

The Engineering Building

ENGINEERING

at the

UNIVERSITY of MISSOURI

1850 - 1940

MENDELL P. WEINBACH

PROFESSOR OF ELECTRICAL ENGINEERING



THE ENGINEERING FOUNDATION

COLLEGE OF ENGINEERING

COLUMBIA, MISSOURI

1941

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THE UNIVERSITY OF MISSOURI

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*To the Alumni and Former Students
of the College of Engineering
this book is cordially dedicated*

“..... to furnish students the means of acquiring a thorough knowledge, theoretical and practical, of those sciences and arts which are playing the most important part in the development of the material and natural resources of our country and the advancement of civilization.”

THOMAS JEFFERSON LOWRY

FOREWORD

THIS brief history of the engineering division of the University of Missouri is the outgrowth of the author's chapter on the College of Engineering written for the Centennial History of the University.

The sources of the material used in preparing this book were primarily the official records and the annual catalogs of the University. Bits of information on student activities and student life were obtained from the files of the *University Missourian*, a student weekly published during the years 1871 and 1880 and from the columns of the *Independent*, also a weekly, published by University students in the last years of the past century and the first decade of the present one. Complete files of these papers are in the library of the Missouri State Historical Society.

I am deeply indebted to Walter S. Williams, Professor Emeritus of Topographic Engineering, for interesting first-hand information on the Constructive Period and to Arthur M. Green, Dean Emeritus of the College of Engineering of Princeton University, for information pertaining to the brief period when he was professor of mechanical engineering and junior dean of the College of Engineering at Missouri.

Particular thanks are due to A. Lincoln Hyde, Professor Emeritus of Bridge Engineering, for reading the manuscript; to Mrs. Thomas J. Lowry, wife of the first dean, for the picture of Dean Lowry, and to James H. Barns, class of 1906, for the picture of the first "kow-tow."

I also wish to take this opportunity to acknowledge my indebtedness to W. J. Young, Director of the University Publications, for taking charge of all the printing arrangements; to my daughter, Edith, for literary criticism and for reading the proofs; and to the Engineering Foundation and its president, E. E. Dittbrenner, for financing this publication.

It has been my object to review the past of the College of Engineering, to chronicle its struggles and bring to light its

endeavors, that they may act as an inspiration for the future. For obvious reasons, but more particularly to circumscribe the size of the book, I have restricted considerably the survey of the last twenty-five years. I am confident, however, that whoever will write the history of the college at some future date will look back with a critical and discriminating mind to this particular period and do more justice to it.

M. P. WEINBACH

Columbia, Missouri
February, 1941.

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CHRONOLOGICAL DATA

- 1840 July 4 Corner Stone laid for University Building.
- 1853 July 1 University Alumni Association organized.
- 1856 Chair of Civil Engineering established. William W. Hudson appointed to the Chair.
- 1859 Department of Civil Engineering established.
- 1862 Morill Land-Grant passed by Congress.
- 1863 March 17 Land Grant accepted by the General Assembly of the State of Missouri.
- 1868 Department of Military Engineering established.
- 1870 Feb. 4 Establishment of College of Agriculture and Mechanic Arts approved by the General Assembly.
- 1871 "School of Engineering" is incorporated in the College of Agriculture as a special department.
- 1877 The School of Engineering is officially separated from the College of Agriculture. Thomas J. Lowry appointed first Dean of the Faculty of the School.
- 1882 A course in Electrical Engineering is offered by the Department of Physics.
- 1883 Thomas Edison donates an electrical dynamo to the University of Missouri.
- 1884 Jan. 10 First public exhibition of incandescent electric lighting on the University campus.
- 1885 The Department of Electrical Engineering established.
- 1888 The Rollins Scholarship established.
- 1891 The Department of Mechanical Engineering established.
- 1892 Jan. 9 The great fire which destroyed the Main University Building.
- 1893 The College of Engineering moves into its own building.
- 1893 Dean Thomas J. Lowry retires.
- 1893 The College of Engineering merges with the College of Agriculture.
- 1903 Office of Junior Dean established. Howard B. Shaw appointed to the office.

CHRONOLOGICAL DATA

- 1903.....Department of Chemical Engineering established.
- 1903....."Discovery" that Saint Patrick was an engineer.
- 1904.....Frederick P. Spalding appointed Junior Dean.
- 1905.....Arthur M. Green appointed Junior Dean.
- 1905.....The first Saint Pat's parade and kowtow.
- 1906.....The College of Engineering is officially separated from the College of Agriculture.
- 1906.....Howard Burton Shaw appointed Dean of Faculty.
- 1906.....Establishment of the Engineering Library.
- 1909.....Engineering Experiment Station established.
- 1910.....Adoption of the five-year curriculum in engineering.
- 1913.....H. B. Shaw resigns to become commissioner of the newly created Public Service Commission.
- 1914.....Elmer J. McCaustland is appointed Professor of Sanitary Engineering and Dean of the Faculty of Engineering.
- 1914.....The College returns to the four-year curriculum.
- 1917.....The Department of Agricultural Engineering established.
- 1925.....The Missouri Engineers of Chicago establish scholarship.
- 1931 March 20....The Engineering Alumni Foundation is organized.
- 1935.....E. J. McCaustland retires and F. Ellis Johnson appointed Dean.
- 1936.....The New Engineering Laboratories Building completed.
- 1938.....Dean F. Ellis Johnson resigns.
- 1938.....Harry A. Curtis is appointed Professor of Chemical Engineering and Dean of the Faculty of the College.
- 1940.....The Frederick C. Norton scholarship established by Dean W. C. Curtis of the College of Arts and Science.

ENGINEERING

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THE FORMATIVE PERIOD

A "POLITE AND USEFUL ACCOMPLISHMENT." THE BEGINNINGS OF CIVIL ENGINEERING. The University of Missouri has the distinction of being the first institution west of the Mississippi River to offer training of a distinctly engineering character. We find that in 1849, when the University was just entering into its tenth year, Acting President William Wilson Hudson, who held also the chair of astronomy and natural philosophy, offered a course in civil engineering. The course consisted of "Surveying, Levelling and Classical Topography."

Engineering education in the United States dates from the first decade of the nineteenth century. The United States Military Academy at West Point, the establishment of which was authorized by Congress in 1802, was the first school where such training was given. The first professorship in civil engineering was established at the Rensselaer Polytechnic Institute in 1853.

Formal engineering education at the University of Missouri dates from 1856. The record of the meeting of the Board of Curators of July 9, 1856, contains a note to the effect that the chair in civil engineering was given to Professor William Wilson Hudson. A Virginian by birth and Yale educated, Wilson had held the chair in astronomy since the University opened its gates in 1840. This action of the Board followed a recommendation of President James Shannon, in which among other things, he says:

I suggest to the Board the propriety of making an appropriation of \$500 for the purpose of securing instruction for students in Perspective and Topographical Drawing. The progress of Civil Engineering and Geodetic Surveys has of late given more than ordinary importance to this branch of instruction, and the State University more than any other Institution should be looked up to for this polite and useful accomplishment.

Thus the chair of civil engineering at the University of Missouri is only three years younger than the oldest in the country. It antedates the laying of the Atlantic cable by one year, the

Civil War by four years, the invention of the dynamo by ten years and the invention of the telephone by twenty years.

The course in civil engineering given by Professor Hudson in 1856 included the study of "The Structure of Roads and Railroads, Illustrated with Instruments in the Field." In a letter dated March 23, 1879, by S. Turner to T. J. Lowry, then dean of the school, Professor Hudson is referred to as "the undisputed field marshal of all that was exact in mathematics or possible of calculation." Turner who was a pupil of Hudson describes him as "quick tempered but indulgent, forbearing and kind to all who were attentive and evinced a desire to learn, but utterly merciless to those whom he thought should, could but would not learn . . . a trifle peppery at times, but always scrupulously just and impartial."

Professor Hudson, who succeeded James Shannon as third president of the University the year he was appointed professor of civil engineering, was assisted in his course in engineering by Bolivar S. Head, Adjunct Professor of Mathematics. The course in mathematics is referred to in the catalog of 1856-1857 as "pure and mixed." The mixed mathematics had to do presumably, with applications such as surveying. It should be noted that although civil engineering is thought of as marking the beginning of formal engineering education in the United States, it consisted at this period primarily of land surveying and topographical drawing.

A course in drawing given in 1856 and for two years following by William Alexander in connection with the work in engineering consisted mainly of "representation of buildings in perspective" and "sketches of tracts of ground, sites of towns, villas, water courses, trees and such other objects as diversify the landscape."

