

Celebrating TAM's First 100 Years

A History of
The Department of Theoretical and Applied Mechanics
University of Illinois at Urbana-Champaign

1890–1990



Arthur Newell Talbot Laboratory, 1930

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A History of
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Table of Contents

| | |
|---|----|
| A Pictorial Foreword <i>James W. Phillips</i> | i |
| Changing Patterns of Research in American Engineering Colleges: The Social Dimension of the Rise of Engineering Science <i>Bruce E. Seely</i> | 1 |
| Practical Engineering Research: Engineering Experiment Stations, 1900–1940 | 3 |
| An Alternative Pattern: Engineering Science | 11 |
| Federal Involvement in Engineering Research: Engineering Science Enters the Main- stream | 14 |
| The Social Dimension of the Rise of Engineering Science | 21 |
| A History of the College of Engineering of the University of Illinois, 1868–1945: The Department of Theoretical and Applied Mechanics <i>Ira O. Baker and Everett E. King</i> | 23 |
| A. Organization of the Department | 23 |
| B. Instruction | 24 |
| C. Building and Room Accommodations | 25 |
| D. Development of Laboratory Facilities in TAM | 26 |
| E. Miscellaneous | 34 |
| F. Departmental Meetings | 35 |
| G. Collections of Photographs, Drawings, and Museum Materials | 35 |
| H. Faculty Personnel | 35 |
| a. Heads of the Department | 35 |
| b. Other Professors | 40 |
| c. Associate Professors | 44 |
| d. Assistant Professors | 47 |
| e. Associates | 51 |
| f. Instructors and Research Assistants | 55 |
| A History of the Department of Theoretical and Applied Mechanics, 1945–1990 <i>James W. Phillips</i> | 63 |
| A. Organization of the Department | 63 |
| B. Instruction | 64 |
| C. Building and Room Accommodations | 66 |
| D. Development of Laboratory Facilities in TAM | 67 |
| E. Faculty Personnel | 68 |
| a. Heads of the Department | 68 |
| b. Other Professors | 75 |
| c. Associate Professors | 91 |

Table of Contents

| | |
|--|-------|
| d. Assistant Professors | 95 |
| e. Visiting Faculty | 103 |
| Selected Annual Reports | AR-1 |
| 1910 Annual Report <i>Arthur N. Talbot</i> | AR-1 |
| 1920 Annual Report <i>Arthur N. Talbot</i> | AR-4 |
| 1930 Annual Report <i>Melvin L. Enger</i> | AR-11 |
| 1968 Annual Report <i>Thomas J. Dolan</i> | AR-19 |
| Chronological List of Master's Degrees Awarded in TAM | MS-1 |
| Chronological List of Doctoral Degrees Awarded in TAM <i>Janet K. Weaver</i> . . . | PHD-1 |

F. DEPARTMENTAL MEETINGS

General. Early in its history, the Department began the custom of holding evening dinner meetings once a month for members of the staff and graduate students to discuss matters pertaining to the Department and topics of current interest in the field of mechanics. Most of these meetings are now held in the University Club. Usually some member of the staff presents a paper or talk on some phase

of research in progress.

For the last several years, the Department has held meetings of the teaching faculty approximately every week to consider routine matters connected with the administration of the various courses and to discuss topics of interest that should be presented by members of the staff.

G. COLLECTIONS OF PHOTOGRAPHS, DRAWINGS, AND MUSEUM MATERIALS

Photographs. As soon as the new Materials Testing Laboratory was completed in 1929, Professor J. O. Draffin of the Department of Theoretical and Applied Mechanics began to bring together a collection of photographs of men prominent in the fields of mechanics and hydraulics. These were

placed in the corridors of the building where they could be seen by those who have occasion to use or visit the building.²² In addition, he is attempting, also, to get a collection of photographs of every man that has been connected with the department as teacher or full-time research worker.

