted in the company's service the best legal talent of the State. He combated political onslaught and conciliated public sentiment; he saw the first compacts made between the conflicting railroad and canal interests, assisted in successive extensions or consolidations, and was quick to begin again new railroad work in New Jersey when released from earlier responsibilities.

The magnificent bequest of Mr. Edwin A. Stevens, endowing the Stevens Institute, will be referred to later, and in succeeding paragraphs reference will be made to the other great national work in which he was associated with his brother. But this epitome of a noble life would not be complete without mention of his engineering talent, which apparently takes place below that of his brother chiefly because he gave his energies to business. While still a young man he invented the Stevens plough, which was long made and sold in large quantities under his patent, and which brought him into very close touch with the agricultural interests of the country. But even more noteworthy was his invention, patented in April, 1842, of the airtight fire-room, one of the important features to be found in the warships of every modern navy for their forced draft. He may, in fact, be said to have taken up steamship improvement at the point where his elder brother Robert left it as age came on.

While assiduously devoted to the arts of peace, none of the three Stevenses

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could altogether forget the scriptural fact that spears were a prerequisite to pruning-hooks. In 1812 Col. John Stevens had projected his interesting circular fort, rotated by steam, for the defense of New York harbor; and before the year of Waterloo, young Edwin, under guidance of his father, was hard at work experimenting with a six-pounder bronze cannon against some iron plating, and anticipating the prolonged savage contest between projectile and armor whose end is not yet. Later again, in 1841, Mr. Edwin A. Stevens, at an anxious period when hostilities with England threatened, took up the subject, with laminated plates, just as during the previous troubles with the same country Robert had experimented with bombs to be fired from cannon and had sold to the government the secret for a percussion shell. From tests made at Bordentown, N. J., in 1841, Mr. Edwin A. Stevens reached the conclusion that four and a half inches of iron sheathing would withstand sixty-four-pound shot at thirty yards from the marine guns of the day; and eighteen years later the first English iron-clad, as well as a French frigate, donned an armor of exactly that thickness. The brothers Edwin A. and John C. submitted to a board appointed by President Tyler their views and data on the subject, in a document full of accurate forecasts on the coming principles in naval warfare; and after the armor tests had been repeated at Sandy Hook before the official authorities, Congress, in 1842, voted $250,000 to Robert L. Stevens for the construction of a war steamer, shot and shell proof. Robert and Edwin dug a dry dock at Hoboken immediately and began work on the steamer. A little later, however, the terms of the contract were changed, to make the armor superior to newer penetrating powers; and this process of interruption and delay was kept up until 1856, when Robert died, leaving the Stevens Battery in the basin at Hoboken, partially finished, with twin-screw engines and boiler in position. She was then four hundred and ten feet long; forty-five feet inside the armor shelf, with two feet of freeboard, and with a square immovable turret enclosing depressible guns. She was similar to the boats of the "Monitor" class built six years after by Ericsson, except that the latter had circular turrets embodying the idea of revolution, as suggested for the whole ship by Col. John Stevens at the beginning of the century, and for the individual guns by Robert L. Stevens about 1840. That the Stevens Battery would have been

irresistible as a ram and invulnerable as a fort is easy to be seen; but the Stevenses were condemned in this case, by official obstruction, to undeserved failure; while Ericsson, with happier conditions, was able to seize the supreme moment, and by a conclusive demonstration do much to determine the fortunes of our country. It is among the memorable links between events that one of the present faculty of the Stevens Institute was able, as the draughtsman and representative of Ericsson, by his energetic and intelligent action, to send the rather erratic "Monitor" off upon her memorable trip to Hampton Roads in time to render never-to-be-forgotten service on the seventh of March, 1862.

Robert L. Stevens left to Edwin A., somewhat in the nature of a sacred trust, the floating battery which his fancy had depicted doing such valiant service for his country. Preceding in conception and construction by more than

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ten years the little French ironclads seen at Kinburn in 1854, she was still a highly available vessel, and in 1861 Edwin A. and John C. offered to complete her at their own expense if the government would simply reimburse them after her utility had been proved. But the fates were against her, and she lay undisturbed until after the death of Mr. Edwin A. Stevens, who bequeathed her, with a million of dollars for completion, to the State of New Jersey. This sum was expended in 1869 and 1870, but the vessel was not launched, and in 1881 she was torn to pieces and her materials were disposed of. The family had not, however, wanted in courage—or in patriotism, either, for that matter— while the war was raging, but at their own expense built and fitted out the "Naugatuck." This craft, accepted by the government, was one of the fleet that attacked the "Merrimac." She was propelled by twin screws; carried a single gun of heavy calibre; could turn from end to end in seventy-five seconds; could be immersed three feet below her load-line, and could come again to full visibility in eight minutes by pumping. And so, having, against much injustice, prejudice, and discrimination, done their part when national perils were greatest, the Stevens family closed with credit and honor this chapter of their history. Might it not be suggested that here were noble deeds and a lofty intent still awaiting proper recognition?