Students specializing in engineering were required to take courses in Physiology and Anatomy, Logic and Rhetoric, Intellectual Philosophy and Christian Evidence, Moral Science and Political Grammar, in addition to Latin, French, and German. There could not have been at that time, as we find three quarters of a century later, widespread complaints of too much professional training at the expense of cultural subjects!



William W. Hudson

In a statement to the Board of Curators dated July 1, 1857, President Hudson reported the spending of \$500 appropriated for equipment in mathematics, natural philosophy and astronomy. The apparatus purchased included a theodolite for measuring angles in horizontal and vertical planes in land surveys. This first engineering laboratory apparatus, although not in use for many years, is still in the possession of the civil engineering department of the College of Engineering.

A SCHOOL WITH NO TEACHERS. On October 10, 1859, the Board of Curators approved a recommendation submitted to them by the faculty for the reorganization of the University into seven independent academic departments and three special courses of study called "schools," namely a School of Scientific Agriculture and Mechanics, a School of Civil Engineering, and a Normal School. It is of particular interest to note that the inclusion of a School of Scientific Agriculture and Mechanics in the above plan of reorganization antedates by nearly three years the Federal Land-Grant Act of 1862 for the establishment of such schools in the various states of the Union.

Things did not go well, however, with the University at this time. At its session in 1860, the State Assembly removed the Board of Curators, dismissed practically the entire University faculty including President Hudson, and elected a new Board. On March 15, 1860, this new Board reduced the number of departments established by their predecessors from seven to five. This explains the fact that although a School of Civil Engineering was legally established and formally included in the reorganization of the University's courses of instruction in 1859, the catalog of 1860-61 merely states that "the Agriculture and Scientific Departments will afford particular advantages to students who desire to receive them." Neither of these two departments is listed in the catalog. We find, however, Edward T. Fristoe, Professor of Mathematics and Astronomy in 1860-61, teaching the "Principles of Mensuration" as an application of trigonometrical studies. This was to all intents and purposes the extent of the engineering

training offered in the three years preceding and the three years following the year 1862. During this year all the activities of the University were suspended and the buildings were occupied by Civil War troops.

In 1864 we find Joseph A. Ficklin, A. M., installed as professor of mathematics, mechanical philosophy and astronomy, and Joseph G. Norwood, M. D., as professor of the natural sciences and natural philosophy. Surveying, including field work with compass and theodolite, was part of the course in mechanical philosophy.

Norwood was the first to consider "Statical and Dynamical Electricity" sufficiently prominent natural phenomena to be included in the course in natural philosophy at the University of Missouri. This was almost twenty-five years after the invention of the telegraph and the epoch-making discovery by Faraday of the relationship between electricity and magnetism.

In describing the course in mathematics, Ficklin refers to the "special attention that is being given to the mental discipline of the student" and to "the development of his intellectual powers and the formation and cultivation of correct habits of thinking and reasoning." These were presumably the guiding principles in the teaching of mathematics in the past and are worthy of being thought such by present teachers of mathematics.

THE FEDERAL LAND-GRANT AND ITS EFFECTS. The failure of continuing the chair in civil engineering established by the Board of Curators in 1856 was primarily due to the prejudices of the classicists of the time against science in general and engineering in particular. How could engineering, which in its ultimate aspects deals with practical affairs, the productions of wealth, of physical comfort and leisure, be thought of as legitimate higher education and culture? The little work in civil engineering at the University was given under the diplomatic name of Mechanical Philosophy and the work in physics was cloaked under the dignified name of Natural Philosophy! In fairness to the University of Missouri, it should be fully understood that this was

not the case here only, but at practically every institution of learning in the country. As we shall see, it took many years and a good deal of effort on the part of broad-visioned educators alive to the needs of the age, before engineering education became an articulated part of higher education in American universities. The change in the attitude of educators toward utilitarian education in the United States of America began with the passage of the Morrill Land-Grant Act by Congress in 1862. By this Act, land grants of 30,000 acres for each congressman in each state were made for the establishment of schools of agriculture and mechanic arts and the promotion of industrial pursuits.

The grant to the state of Missouri, amounting to 330,000 acres of land for the endowment of a college of agriculture and mechanic arts, was unanimously approved and accepted by the General Assembly of the state on March 17, 1863, in the following terms:

Resolved by the General Assembly of the State of Missouri that the said act of Congress of the United States is assented to and accepted by the State of Missouri with all conditions, restrictions, and limitations therein contained, and the faith, of the State of Missouri is hereby pledged for the faithful performance of the trust hereby created.

This Act for the establishment of a College of Agriculture and Mechanic Arts constituted the most powerful tool in the hands of the University Administration to force the Legislature to establish courses of instruction in non-classical branches of human knowledge. The prejudices against utilitarian pursuits of study eventually came to an end, and the opposition to the introduction of agricultural and engineering courses of study in the university curricula ultimately died out.

To take advantage of the offer of the federal government to detail to the University an army officer to give instruction in civil and military engineering, the Board of Curators established in 1868 departments of civil and military engineering and provided that the degree of Civil Engineer (C. E.) be conferred on any student who completes and passes a satisfactory examination in the following subjects: algebra, geometry, trigonometry, surveying, navigation, mensuration, analytical geometry, calculus, mechanics,

astronomy, chemistry, mineralogy, geology, descriptive geometry, military engineering, construction of common roads, pikes, gravel roads, railroads, bridges, canals, slack water navigation, improvement of rivers and harbors.

This is the first completely outlined curriculum in civil engineering at the University of Missouri and is quite comprehensive in scope. The work was given under the direction of Major General R. W. Johnson, U. S. A., with the able and enthusiastic assistance of Professors Ficklin and Norwood. It is a milestone not only in the career of the College of Engineering but in the life of the University. It marks the real beginning of the adaptation of scholastic education to the changing needs of society and of the University's realization of the great services it could render the state. We wonder whether there is any significance in the fact that a prize was awarded at the commencement of 1868 for an essay entitled "On the Influence of Manufacturing Establishments in a Community."

Although the Federal Land Grant to the state of Missouri for the specific purpose of establishing a College of Agriculture and Mechanic Arts was unanimously accepted by the General Assembly of the state on March 17, 1863, it was not until five years later that the Legislature decided that the College should be a major division of the University and thus located at Columbia. By this Legislative Act, the University was placed upon a firm foundation for growth. Its function and its prospect for usefulness to the state and nation were thus greatly enlarged. The Legislative Act providing that the College of Agriculture and Mechanic Arts of the University of Missouri be organized specifically to promote "liberal education of the industrial classes in the several pursuits and professions of life," was approved on February 24, 1870, eight years after the passage of the Federal Land-Grant Act by the Congress of the United States. The College of Agriculture and Mechanic Arts thus created was to include in addition to agriculture proper, a School of Engineering, a School of Analytical Chemistry, and a School of Mining and Metallurgy.

RULES OF CONDUCT FOR STUDENTS. A committee on reorganization was appointed by the newly elected President Daniel L. Read to advise him and the Board of Curators regarding courses of study, suitable degrees to be conferred upon those who would successfully complete them, and rules of conduct for the students.

These rules formulated primarily to promote the good order and welfare of the University community were for the best interest of the individual student. Each student had to be present at the morning worship services in the University Chapel. He had to observe faithfully definite "study hours," not loiter on the streets, in town shops, and amusement places "during these hours or after dark or at late hours." The students were expected to attend on Sunday the church of their choice or that of their parents and observe the day as good and orderly citizens. Students must abstain from whispering or communicating with each other during recitation periods, "from spitting on the floor, from all unseemly postures and at all times to observe the conduct and deportment of well-bred gentlemen." The student was given to understand in unmistakable language that the University is for the "good and industrious young men of the State and not for the idle and disorderly, the vile and the vicious." Students were strictly forbidden to enter billiard or drinking places, to carry concealed weapons, to use profane or indecent language, to whistle within the University building, or to do anything which would "tend to prevent the intellectual and moral advancement, in short, all those wicked and immoral practices and habits which would be forbidden in good and cultivated families and which tend to prevent preparation and training for good citizenship."