H. FACULTY PERSONNEL

General. Brief biographical sketches of the staff members above the grade of assistant that have been connected with the Department of Theoretical and Applied Mechanics, are listed in the following pages in chronological order according to rank.

a. Heads of the Department

General. Arthur Newell Talbot served as Head of the Department of Theoretical and Applied Mechanics from its beginning in 1890 to 1926. Melvin L. Enger was Head from 1926 to 1934, and Fred B. Seely has been Head from 1934 to date (1945). Biographical sketches of these men follow.

Arthur Newell Talbot—The early biographical sketch of Professor Talbot's work was given under Municipal and Sanitary Engineering [as follows].

Arthur Newell Talbot was born at Cortland, Illinois, on October 21, 1857, and was graduated from the civil-engineering curriculum at the University of Illinois in 1881. . . . The average grade of his undergraduate studies was 98—an achievement that remained the record for many years.

The student Talbot did not devote all of his time and energy to study As the literary society was the chief source of interest outside of the classroom . . . he took a prominent part in the affairs of the Philomathean organization, [serving as] Secretary, Vice-President, and President of that organization. He served as delegate to

the Interstate Oratorical Association, as Class Essayist, and for a year as Associate Engineering Editor of the *Illini*. It cannot be doubted that his interest in student literary activities . . . helped to develop the precision and clearness in speech and writing which became one of his outstanding characteristics. . . . [He also] gave instruction in preparatory mathematics and in his senior year, was a student assistant in Physics.

After graduation he was engaged for four years in railroad surveying, construction, and maintenance of way in the West; and in June, 1885, for his practical experience and the preparation of a thesis, he was granted the degree of Civil Engineer. It was then that he became a member of the Department of Civil Engineering. He remained with this Department until June, 1890, when he became Professor of Municipal and Sanitary Engineering. At that time also, he was formally placed in charge of the Department of Theoretical and Applied Mechanics although for several years he had practically directed that work, and had already inaugurated laboratory practice in materials testing and hydraulics. During the 1890's, although seriously hampered by lack of money and suitable space, he gradually developed his work to a high degree of efficiency; and this did much to advance the status of the entire College, since all engineering students took mechanics and most of them hydraulics.

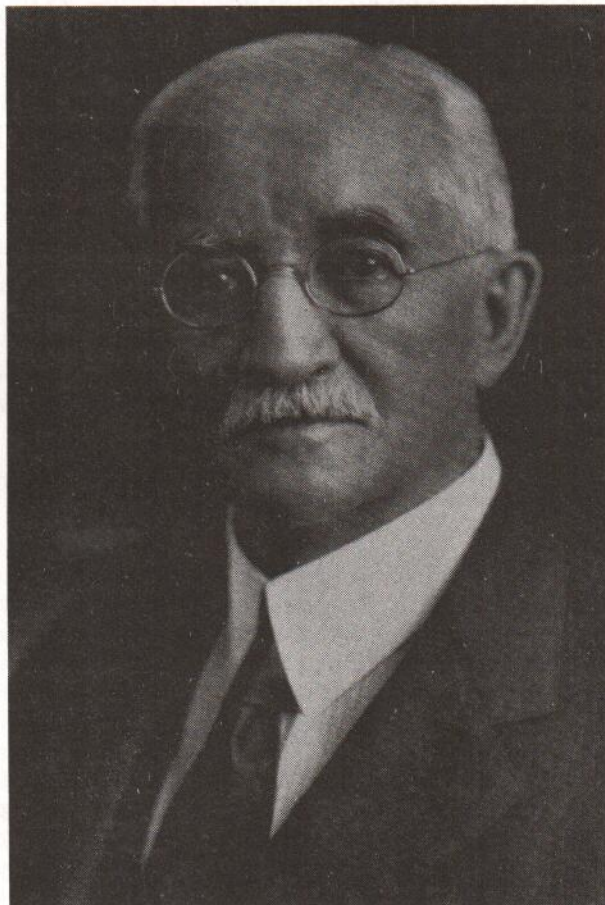
Before the turn of the century, Professor Talbot had made contributions to the engineering profession in a number of fields which brought distinction to him and