It is worthy of note, moreover, that although the Stevens Battery was never launched, and of course, therefore, was never in actual conflict, yet for the twenty years which intervened between 1840 and 1860 she was potentially effective for the protection of New York and its harbor from any attack which might have been made by a foreign fleet.

During these years, though constantly undergoing alteration and reconstruction, she was at all times in a condition which would have admitted of her rapid completion, had an emergency arisen, on the plans which were for the moment being carried out, and these plans were always so far in advance of general naval construction that if so finished she would have been a match for a fleet of the best vessels of the world at the same date. Thus, while the naval armament of the world was light, her original armor of four and a half inches would have rendered her invulnerable to the shot of an enemy, while her shell-guns would have meant certain destruction to any vessel not provided, like herself, with an armor capable of keeping out all such shells. As the size and penetrating power of cannon-shot were increased, so was the provision for heavier armor made in the Stevens Battery, and her own guns were at the same time enlarged in the successive designs.

It is interesting to know that the utility of a marine ram in naval warfare was brought home to the mind of Mr. Stevens by an accident which occurred on the Hudson River at an early period. One of the swift wooden steamboats, by reason of some derangement of her steering-gear, ran into a “crib” dock, cutting through the massive timbers of the crib and penetrating the body of stone with which the crib was filled for a distance of twenty feet. After this performance she backed out and went on her way, having suffered no material injury. If, argued Mr. Stevens, a frail wooden hull could accomplish this,

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how irresistible must be the blow delivered by an iron steamer specially constructed with a view to such work, and armed with an immense steel prow shaped like the blade of an axe and solidly attached to and supported by the entire framework of the vessel.

Turning now to those paths of peace fuller of pleasantness than the grim arena of war, we may tell briefly how the Stevens Institute of Technology took root and grew as a seat of scientific and technical culture. Here we have the best, the most lasting monument of the Stevens family; for while steamboats and railroads and warships' may disappear from the earth, the intellectual and spiritual work of such a place can never fade away. Mr. Edwin A. Stevens, dying in 1868, left by will land in Hoboken, a building fund, and an endowment fund, so that his executors might create the Institute. This was done, and, the nature of the college having been left for their decision, they wisely resolved to make it a centre for hitherto neglected mechanical engineering study, so that the wealth which had been derived largely from steam and transportation might return to fructify its origin. Thus the work began which up to 1895 had sent out from the Institute no fewer than five hundred and fifty-one graduates, of whom nearly five hundred today are occupying positions of honor and responsibility in the fields of work for which it was the special aim to educate them.

In no respect has failed the ambition to establish firmly one more place for the preservation of ancient knowledge, one more fountain for the refreshment and stimulus of studious youth, one more quiet asylum for the patient, devoted investigator. Nor has the growth of the foundation ceased. With the celebration of February, 1897, came the announcement that Mrs. E. A. Stevens, widow of the founder and a trustee under his will, had added to its resources real estate valued at $30,000; with the further news that Dr. Morton had added to his previous donations, aggregating $50,000, railroad securities worth $10,000, and that other members of the Faculty and friends were contributing toward the proposed new building and the equipment of various departments of instruction.

The exhibit made at the celebration by the graduates constituted in itself an ample justification for the existence of the Institute. Twenty-five years ago the mechanical engineering professions had barely suggested their present prominence, and many of the mechanical inventions that have rendered the age memorable had not been born. This display, comprehensive and compact, could not then have been made, but it now signalized the readiness with which young men well trained had gone out into the world and had adapted themselves to the later conditions or had shaped the newer environment of the race. Plant for power generation, transmission, or conversion; electricity in its varied work; apparatus to gratify the civilized passion for utmost accuracy in measurements; invention in its latest reaches; journalism in its most authoritative technical organs; literature in its standard technical books—these, in suggestive contrast to the Stevens relics with their records of pioneer triumph, formed an exhibition

that summed up felicitously the glory of a great benefaction and all the marvelous progress of the century.

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