THE SCHOOL AS A DEPARTMENT OF THE COLLEGE OF AGRICULTURE. The beginning of the 1871-72 session finds the "School of Engineering" organized as a department of the College of Agriculture and Mechanic Arts, with Professor Ficklin in charge of courses in mathematics, astronomy and engineering, and Professor Norwood, who soon became dean of the faculty of medicine, in charge of the work in natural philosophy including

physics and chemistry. Major J. Wilson McMurray, U. S. A., detailed by the President of the United States, in charge of military science and tactics, took charge also of a class in "Practical Engineering" including topographical and field surveying "with the use of instruments." A class in drawing was organized by James A. Abert, Professor of English Literature, French and German. With regard to Professor Abert's ability to teach drawing, the catalog of 1870 states that "his particular taste and artistic culture eminently qualify him to give instruction of the highest order to this important art, elegant as an accomplishment and indispensable to the engineer, the architect and in all the applications of science to the pursuits of life." Professor Abert, who had some experience as an engineer in the United States Army, was made professor of civil engineering the following year.

The comparative importance gained by courses of study of a utilitarian character may be fully realized when we find that a man of such wide and varied culture as Professor Abert should forsake the teaching of English literature for the teaching of civil engineering.

For the first time we find a completely outlined schedule of courses required for a new degree, that of Bachelor in Civil Engineering. It may be of interest and possibly of some satisfaction to present students in the College of Engineering to learn that in 1870 the requirements for the degree included in addition to mathematics, physics, chemistry and English literature, a successful examination in such subjects as Logic and Polemics, Mental Philosophy and Natural Theology, Anatomy and Physiology, Paleontology and Lithology!

The inclusion of a "School of Engineering" as a department of the newly created College of Agriculture and Mechanics marks the beginning of organized technical education in the state of Missouri. The population of the state was largely rural. The land-owning class, which dominated the political life of the state, rejoiced of course at the establishment of the College of Agriculture. The commercial and industrial class on the other hand



James S. Rollins

had very little political influence and as a consequence the School of Engineering failed for several years to get any support from the state. There was no organized course in "Mechanic Arts." It was only part of the official name of the College of Agriculture and no more. Engineering education had, however, numerous able and broadminded supporters who pleaded its cause at every opportunity. Listen, for instance, to this part of an address by Dr. Daniel L. Read, President of the University at the formal opening of the School of Mines on November 23, 1871.

When such a School was proposed at Cambridge in connection with Harvard, though to be endowed by a single individual without touching a dollar of College funds, an outcry was raised as though the Barbarians had for the first time assaulted Rome . . . as though all learning was to perish. Still the new idea advanced and spread. There were men all over the Nation who had awakened to the idea of a more enlarged education, practical and energetic men, the men who were digging up our ore, building our railroads, erecting our great manufactories and machine shops, spanning our rivers with bridges, navigating the ocean and our great rivers and lakes, stretching telegraph wires over continents like nerves over the human body, improving the soil and stimulating the productive energies of the earth—men who did not feel satisfied with church colleges which had sprung up mainly to furnish the Church with Ministers of the Gospel . . .

Listen also to this eloquent description of the achievements of science:

It is by no means my purpose to dwell upon what science has done for our age and generation . . . We see its achievements everywhere and in all departments of life, in the very greatest and in the humblest and most minute. It has accomplished and made realities of what but a few years ago have been regarded as the wildest dreams of the imagination, if not in the nature of things utter impossibilities. I stand amazed at its results whenever I think of them. Steam and lightning and air and all agencies of nature, as now subdued to the dominion of man by the simplest principles of science, have changed our whole earthly condition . . . But the same science is yet to do more. She has but begun her triumphs. Think of the wonderful discoveries of the past few decades. Far more will they be in the years to come, for one discovery makes way for another, one step prepares for the succeeding one . . .

It sounds fresh, this eloquent and luminous word picture of the achievements of science. As though it might have been spoken

today! It is part of an address delivered sixty-nine years ago on March 19, 1872, by the Father of our University, Hon. James S. Rollins, before the Senate of Missouri when pleading for appropriations greatly needed for the scientific and industrial departments of the University!

It was due to the Reads and Rollinses all over the country, who envisioned clearly what is today an accomplished fact—the economic possibilities of science and applied science—that the aloofness of classical education and its hostile attitude toward technological instruction in American universities were forever removed. “The change has come,” said President Read in an address before a joint meeting of the State Board of Agriculture and the curators of the University. “The state of the Arts, the condition of the human society, the tendency of the age, the philosophy of the human mind, the advance of scientific discovery, the more general diffusion of knowledge, made the change a necessity of the age.”

A PROGRESSIVE POLICY. With the establishment of the College of Agriculture including Mechanic Arts and Engineering, the University of Missouri had changed from an old style classical college into a progressive University, which could serve a greater number of students with a greater freedom of choice of studies and objects of life. It entered now into a period of expansion and adaptation to the growing needs of the age, particularly of our own state. A new and far-reaching policy had thus tacitly been adopted by the University of Missouri, the policy of continuously setting itself in line with the ever changing conditions of human society. A careful study of the University's progress from this time to the present day bears out this fact. Our University is now as it should be—“an Institution of Universal Learning, broad as Humanity itself.”

In his address at the laying of the corner stone of the building dedicated to the College of Agriculture and Mechanic Arts, now Switzler Hall, on June 28, 1871, Governor B. Gratz Brown expressed his belief in the great destiny of the University through

its growing usefulness "by making education and science keep pace with the practical economy of the times and the wants of practical men."

Let it be clearly understood that this expansion was not spontaneous. The "School of Engineering" even as a department of the College of Agriculture was as yet in this year 1873 a "school" on paper only, and in the following quarter of a century it went through rather severe growing pains. In the sessions from 1873 to 1876, the School of Engineering had no faculty of its own and whatever work of an engineering character was given, was taught by teachers of mathematics and physics. Professor Norwood, whom we have mentioned before as professor of natural philosophy and who became dean of the medical faculty and also University librarian, seemed to have been a tireless worker. He had charge of and conducted the classes in physics and chemistry. It was he who introduced experimental work in the study of physics at the University. He kept on asking for funds for laboratory equipment. The records do not show that he ever got any, but they do show that once in a while some new piece of equipment made its way into the laboratory. Whether he bought this equipment with his own money or "*begged*" it from the manufacturer as some of us do this very day, we cannot tell. In a report to the president in 1873 he mentions the acquisition of an induction coil, "the largest ever made," a Holtz static machine, an automatic arc lamp, and a complete set of apparatus for illustrating wave motion.

And thus we come to the year 1876 and witness the completion of a whole century of our national existence and slightly more than one third of a century of the life of the University. We find on the campus a group of men, small in number but full of enthusiasm pertaining to the possibilities of technical education at Missouri. Some, like the two Josephs, Norwood and Ficklin, for many years on the staff of the University, are as stout supporters of the progressive policy of the University as they ever were. We find an Erastus L. Ripley who, although dean of the faculty of the Normal School and professor of pedagogics, went

out of his way to help the new department of engineering by offering instruction in mechanical drawing and descriptive geometry. William A. Cauthorn, affectionately called "Uncle Billy" by his students of later years, is a newcomer in mathematics in 1876. Many stories have come to us about Uncle Billy. The one which is undoubtedly true is told by Professor Walter S. Williams who was a pupil of Cauthorn. The story tells of the complete mystification of the good old professor when he failed to see the appearance of the Polaris during an observation for time with the meridian transit. He rechecked his calculation for the time from the ephemeris and rechecked the setting of the vernier for the declination. When these were found correct and the star not seen he ran to Ficklin, the professor of astronomy, and excitedly told him that the star failed to appear in accordance with the ephemeris. Professor Ficklin went with him to the observatory, deliberately removed the cap from the transit telescope, and held it in front of Cauthorn who not used to stronger language, said "I'll declare!"

Paul Schweitzer, whom the writer of this chronicle had the privilege of meeting when he was the grand old man of the chemistry department, joined the faculty staff in 1876 as professor of chemistry. A man of great erudition, with an extensive training in German schools, he is the first to occupy the chair in chemistry proper. Schweitzer gave nearly a half a century of his life to the service of the University and to the country of his adoption. These services are appropriately commemorated by "Schweitzer Hall," housing the strictly modern laboratories of the department of agricultural chemistry on the East Campus. It was this Paul Schweitzer who was the first to give a course in fuels, steam and the steam engine, the embryo course in mechanical engineering.