²²In 1984, when renovation of the third floor of Talbot Lab was begun for the Center for Supercomputing Research and Development, Draffin's collection had to be taken down. The biographies Draffin had prepared were updated, where appropriate, by Engineering Mechanics senior George H. Thiel, who then photographed the entire collection and assisted Prof. James W. Phillips in preparing TAM Report No. 487, "Early Mechanicists," based on Draffin's work. Draffin's original photographs and sketches now reside in the University Archives.—JWP

the College of Engineering. One of these was a formula for areas of waterways for bridges and culverts, which was first published in 1887-88 in "Selected Papers of the Civil Engineers' Club"—an organization that later became *The Technograph*. Another was a formula for rates of maximum rainfall. This was also published in an early issue of *The Technograph*. Both formulas have been quoted and widely used and bear his name today. A small treatise on a very flexible method for laying out easement spirals at the ends of circular curves (first described by him in Volume 5 of *The Technograph* issued in 1890-91) was published in 1899 as "The Railway Transition Spiral." It has gone through several editions and has been used by many railroads. His pioneer work in sewage treatment by means of septic tanks later made it possible for municipalities to contest certain patent claims on methods and principles of sewage disposal. During this period his investigations provided standard tests of paving brick for strength and abrasion. Before the age of forty he had made important contributions in hydrology, railway engineering, sanitary engineering, and testing materials. After the era of expansion in engineering schools began, mechanics and engineering materials absorbed the attention of Professor Talbot even more than sanitary engineering; and without a change in title, the emphasis of his work swung to the field of theoretical and applied mechanics.

His early activities in practice and in the conduct of these two departments—Municipal and Sanitary Engineering and Theoretical and Applied Mechanics—produced a background of experience and ripened judgment that prepared Professor Talbot to take full advantage of the increased facilities for work which were provided when the Engineering Experiment Station was organized in 1903. As a matter of fact, he was very influential in the formation of the Station, and he provided the first Station bulletin. His leadership in formulating policies, ideals, and methods made the Engineering Experiment Station an immediate success. A comprehensive and thorough investigation on reinforced concrete, conducted and directed by him, was started in 1903, and was continued for many years on reinforced concrete beams, slabs, columns, footings, pipes, frames and building. This experimental work became a principal source of the early knowledge on which the properties and requirements for the design of reinforced concrete structures was based by engineers and engineering organizations and on which the principles and methods of practice were formulated. The conception of relations existing between the strength of a concrete mixture and items involving the absolute volumes of cement, sand, and coarse aggregate, and the voids in the mixture, as well as the so-called relative water content of the mixture, put forth in a paper in 1921, and in a later bulletin of the Engineering Experiment Station, has proved useful to concrete engineers. Tests of stone, brick, and concrete, the investigation of steel columns and

timber stringers, and a variety of other experimental and analytical works have also added to engineering knowledge. There were many contributions, in addition, in the field of hydraulics. Altogether, Professor Talbot was author of thirteen bulletins and was co-author of nine more.



Arthur N. Talbot²³

A notable piece of research which Professor Talbot directed from 1914 to 1941 was the investigation of railroad track and described usually as "Stress in Railroad Track." This investigation was conducted with the view of obtaining definite and authoritative information on the properties, mode of action, and resistances developed in the various parts of the track structure (rail, ties, ballast, and roadbed) under the application of locomotives and cars moving at various speeds. At the time the work was begun, comparatively little of a scientific nature was known of the stresses in rail and other parts of the track or the effect on the track of the many variations in action of the rolling stock in its