THE CONSTRUCTIVE PERIOD

THE FIRST DEAN. The session of 1877-78 was a momentous period in the life of the School of Engineering. The "school" was officially separated from the College of Agriculture and it thus acquired an individuality of its own. Its faculty, with Thomas J. Lowry, Professor of Civil and Topographical Engineering, as dean, consisted of S. S. Laws, President of the University, and Professor of Logic; Lieut. Frank P. Blair, Professor of Military Engineering; Joseph G. Norwood, Professor of Natural Philosophy; Joseph Ficklin, Professor of Mathematics and Astronomy; E. L. Ripley, Professor of Free-hand and Mechanical Drawing; G. C. Swallow, Professor of Economic Botany and Geology; Paul Schweitzer, Professor of Chemistry; and D. R. McAnally, Jr., Professor of English.

The function of the school was given the broad definition "to furnish students the means of acquiring a thorough knowledge, theoretical and practical of those sciences and arts which are playing the most important part in the development of the material and natural resources of our country and the advancement of civilization." There is no record of the author of this definition of the function of our College of Engineering. From a careful study, however, of the personality and work of Dean Lowry we may hazard the guess that it was formulated by him. It is broad and comprehensive and just as fitting now as it was sixty years ago.

A rather ambitious program was initiated by this newly organized faculty of the School of Engineering. In addition to the fundamental courses in mathematics, drawing, chemistry and physics, the professional preparation of students in engineering comprised the following studies: Location and construction of roads, railroads, canals and water works; surveys and improvements of coasts, harbors, rivers and lakes; determination of geographical coordinates on land and sea; design and construction

of roofs, trusses and suspension bridges; design and construction of various kinds of arches; the design, construction, and application of wind and hydraulic motors, air and steam engines; economic geology; military engineering and the art of war; selection, tests and application of materials used in construction; higher analysis in engineering investigations and the preparation of papers and essays on professional subjects. As seen, it is a complete, quite comprehensive and diversified outline of a course of study required for the professional degree of Civil Engineer.

The faculty soon realized, however, that it would be impossible for any student to master all these subjects and to acquire proficiency in any of them. The course of study was split, therefore, into three parallel courses referred to as civil engineering, topographical engineering and military engineering, with appropriate degrees in each. The first three years of work were identical for all three. They were not yet called curricula. In so far as we are able to learn no one ever received the degree of Military Engineer from the University of Missouri.

The fact that the above outlined course includes "engineering investigations and the preparation of papers and essays on professional subjects," is of particular significance. It indicates that the members of the faculty were fully alive to the needs of the profession. The successful completion of engineering projects at this time depended almost entirely upon the experience and sound judgment of the practitioner. Engineering projects of greater diversity and magnitude began to appear now in larger and larger numbers. There was an acute and urgent need of more accurate data on materials of construction and of more scientific approach in the solution of problems pertaining to the correct utilization of such materials. The faculty of engineering, aware of these needs of the profession, soon recognized that one of its foremost functions is to contribute to the growth of the engineering art by actual research and publication of such research. This policy was encouraged by practicing engineers in the state. There is a record, for instance, of a prize offered in 1878 and for

some years following, by Charles Dachsels, an engineer of Jefferson City, for the best thesis on the steam engine.

The students enrolled in topographical surveying during the session of 1878-79 undoubtedly took great pride in the following comments of Dean Lowry in a report to President Laws and dated June 6, 1878:

The energy, enthusiasm, painstaking care and accuracy displayed by this class have confirmed me in the opinion previously formed from observation and experience of seven years with field officers of the U. S. Coast Survey and Navy, that the American mind possesses a fertility of resources, a power of adapting means to ends and an acuteness of perception which peculiarly fits it for an observer in the exact arts!

He mentions in this report that the University campus and adjoining city blocks were surveyed by his students; he indicates that the survey will be extended the following year to the state farm, and expresses his hope that the work "will be gradually expanded until it eventually covers the entire state of Missouri!" It seems that the good old Dean was completely carried away by his own enthusiasm.

Dean Thomas Jefferson Lowry, to give him his full name, was an alumnus of the University of the class of 1870. For seven years following his graduation he served as an officer in U. S. Coast Survey. When told in 1878 by President Laws that the chair in civil engineering would have to be discontinued because the salary for the professorship was not included in the budget, he offered and did serve the University the entire session of ten months for "just enough to pay his board" which amounted to \$250.

Eleven years later on the occasion of the semi-centennial celebration of the University in 1889, Dean Lowry published in the *Columbia Herald* a series of articles on the University dealing particularly with the fifteen year period from 1875 to 1890. These articles, subsequently collected and published as "*A Sketch of the University*," were reprinted in 1898 by the United States Bureau of Education under the title *Higher Education in Missouri, Contributions to American Educational History*.

Walter S. Williams, retired professor of surveying, who studied under him, tells us that Dean Lowry was short of stature and of slight build. He had an undershot jaw covered with a short straggly, reddish beard, and wore long hair. In cold weather he usually wore a military cape and for greater protection against the cold wound a comfort around his neck. Numerous stories have come to us from some of his former students. There were eight graduates in civil and topographical engineering in 1878, and the fact that all secured positions soon after commencement had, in the language of Dean Lowry, "awakened great interest and enthusiasm for the cause of engineering education at the University of Missouri."

The faculty of the School of Civil Engineering was augmented for the 1879-80 session by the appointment of Conrad Diehl to the chair of free-hand and topographical drawing. To meet the demand for specific information pertaining to various phases of engineering practice, prominent engineers were invited to lecture to the students in engineering. Captain James B. Eads, the designer and builder of "Eads" bridge across the Mississippi at St. Louis was the first to accept. We find him for several years a visiting lecturer on bridge design and construction. At the commencement in 1885, Captain Eads was presented with the C. E. degree, *honoris causa*. Major Charles R. Sutter and Lieut. Smith G. Leach, both of the Engineers Corps U. S. A. were detailed for several years beginning with the 1879-80 session as visiting lecturers on engineering subjects. George C. Pratt, Railroad Commissioner of the state of Missouri, was added to the list in 1881 as special lecturer on railroad engineering. Pratt had a most colorful career. A native of Massachusetts and a graduate of Amherst, he came out "west" in 1841 as a civil engineer. He settled in Boone County, Missouri, and soon became a teacher of the classics at the Bonne Femme Academy, a good school by the standards of that time, and which was located a few miles south of Columbia. In 1848 he was made principal of the Academy but resigned in 1850 and went to California for his health. Five years later he returned to Missouri and took quite



Thomas Jefferson Lowry

an active part in the location and construction of the first railroads in the state. He was secretary of the Missouri Railroad Commission in 1875, elected commissioner in 1881, and was appointed the same year, as previously mentioned, special lecturer on railroading in the College of Engineering. Several years later he served the University as a member of the Board of Curators.

THE LAWS ASTRONOMICAL OBSERVATORY. The department of astronomy is not an integral part of the present College of Engineering. It played however, as we have seen, an interesting part in the shaping of the college's destiny, particularly when the professors of astronomy took it upon themselves to give instruction not only in the mathematical sciences but also in surveying. For many years, astronomy was a required course of study for civil engineering students, and even now a limited amount is elected in connection with courses in surveying.

The department has a most interesting history worth recording. Unlike any of the other departments of the University, astronomy occupied by itself a rather small building, built in 1854 and which housed a few measuring instruments that were used in surveying, in the determination of the azimuth, longitude, and latitude, such as a sextant or two, compasses and a theodolite. This small building was located until 1880 about 15 feet southwest of the main academic building which was destroyed by fire in 1892. This location coincides almost exactly with the present office of the dean in the Engineering Building. The telescope now in the possession of the department was acquired by the University in 1879 and formally dedicated January 13, 1880, in a much larger building especially designed to house this telescope and which was located until 1910 where the Jay H. Neff Hall of Journalism now stands. The observatory is now located just east of the University golf links.

The telescope was constructed in Munich, Germany, in 1848 by the firm of Merz and Mahler for Shelby College of Shelbyville, Kentucky. It was mounted there under the supervision of Professor Winlock of Shelby College. When Winlock went to

Cloverden Observatory at Cambridge, Massachusetts, a few years later, the telescope went with him. The University of Missouri acquired it in 1879 for \$500 out of a fund of \$2000 donated by President S. S. Laws for the advancement of astronomical studies at the University. The generosity of President Laws was rewarded by the Board of Curators by naming the observatory "The Laws Observatory" and the telescope "The Laws Telescope." The Board established also a prize in the form of a gold medal, known as the "S. S. Laws Astronomical Medal" awarded annually at commencement to the student who has done the most creditable work in astronomy.

The height above the sea level of the bench mark on the north side of the steps of the present Engineering Building, and so much used by classes in surveying as a datum level, was determined from the bench mark on the sill of the north window of the old Laws Observatory building. This original bench mark was determined in 1893 by F. B. Williams, brother of Professor Walter S. Williams, and W. L. McCrary, graduates in civil engineering, who ran a line of levels from the observatory to a bench mark established by U. S. Coast and Geodetic Surveys near the Missouri River in the town of Providence, nine miles south of Columbia. The work was carried out under a special appropriation made by the Board of Curators for the purpose.

THE BEGINNINGS OF ELECTRICAL ENGINEERING. The year 1880 is of particular significance in the life of the College of Engineering. Joseph Norwood, that staunch supporter of engineering education, retired this year and became Professor Emeritus of Natural Philosophy. His place was taken by Professor Benjamin E. Thomas, not as professor of natural philosophy, but of physics. Natural philosophy as a course in the University curriculum became from now on a thing of the past.

Professor Thomas is the first who taught in his course in physics the few practical applications of electricity known at that time such as telegraphy, primary batteries, signalling. Electrical engineering as an integral part of engineering education thus had

its beginning at Missouri in Thomas' teaching. He was fully aware of the commercial possibilities of Bell's telephone, only four years old, and of Edison's incandescent lamp which had been just given a public exhibition in New York. In 1882, even before Edison put into operation his Pearl Street lighting station in New York City, we find Thomas endeavoring to get an appropriation for the purchase of an Edison dynamo and of Edison lamps to be studied by his students. He was not successful, however, in his efforts, and President Laws who was keenly interested in science appealed directly to Edison. He had reasons to believe that Edison would not refuse him. These reasons go back nearly twenty years to 1863.

Doctor Samuel Spahr Laws, an ordained Presbyterian Minister, had a most eventful career before he became president of the University of Missouri. In 1854 we find him professor of natural philosophy at Westminster College, Fulton, Missouri, and a year later president of that college. Because of his strong sympathy with the South, he lost the presidency of that college at the beginning of the Civil War. He spent several months in a federal prison, and after being released on parole went abroad. A year later we find him in New York as vice-president of the New York Gold Exchange. This was just twelve years before he was elected president of the University of Missouri, and not quite twenty years before the event of our narration. At the time he was vice-president of the Gold Exchange, speculation in gold was at its height. Laws, who had unusual inventive ability, promptly invented an electrically operated quotation indicator, the forerunner of the present-day stock ticker. This device he rented out to brokers to whom he transmitted simultaneously the quotations on gold by means of a master indicator installed at the Exchange. One day something went wrong with the controlling equipment. The brokers failed to get the watched-for quotations and a near panic was on. Edison, only twenty-one years old at that time, was in New York waiting for a job as telegraph operator with the Western Union. He happened to be visiting the Exchange when the Laws device failed to operate. It did not take very

long for the keenly observant Edison to discover and to point out to Laws the cause of the failure of the device. At Laws' request Edison made the necessary repairs, and was promptly hired at a very substantial salary to supervise the operation of the so-called "Laws Gold Reporting Telegraph."

In the spring of 1882, shortly after the Pearl Street station was put in operation, Edison presented to the University through President Laws a dynamo of his manufacture and some incandescent lamps. This dynamo is still in the possession of the electrical engineering department. Professor Thomas was overjoyed with this magnificent gift. His joy was, however, of short duration. To actually operate the dynamo, he needed a steam engine to supply the motive power. The steam he could obtain from the steam plant used to heat the building. But a steam engine costs money, and money Professor Thomas did not have. He corresponded with a few manufacturers of steam engines. We do not know the contents of these letters; they must have been quite persuasive, for before the year was over, Messrs. D. June and Company of Fremont, Ohio, makers of engines, loaned Professor Thomas a new steam engine to drive his cherished Edison dynamo.

The complete equipment was set up by him and his students in the basement of the old Academic Building, and on January 10, 1883, Professor Thomas gave a public exhibition of incandescent electric lighting in the presence of the Board of Curators. In so far as we can tell, it was the first public exhibition of such a light in Missouri and very likely, the first west of the Mississippi River.

At the request of the Board and of the president, the Chapel in the old Academic Building was wired for incandescent lighting by Thomas and his students. He did much to awaken public interest in this new method of producing light. Using a cluster of incandescent lamps and a powerful reflector he was fond of throwing a beam of light from the top floor of the building across the length of Eighth Street. Referring to this the *Missouri Statesman* of January 19, 1883, gives the following account:

"An electric light placed in a window at the University last



Samuel S. Laws

Saturday night, illuminated the entire street from the University to the Courthouse and attracted a great deal of attention.”

We are told by Judge North Todd Gentry, who knew Professor Thomas, that Thomas installed the first telephone line ever seen in Columbia. The line extended from the Boone County National Bank, located at that time at the northeast corner of Broadway and Eighth Street, to the residence of I. O. Hockaday, southeast corner of University and College Avenues.

With such interesting work, interestingly taught by Professor Thomas, there is no wonder that the students in physics more than doubled in number the following year, in 1884. Experimental studies were now made in electrical measurements, in performance of dynamos and of complete lighting plants. The old Academic Building was wired for electric lighting under his supervision. Two larger Edison dynamos and a 35 horse power Armington and Sims engine were purchased for the purpose. These dynamos, although not in use at present, are in the electrical engineering laboratories.

THE DEPARTMENT OF ELECTRICAL ENGINEERING ESTABLISHED.
The various extra activities undertaken by Professor Thomas, in addition to his heavy teaching load, were fully recognized and appreciated by the president and the Board of Curators. In 1884 the Board appointed William F. Shuerman to help Thomas whose hard work was beginning to tell on him.

Like many teachers of physics of this period, Thomas realized the commercial possibilities of the telephone, of electric lighting, and of electro-magnetic machines in general for a multitude of useful purposes. There appeared a steadily increasing demand for competent men familiar with the scientific principles involved and who could undertake to design, construct, and operate such machines, telephone systems, and electric power and lighting plants. To meet this growing demand, Professor Thomas recommended the advisability of establishing a department of electrical engineering as an integral part of the School of Engineering, leading to the degree of Electrical Engineer.

This was done the following year, in 1885, soon after the resignation of Dr. Thomas and the appointment of Dr. William B. Smith, then at Central College at Fayette, Missouri, to the chair of physics. With the establishment of the department of electrical engineering, the University of Missouri fell in line with the leading institutions in the country. The oldest department of electrical engineering is that at Massachusetts Institute of Technology established in 1882. Formal instruction in electrical engineering at the University of Missouri is thus only three years younger than the oldest in the country.

With the resignation of Professor Thomas, the experimental studies to which he had given such noteworthy prominence received a set-back. Dr. Smith, admired and loved by all who knew him, was a great scholar, more interested however in the theoretical than in the practical aspects of science, more interested in the philosophy of things than in their application to everyday affairs. Realizing the importance of experimental work for which he had no particular inclination, Dr. Smith asked for and was transferred to the chair of mathematics which he held for several years.

The transfer of Dr. Smith to the chair of mathematics created a vacancy in the department of physics which President Laws immediately filled by the appointment of a young man from a small college in Kentucky. This man had no particular qualification for the position, and the rather large group of students in physics and mathematics, pupils of both Thomas and Smith resented vigorously the appointment. The leaders of this dissenting group, Thomas J. J. See, now astronomer at the U. S. Naval Observatory, Mare Island, Calif., and the late Luther M. Defoe, were delegated to talk to President Laws and ask him to appoint W. F. Shuerman, Thomas' assistant to the chair of physics. When President Laws intimated rather strongly that he was not inclined to listen to their plea, See and Defoe told him in a straight-forward manner that they and the group they represented were much more competent judges regarding the fitness and abilities of their teachers than the president himself.

Shuerman was promoted to an assistant professorship, and as such carried on the work so successfully begun by Dr. Thomas.

William F. Shuerman was a graduate of Johns Hopkins University which undoubtedly explains the nickname of "Johnny Hopkins" bestowed on him by his students. We are told that he was very timid and that he blushed profusely when students asked him to explain some problem, particularly when the questioner happened to be some young lady. With such odds against him, he deserves considerable credit for sticking to his job in the pioneering instruction in electrical engineering until the spring of 1888 when Millard L. Lipscomb was appointed to the chair of physics.