²³ The Baker and King *History* is completely devoid of photographs; this picture of Talbot was furnished by the University Archives. Other photographs reproduced in this chapter are either from the Archives or from personnel files maintained by the TAM department.—JWP

operation. Through the twenty-seven years, with the help of a trained staff, a multitude of tests were made with a number of different types of locomotives and cars on track of more than twenty railroads in different parts of the country. Besides, much experimental work supplementing the field tests was carried on in the laboratory. Data from all these tests were interpreted and coordinated with analytical treatment to establish principles and findings. In addition to many minor reports of this engineering research, Dr. Talbot²⁴ prepared seven formal reports, all of which were printed in the Proceedings of the American Railway Engineering Association and part of which were published in the Transactions of the American Society of Civil Engineers. This research project produced reliable knowledge on the interrelation between track and rolling equipment, and thus aided in putting on a more nearly rational basis the design and construction of the track structure to carry locomotives and cars under modern traffic conditions, as well as giving valuable information applicable to the design of rolling stock. Commendation by railroad engineers in important executive and supervisory positions is indicative of the value placed on the investigation by men fitted to pass judgment. It has been characterized as one of the most significant contributions to the scientific knowledge of railroads ever made. On March 11, 1925, the American Railway Engineering Association at its annual convention held in Chicago, passed a resolution of appreciation and commendation of this work done by Professor Talbot and his assistants.

Having attained a high rank among engineering teachers, Professor Talbot was an influential member of the Society for the Promotion of Engineering Education after its formation in 1893, holding various offices including that of President. He was President of the American Society for Testing Materials in 1913-1914, and was prominent in the work of the American Society of Civil Engineers, serving on its research and other committees and on its Board of Direction. He was President of the Society in 1918. He was a member of a number of other engineering societies in this country and abroad, in all of which he gave service in one way or another by written contributions or by direction.

For forty-five years, Professor Talbot moulded and inspired generations of young men. During that time he selected and trained many men for teaching and research positions. He always took a keen interest in the men on his staff and used every means to promote their progress and development. Those associated with him could not be unaffected

by the force of his example, by his high ideals, and by his strong personality. Among those who worked with Professor Talbot, are many men in all parts of the world who were so inspired by his personality, depth of knowledge, and enthusiasm, that it gave them such an understanding and vision of their work as to make them more than mere technical experts in their chosen professions. It made them leaders in various fields in the science of engineering.

In addition to his teaching work, Professor Talbot spent such time as his educational and research schedule permitted in engineering practice on railroad construction, on pavements, sewerage and water works, and on reinforced concrete design and construction. He acted as consultant to cities and business organizations on numerous occasions. To cite only two of his commissions, he served on one board to determine the type of structure for the Galveston causeway and on another to make a preliminary report on the location of a bridge over San Francisco Bay between San Francisco and Oakland. However, his research and administrative work, and his connections with technical committees always had such claim on his time, energy, and affection that he never faltered throughout the years in his purpose to limit the principal contributions of his life to engineering education, engineering research, and the utilization of the fruits of research through engineering society channels.

A portrait of Professor Talbot, painted by Ralph Clarkson of Chicago, was presented to the University by former students, colleagues, and other friends. The portrait hangs in the Engineering Library.²⁵ The formal presentation was made by Doctor W. L. Abbott, '84, at a convocation of the College of Engineering on March 27, 1925, and the acceptance was by President Kinley. The principal speaker at the convocation, Edward J. Mehren, '06, Vice-President of the McGraw-Hill Company, after a brief biographical sketch of Professor Talbot's life and activities and a critical estimate of the value of his work to society, concluded as follows:

"This is his great achievement. This is the work that makes him brother of those giants who since the days of Watt have been bearers of gifts to humanity. Into that grand galaxy of engineers' names fits worthily his name, the name of our

²⁴ Although he did not have an earned doctorate, Talbot received honorary doctoral degrees from three different institutions later in his career, as noted subsequently.—JWP

²⁵ The portrait was later transferred to Talbot Laboratory, where it has hung for many years in the Student Lounge, next to a portrait of Melvin L. Enger, who succeeded Talbot as head of the department in 1926.—JWP

teacher, our inspiring leader in science and in engineering, our lovable friend, Professor Arthur Newell Talbot."²⁶

On September 1, 1926, Professor Talbot reached the University's statutory age limit and was retired with the title of Professor of Municipal and Sanitary Engineering, Emeritus. After his retirement, though, he continued to be actively engaged in directing his extensive research programs and in participating in the affairs of engineering societies.