THE DEPARTMENT OF MECHANIC ARTS ESTABLISHED. We have seen that the College of Agriculture including a department of mechanic arts was officially established as a major division of the University in 1870. Its function in the sciences basic to agriculture was by now in 1890 well formulated and the college under way toward the position of leadership it now has in that field. Nothing was done, however, in the twenty years after its establishment to organize the department of mechanic arts which was evidently contemplated by the legislature's acceptance of the Federal Land-Grant Act in 1863.

Now and then we find presidents of the Board of Curators reminding the governors of the serious neglect on the part of the General Assembly to establish a department in which this kind of instruction be provided for those youths of the state who desire it. In this report to Governor John S. Marmaduke in 1886, Hon. E. W. Stephens, then President of the Board, expresses emphatically his hope that the state would no longer neglect this "manifest duty." Dr. W. Pope Yeaman, President of the Board in 1888, uses rather forceful language when he brings this matter to the attention of Governor David R. Francis. Thus in his annual report to the Governor he says: "The College of Mechanic Arts, as provided for and required by the Act of Congress of 1862 and under the operation of which the State of Missouri acquired

a large acreage of lands from the federal government, has been and still is practically ignored by the Legislature of Missouri. Thus faith with the federal government is broken and a great educational benefit is withheld from the people."

There seems to have been, however, some fully acceptable reasons for the twenty-year delay in organizing the department of mechanic arts. The purposes of such a department were not clearly defined either in the Land-Grant Act or in its acceptance by the State Legislature. Opinions regarding the character or type of instruction differed quite widely. Some educators thought that the function of such a department should be the training of students in the acquisition of skill in the handling of tools and machine shop practice. Others felt that the establishment of a trade school would be obviously below the plane of University work, and that the function of such a department should be the teaching of scientific principles underlying industrial methods and schemes of manufacture. In the minds of the men who held this latter opinion, the department of mechanic arts was to be a professional school on the same plane with the professional schools of law and medicine and whose graduates would be leaders in industry, professionally the equals of lawyers and doctors.

Dr. Richard H. Jesse, newly elected president of the University, recommended very strongly the establishment of the department, and when it was finally organized in 1891 as an integral part of the College of Agriculture, a struggle that lasted over twenty years came to an end.

The department was organized on a strictly professional plane. In addition to subjects in drawing and shopwork, a regular course of study, both cultural and scientific, was prescribed for all students who desired to specialize in mechanic arts. The larger cities in the state such as St. Louis and Kansas City, growing industrial centers, began from this period on to be more favorably disposed toward the University. By providing instruction and training in fundamentals of industry and manufacture and related arts, the University of Missouri added one more to its many services to

the people of the state. This was fully realized by the Administration. Note what Hon. G. F. Rothwell, President of the Board, had to say in his annual report to Governor Francis:

. . . The hand of industry is every hour growing into greater comparative importance. It was denied a position by the side of the professions. Now the spirit of the age calls the industrial pursuits into the halls of the University and crowns the hands of toil and the implements of industry with the same honor in which it clothes the bar, the bench, and the forum. The State and Nation join in welcome of the industries to the home of the classics and the sciences.

On June 3, 1891, the Board of Curators appointed C. W. Marx, well-known mechanical engineer with extensive shop practice, as "superintendent of the newly created 'School' of Mechanic Arts." C. B. Rearick was appointed instructor in drawing. A sum of \$5000 was spent for the purchase of equipment for woodworking, forging, and machine work, all of which was installed in the basement west wing of the main University Building.

THE GREAT FIRE AND ITS EFFECTS. In the fall of 1891 we find the main University Building housing both the classics and the engineering shops. On the upper floor we hear students reading Xenophon's "Memorabilia," discussing Greek and Roman Art, or disputing Locke's "Essay Concerning Human Understanding," while on the basement floor we see others hammering away with all their might at a red hot piece of iron, running a lathe or whittling diligently at a piece of wood to shape a pattern! The fire of January 9, 1891, which completely destroyed the building and most of its contents was surely, by the creed of the classicists of 1860, a revenge of the Gods!

Fortunately the new shop equipment was little damaged. The two Edison dynamos which supplied the building with electricity for lighting were salvaged and are now in the electrical engineering laboratories. Two materials testing machines in the civil engineering laboratory were destroyed completely. We were told by the late Marquis H. Lockwood, the first to receive the E. E. Degree from the University, that the fire was caused by a short-circuit in the wiring of the chandelier in the chapel. Lockwood,

a junior at that time, was helper to the engineer of the University power plant. Just before the alarm was given, he noticed that the switchboard meters behaved rather queerly, and that one of the generators raced. He stopped his engine just about when the alarm was given and rushed out to give whatever help he could to fight the fire and salvage the contents of the building.

The fire was a blessing in disguise. It stirred up public interest in the University—even to the extent of having it moved to another locality. . . . With the funds collected from the insurance, given by the state and generously subscribed by the people of Boone County there were built six new buildings including the present Engineering Building, a Mechanic Arts Building, and a power house just south of it. These buildings were grouped around the quadrangle with the stately six columns, the remains of the destroyed building, in the middle.

In the debate over the columns as to whether they should be left standing or be done away with, Hon. G. F. Rothwell, then president of the Board said:

Let the columns stand—let them stand a thousand years, a memorial to the men who in their magnificent presence, learned what life and duty are, to live the one and do the other. They will be a rallying point of future devotion and service to the University. And the sad columns will in future years prove of deep significance and impressive force upon the columns of new students growing ever longer as time proceeds and the state makes greater provision . . .

What a true prophesy from a loyal son of his Alma Mater! We have seen these columns of students grow longer and longer and the state more and more generous in providing for the needs of the University. We have also witnessed the columns grow into a sacred symbol of the institution. There is no alumnus of the University to whom they do not call to mind his college life and all the associations that cluster around it.

THE DEPARTMENT OF MECHANICAL ENGINEERING ESTABLISHED.
The session of 1892-93 is a momentous one in the life of the College of Engineering. It now had its own quarters, a two-storied building with a frontage of 145 feet and with a depth as

originally built of 75 feet. It had 32 rooms in addition to two lecture halls. Its cost was \$30,000. The Mechanic Arts Building (now Engineering Hall, South) has a frontage of 108 feet and a depth, as originally built, of 117 feet. It contained six shop rooms, an exhibit hall, two offices, a drawing room, two class rooms, a store room and an engine room. The driving power for the equipment in the shops was supplied by a 90 h. p. Corliss engine. The total cost of this building was \$27,000.

This public support of engineering education coupled with the sympathetic encouragement of President Jesse was a great stimulus to the small group of teachers of engineering. It was a challenge in their endeavor to fit the youths of the state to the evergrowing opportunities offered by the engineering profession.

On the recommendation of Mr. Marx, whose official duties were to superintend the shop work, a department of mechanical engineering on the same plane as that of civil and electrical engineering was established this year. The shop work which was the major course in the department of mechanic arts was made a subordinate subject of the new department and Marx was elected to the newly created chair of mechanical engineering. This department has thus the distinction of having been placed at its inception in the charge of a full professor. That of electrical engineering, although six years older, was to be manned for one more year by the staff in physics which now included William Schrader who, as we shall see, was destined to be the first to occupy the chair of electrical engineering at the University of Missouri.

THREE "SCHOOLS" WITHIN ONE COLLEGE. At the opening of the 1893-94 session we find the School of Engineering quite well organized with departments of civil, electrical and mechanical engineering, each with definitely outlined curricula leading to the degrees of B. S. in the respective courses. The enthusiastic and tireless Dean Lowry retired at the end of the preceding session and Harry T. Cory, well-known mechanical and civil engineer, was appointed to the chair of civil engineering. Dr. William Schrader,

who for the past two years had been assistant professor of physics in charge of courses in electrical engineering, was promoted to the newly created chair of electrical engineering.

With the retirement of Dean Lowry, the School of Engineering lost its identity as a separate division of the University. Since the Land-Grant Act called for the establishment of a College of Agriculture and Mechanic Arts, it presumably was felt by the administration of the University that the letter of the law would be more fully complied with by placing the "Schools" of Mechanic Arts and Engineering under the headship of the dean of the College of Agriculture just as they were during the session of 1871-72. There was a possible presumption that the merging of the three "Schools," Agriculture, Mechanic Arts, and Engineering into one college would probably bring greater financial aid from the federal government, and that some of the federal moneys would be available for the School of Engineering. Whatever the reasons were, engineering was for the following ten years a subdivision of the College of Agriculture and Mechanic Arts.