Professor Talbot received so many honors and awards during his lifetime that his biographical sketch would be woefully incomplete without some brief record of these testimonials commemorating his achievements.

At a special convocation held at the University on April 21, 1938, which was attended by students, faculty, and many prominent visitors representing the engineering profession, the Materials Testing Laboratory was renamed the Arthur Newell Talbot Laboratory. This was an unusual procedure, for only in one other instance had a University building been named after a living person. In connection with this event, President Willard wrote the following tribute:

"The University of Illinois takes this occasion to recognize and acclaim a distinguished son, Arthur Newell Talbot of the Class of 1881. Honors and awards, degrees and memberships, medals and tablets attest to the lifetime achievements in many scientific fields of Dr. Talbot, Professor of Municipal and Sanitary Engineering, Emeritus. Over a period of nearly sixty years his contributions to engineering education, research, and practice have grown more and more notable until today he is an acknowledged leader among engineering teachers, research organizers, scientific investigators and writers, and, above all, among men. Many generations of college students have gone forth from this institution inspired by his high standards, and impressed by his sterling character and unwavering devotion to his ideals. It now remains for his Alma Mater to signalize for future generations of students the enduring contributions of this man to the engineering profession by replacing his name on a great materials testing laboratory at the University of Illinois."

Dean M. L. Enger presided at the Convocation—short talks being given by Mr. Orville M. Karraker of the Board of Trustees, President Willard, and Professor Talbot. The main address of the occasion was by Dr. Robert Ernest Doherty, '09, President of Carnegie Institute of Technology on the subject "Technology, Education, and Social Welfare."

On October 21, 1941, the American Railway Engineering Association held a special convocation at the University, which was attended by a large representation of its own membership as well as by students and faculty of the University, in order to present to the University a bronze plaque honoring Professor Talbot on the occasion of his eighty-fourth birthday for his outstanding services to that Association. The plaque placed in the Arthur Newell Talbot Laboratory bears the following inscription:

"A.D. 1941

to

Arthur Newell Talbot

With affectionate admiration of his fine personality, the American Railway Engineering Association inscribes this tablet in recognition of his pre-eminence in engineering education and research where he has made notable contributions to the science of engineering and in acknowledgment of his brilliant research as Chairman of the Association's Committee on Stresses in Railroad Track from 1914 to 1941 whereby were brought to light facts and principles on which to found a national basis for the design of track of great value to railroad transportation."

Professor Talbot was honored also by a number of other plaques or tablets. They include the following:

1. A tablet placed in 1924 at the Urbana and Champaign Sanitary District Building, which states among other things, "On this site, 1897, The Champaign Septic Tank was built. Designed by Prof. A. N. Talbot. It was among the first of its kind in this country."

2. A bronze plaque presented in 1925 by the American Railway Engineering Association which reads: "An appreciation to Arthur Newell Talbot, worker in research and scientific advancement." This was accompanied by resolutions reciting "... its high appreciation of you as a scientist, and teacher, and investigator and organizer, and, last but not least, as a man."

3. A bronze tablet by students on the occasion of the second biennial Illinois Student Engineering Exhibit, on April 17, 1937, which "Honors the Achievements of Arthur Newell Talbot and His Contributions to Engineering and the Prestige of the College of Engineering, University of Illinois."