Edward D. Porter, who was the first dean of the merged three schools, died in 1894 and Henry J. Waters, Professor of Agriculture at the Pennsylvania State College and an alumnus of the University became dean. The division of engineering owes much to Dean Waters, who although a specialist in another field of scientific endeavor, was a staunch supporter of engineering education at the University of Missouri. Under his vigorous and constructive administration, the faculty of engineering adopted the plan to meet monthly for discussion of educational policy, curricula, entrance and graduation requirements.

We have seen that the first to occupy the chair of electrical engineering was Dr. William Schrader. His connection with the University began during the first year of President Jesse's incumbency. A native of Indiana and a graduate of Rose Polytechnic Institute, Schrader took his graduate work at the University of Berlin under Helmholtz, and at the Imperial University of Strassbourg where he studied under Kohlrausch and where he received his doctorate. We are told by those who knew



Howard B. Shaw

him that he was a daring horseman, a graceful dancer, an adept at fencing, a good marksman, an inspiring teacher and an enthusiastic experimenter. For five years (1891-1896), he and Professors Cory and Marx worked earnestly in formulating higher standards of admission to the school, organizing courses of study and elevating the requirements for graduation. On August 13, 1896, Schrader was stricken ill with acute nervous prostration and died at the age of thirty. At the time of his death he was experimenting with X-Rays then newly discovered by Roentgen. Cory and Marx, after carrying on for five more years their work so excellently begun in 1893, were called to more attractive and remunerative fields. Marx joined the faculty of engineering at the University of Cincinnati, while Cory went into practice and soon became nationally known as a builder of dams and, incidentally, the hero of Harold Bell Wright's novel "Barbara Worth!"

THE CONTEMPORARY PERIOD

THREE JUNIOR DEANS. The industrial and economic structure of the country has experienced in the last two decades of the nineteenth century a gradual but well defined change. Crossing the threshold of the twentieth century this change becomes quite apparent, for the complete mechanization of American industries was to all intents and purposes an accomplished fact.

A more comprehensive knowledge of physical and chemical phenomena and of the laws governing them and their relationship to each other, multiplied their application to arts and industry. New theories were evolved, new laws were discovered and formulated, resulting in continuous and uninterrupted developments in manufacturing methods and in the creation of new demands for newer products that required new processes. The demand for power by this great and almost feverish industrial activity increased beyond what the human mind could foresee. It became an imperative need in factories and shops, in the erection of huge structures, bridges, dams, in the construction of ships and locomotives and soon of automobiles and airplanes. All this brought about a constantly increasing demand for technical graduates prepared to formulate and solve new-born problems of engineering and take care of the ever multiplying needs of modern industry.

The College of Engineering of the University of Missouri was most fortunate in having at this time as heads of its three major departments, men of high professional standing who had a clear vision of the responsibilities of the engineer in a highly industrialized world.

Howard Burton Shaw, now professor of industrial engineering at North Carolina State College and a graduate of the University of North Carolina and of Harvard, came to the University of Missouri following the untimely death of Dr. Schrader. Frederick



Frederick Putnam Spalding

Putnam Spalding, a graduate of Lehigh, took the chair in civil engineering vacated by Professor Cory, and Arthur M. Green, now Dean Emeritus of Engineering at Princeton University, a graduate of the University of Pennsylvania, became head of the department of mechanical engineering soon after the resignation of Professor Marx. It is to the vision and fine cooperation of these three pioneer leaders in engineering education that the College of Engineering at the University of Missouri owes its solid structure erected upon the firm foundation laid by their predecessors.

In 1904 the enrollment in the School of Engineering had increased to such an extent that the Board of Curators decided to establish the office of Junior Dean for a period of three years. This junior deanship was filled successively by the heads of the three departments starting with H. B. Shaw and ending with Arthur M. Green, at which time the School of Engineering was completely severed from the College of Agriculture and became again an independent and separate division of the University.

The forty-year period from the beginning of the century to the present day should be the most easy to survey by virtue of the writer's own direct contact with the personalities that influenced the development of the school and because of his more or less intimate knowledge of significant events. And yet for very obvious reasons he finds it more and more difficult to do so. With Spalding, Shaw and Green as heads of the three departments, the College of Engineering got well under way toward the position it now has among technical schools in the country. They were not only able educators but well trained engineers and as such they imparted to their students that professional consciousness which has just begun to be felt by practicing engineers. The faculty consisted of a small but energetic group of young men with advanced ideas of scholarship and with well defined objectives. They took their job of teaching seriously. They were greatly concerned with methods of presenting their subjects; with standards of admission to the College, with curricula, with requirements of graduation. The coming of age of the College

by its separation from the College of Agriculture and its promotion to the rank of an independent, though articulated, division of the University brought about a new spirit that injected into the faculty and student body self-reliance and a strong determination to "make good."

It was a great loss to the University and to the School of Engineering in particular when Professor Green resigned in 1907 to go to Rensselaer Polytechnic Institute. President Jesse chose him for the chair in mechanical engineering from a large number of candidates. In accepting his appointment, Professor Green, not acquainted with the liberalism of the University of Missouri, asked President Jesse "whether politics or religious belief entered into the future of members of the faculty." President Jesse gave him the characteristic answer that "Missouri does not care how a man votes or where he eats his communion!" Professor Green is responsible for various improvements in the operation of the old electric and heating plant of the University. He introduced a cost system of accounting for the University's expenditure for light, power, water and gas. With all these *ex cathedra* activities, Professor Green found time to write a reputable text on steam engineering and to court successfully Miss Mary Lewis, the University Dean of Women. No wonder that Professor Green has a warm spot in his heart for the University of Missouri and for the College of Engineering in particular. He became an honorary and honored alumnus of the University when at the commencement of 1940 the University conferred upon him the degree of Doctor of Laws.

Scores of alumni cherish the memory of Spalding. How well we recall him with hands in trouser pockets giving his characteristic dry chuckle, the preliminary to the telling of a good story—when a wan and grateful smile would spread over the faces of his students!

Professor Shaw, referred to by his students as H. B., was the first Junior Dean and the second full Dean of the School of Engineering, a position he held until 1913 when he was appointed



Arthur M. Green

by Governor Elliot Major as a member of the newly created Public Service Commission of Missouri.

THE DEPARTMENT OF CHEMICAL ENGINEERING. This department was established in 1903 and originally conducted by the staff of the department of chemistry, headed by the late Herman Schlundt. The department had a slow growth but picked up rather rapidly in the years following the World War. It is now one of the most active departments in the College, having four well-trained men who devote their entire time to teaching and research. The present curriculum is well planned to furnish a broad fundamental training in manufacturing processes of chemical products. The laboratory, covering over 8700 square feet of floor space, is well equipped with apparatus and measuring instruments for experimental studies by students and for research work.

SAINT PATRICK WAS AN ENGINEER. It is generally admitted that traditions are very essential to the development of what is usually referred to as college spirit. The introduction of certain customs and the close observance of such customs from year to year go a long way in fostering loyalty to and veneration of one's Alma Mater. Undergraduates look forward with pleasure to their participation in these ceremonial customs and the alumni look back with delightful memories to the customs and traditions they have taken part in.

The tradition religiously observed by the students of the College of Engineering for the past thirty-eight years is "Saint Patrick's" on March 17. It has fostered among Missouri engineers both students and alumni a wholesome and enthusiastic spirit of cooperation equalled only by the students in the College of Agriculture in their "Farmers' Fair." The St. Pat's celebration started on March 17, 1903, when the engineers of Missouri "discovered" that Saint Patrick was an engineer and that his day should be celebrated by "cutting" classes. Who the "discoverer" was is not definitely known. Four of our prominent alumni claim

the distinction, and in fairness to each their names will not be mentioned. They did not know at that time, and for that matter our students of today do not suspect that there is a perfectly legitimate reason for making March the 17th a holiday and to celebrate it in a fitting manner. The endowment of land for a College of Agriculture and Mechanic Arts by the federal government was, as previously mentioned, unanimously accepted by the General Assembly of the state of Missouri on March 17, 1863. It is appropriate therefore that the administration and faculty look with favor upon this celebration.