The medals and awards presented to Professor Talbot include the following:

1. The Washington Award of the Western Society of Engineers in 1924 "For pre-eminent services in promoting the public welfare, for his life work as

²⁶The subject of Mr. Mehren's address was "The True Measure of Engineering Achievement."

student and teacher, investigator and writer, and for his enduring contribution to the science of engineering."

2. The George Henderson Medal by the Franklin Institute in 1924 as "No. 5 for Invention in Railway Engineering."

3. The Henry C. Turner Medal by the American Concrete Institute in 1928 "For outstanding contributions to the knowledge of reinforced concrete design and construction."

4. The Benjamin Garver Lamme Medal by the Society for the Promotion of Engineering Education in 1932 for "Achievement in Engineering Education."

5. The John Fritz Medal by the United Engineering Societies in 1937 which states "Moulder of men, eminent consultant on engineering projects, leader of research and outstanding educator in civil engineering."

The following honorary degrees were conferred upon Professor Talbot:

Doctor of Science, by the University of Pennsylvania in 1915; Doctor of Engineering, by the University of Michigan in 1916; and Doctor of Laws by the University of Illinois in 1931.

Professor Talbot was recipient of the following honorary memberships:

Institution of Structural Engineers, London, 1913; American Society for Testing Materials, 1923; Illinois Society of Engineers, 1924; American Society of Civil Engineers, 1925; Western Society of Engineers, 1927; American Water Works Association, 1930; American Concrete Institute, 1932; and American Railway Engineering Association, 1933.²⁷

Even after he had passed the four-score milestone in years, Professor Talbot continued to be persistently active in matters pertaining to engineering. In fact, it was while attending and actively participating in the affairs of the annual meeting of the American Railway Engineering Association in Chicago, that he was suddenly taken with serious illness, which resulted in his death there only a few days later, on April 3, 1942.

Melvin Lorenus Enger. See Deans, Chapter V [as follows].

Melvin Lorenus Enger was born on May 5, 1881, at Decorah, Iowa. He received the B.S. degree from the University of Illinois in 1906, the C.E. degree in 1911, and the M.S. degree in 1916. After spending two years in railway service with the Chicago, Milwaukee, and St. Paul Railway, he came to the University in 1907 as Instructor in Theoretical and Applied Mechanics. He was made Associate in 1909, Assistant Professor in 1911, and Associate Professor in 1917. In 1919, he was appointed Professor of Mechanics and Hydraulics, and in 1926 was made Head of the Department of Theoretical and Applied Mechanics. He continued in that position until 1934, when he was made Dean of the College of Engineering and Director of the Engineering Experiment Station, which positions he has held to date (1945).²⁸



Melvin L. Enger

He was an excellent teacher, a helpful administrator, and a generous contributor to educational and technical literature. He is joint author of two Bulletins of the Engineering Experiment Station. He is an active member of a number of engineering societies and was Director of the American Society of Civil Engineers during 1932-34. There is no doubt that under Dean Enger's counsel, leadership and direction, the College of Engineering will continue to grow and expand to a position of even greater pre-eminence among the technical institutions of higher learning in the United States.

²⁷ Much of the material in this biography was taken from a University of Illinois publication Vol. XXXV, No. 62, issued on April 1, 1938, entitled *Arthur Newell Talbot Laboratory, a Tribute to Arthur Newell Talbot*.

²⁸ Enger continued as dean of engineering until 1949. During his 15 years as dean, enrollment in the college increased from 1,000 to 3,000, and the staff from 160 to 450. Research grew to \$2 million a year. Much valuable war-time research was done. The University Airport was built and completed in 1945, and Dean Enger was for a time acting director also of the new Institute of Aeronautics, now the Institute of Aviation.

In 1950, a portrait of Enger was commissioned by Fred B. Seely on behalf of the TAM faculty; the portrait was placed in the Engineering Library, and later moved to the Student Lounge in Talbot Lab, where it resides now (1990). Enger died in 1956 at age 75.—JWP