The celebration of Saint Pat's started in 1903 with a seniors' decision to refrain from any scholastic exercises on that day. Professor Arthur M. Green appealed (?) to the seniors in the department of mechanical engineering and they were the only ones of the senior students who attended classes. The following year, in 1904, both the junior and senior classes in all departments "cut" classes. In 1905, the entire student body made a holiday of the 17th of March, had an exhibition of electrical and mechanical phenomena in the engineering laboratories, kow-tow-ed before Saint Pat, and wound up the day with a dance. It was in 1906 that the "Blarney Stone" bearing the marks of evidence that Saint Patrick was an engineer was "discovered" by Veit Aull Hain of the class of 1906 during the excavations for the foundation of the engineering annex building. The festivities this year were for this reason more elaborate. A reincarnated Saint Patrick arrived by an airship which, well guarded, was exhibited with great pride by the engineering students. The celebration began with the firing of the cannon, the ringing of the University bell, and the blowing of all the whistles in the city. Posters printed in green announced the arrival of the good old patron Saint of the engineers. The Wabash train, which left for Centralia that year at 6:15 a. m., was profusely decorated with banners bearing the inscription "Erin Go Braugh—Saint Patrick was an Engineer." The ceremony consisted of a grand parade headed by a band including an accordion, a mandolin, a cornet and a drum. Following the band there came six husky freshmen carrying the recently



First Kow-tow, 1905



The Blarney Stone

discovered "Blarney Stone." Next came a reincarnation of the good old Saint himself followed by the entire student body, each with a large green sash and armed with the most crooked shellalah obtainable. After a review before an immense crowd of spectators, the engineers assembled before the mound upon which Saint Pat had taken his stand. Here the grand "kow-tow" was performed, the students prostrating themselves face downward. Saint Pat addressed his followers and admonished them to keep faith and remain loyal. Each senior then came forward and as he knelt and kissed the Blarney Stone was properly dubbed a Knight of Saint Patrick. The conferring of the knighthood upon the seniors of the College was a feature of the celebration which started this year. The ceremony was concluded with the singing of the well-known Missouri Engineers' song, one stanza of which runs as follows:

Saint Patrick was an Engineer, he was, he was
For he invented the Calculus
And handed it down for us to cuss.
Erin Go Braugh, Rah! for the Engineers.

The 1906 class in engineering was a particularly privileged one. In so far as the writer is aware it is the only group of students who were honored with a special reception by the senior co-eds. The program of this social function honoring the graduating class in engineering was patterned after the Saint Pat's festival. The ceremony was held in the ladies parlors on the third floor of the Academic Building now Jesse Hall about one week following Saint Pat's celebration. The girls costumed with caps and aprons and great green bows, headed by a band consisting of an accordion, a harp and several hair combs, were conducted by a grand marshal bearing the sacred stew kettle to a throne occupied by Saint Bridget. With great solemnity they performed a modified kow-tow, kissed the sacred stew kettle and were dubbed Maids of Saint Bridget. To the tune of "Saint Patrick Was an Engineer," they sang an improvised song, one stanza running as follows:

Saint Bridget was a senior girl, she was, she was
She loved the Irish, she loved the Engineers
She is skilled with pen, spoon and shears
Erin Go Braugh, Rah! for the Engineers.

The affair closed with a dance and the engineers had indeed a good time.

The conferring of honorary knighthood started the following year in 1907. The first one to receive it was Professor Green who, considering his action the preceding year, had a change of heart and declared the day a semi-official holiday. The honorary knighthood has been conferred in the past thirty-five years upon many professors, deans, prominent engineers and all the presidents of the University beginning with Dr. A. Ross Hill, who became president in 1907. This ceremonial tradition which had been followed with slight variations to this day, is sponsored by the Engineers' Club of the College of Engineering. The club, which was organized fifty-eight years ago, sponsored also in 1906 the publication of a semi-technical journal called the Engineering Quarterly, which, unfortunately, had to suspend publication five years later for lack of funds. It was revived in 1933 as the "Missouri Shamrock," and as such has won an enviable place among the semi-technical publications of the colleges in the country.

One of the most cherished memories of our older alumni is their participation in the feud between the students of engineering and those in the School of Law. Once a year, usually early in fall, the students in these two divisions of the University engaged in a fist to fist battle in front of the old Law Building, now the B. & P. A. Building.

Many but conflicting stories have come to the writer pertaining to this joint and spectacular activity of the students of law and engineering. It dates apparently with the removal of a board walk from the front of the Law Building by the engineers, or the removal of the boardwalk by the lawyers from the front of the Engineering Building. The feud which started in 1896 continued



A. Lincoln Hyde

until recent years with the lawyers attempting to steal the Blarney Stone during the knighting ceremonies or to carry off the queen of the Saint Pat's ball.

The shooting of an engineer by a lawyer during a fray growing out of such a kidnaping of the queen, brought this feud to a climax. The University authorities took a hand in the affair, and punished those involved. The feud is somewhat abated but by no means terminated.

THE ENGINEERING ALUMNI ASSOCIATION AND THE ENGINEERING FOUNDATION. The alumni of the College of Engineering are a loyal group. On March 20, 1931, they organized the "Engineering Foundation" of the College, a corporation whose specific purpose is the promoting of the welfare of the University and the furthering of engineering education by aiding and extending the work of the College of Engineering. The Engineering Alumni Association which provided the necessary funds for the incorporation of the Foundation is in complete accord and fully cooperating with it in its aims and work. Credit for establishing the Foundation on a sound basis is due to a few active alumni and notably to its first president, W. B. Rollins of Kansas City, and its second president, E. E. Dittbrenner of Jefferson City.

The membership of the Engineering Foundation consists of alumni, former students and friends of the College who have paid or pledged themselves to pay the minimum membership fee of \$100, or who conveyed or agreed to convey to the Foundation any property. The limiting of the membership fee to this small sum and the arrangement of its payment in installments suitable to each individual case has made it possible for many alumni and former students to join, and thus become privileged to actively participate in this worthy purpose of the Foundation. The present potential membership is nearly two thousand. The annual potential increase is the number that graduate yearly from the College. We trust that as time goes on the Foundation membership will grow, and with it its activities for aiding and furthering engineering education at the University of Missouri.

The funds of the Foundation are at present invested in low-interest student loans administered by the University and secured by insurance policies on the life of the borrowers. Thus the funds provide at present financial assistance to needy students in the College and incidentally an income, however small, to the Foundation. In 1939 the Foundation established the Junior Merit Award as an incentive to scholastic attainment. Ten prizes consisting of professional handbooks are awarded with appropriate ceremony and citations of merit to ten high ranking juniors, two from each department, at the joint annual banquet of the Alumni Association and Foundation during Saint Pat's Week.

The affairs of the Foundation are directed and administered by fifteen trustees and the dean of the College. Five of the trustees are elected each year by the members of the Foundation at the annual meeting on Saint Pat's day. To the loyal alumni of the College, this day has long since lost its original significance as an opportunity for students to cut classes or to show contempt for faculty authority. It has become a tradition which stands for loyalty and devotion to the College, for its upbuilding and the upbuilding of the University of which it is a part.

SCHOLARSHIPS. The first scholarship award in the College of Engineering, amounting at present to \$50 was established in 1888 by the Hon. James S. Rollins and is known as the "Rollins Scholarship." Six Rollins Scholarships, one in each division of the University, are awarded annually at commencement and are intended as a recognition of "merit and character" to those of the junior class "who shall be adjudged entitled" by the faculty. In awarding this scholarship, the donor had in mind that "the moral character of the contestants should be regarded as a factor of no small weight in coming to a decision."

The engineering alumni of Chicago, a well organized and loyal group established in 1925 the "Missouri Engineers of Chicago Scholarship." It is worth \$100 and is awarded annually at commencement to the highest ranking junior in the College who has also participated creditably in extra-curricular activities. The



Walter S. Williams

recipient of this award is chosen by a "Scholarship Board" of the engineering alumni of Chicago from a list of candidates submitted to them by a faculty committee appointed by the president of the University. This scholarship board has been headed for many years by Andrew K. Bushman of the class of 1912.

Dr. Winterton C. Curtis, Professor of Zoology, and Dean of the Faculty of Arts and Science has established in 1940, the "Frederic O. Norton" prize of \$50 in memory of his uncle. This prize is to be awarded annually to that junior engineering student of high scholastic standing "who gives promise of leadership along lines of social service appropriate to the engineering profession."

HONOR AND PROFESSIONAL SOCIETIES. Companionship of the right kind and the stimulus one gets from well chosen associates are forceful factors in all human relations. That they are so recognized on college campuses is evidenced not only by the large number of social fraternities, but also by the honor and professional societies sponsored by national groups whose members have common and mutual interests. Some of these groups were organized in colleges for the specific purpose of encouraging scholarship and fostering the acquisition of those qualifications which are so essential to the successful prosecution of one's profession.

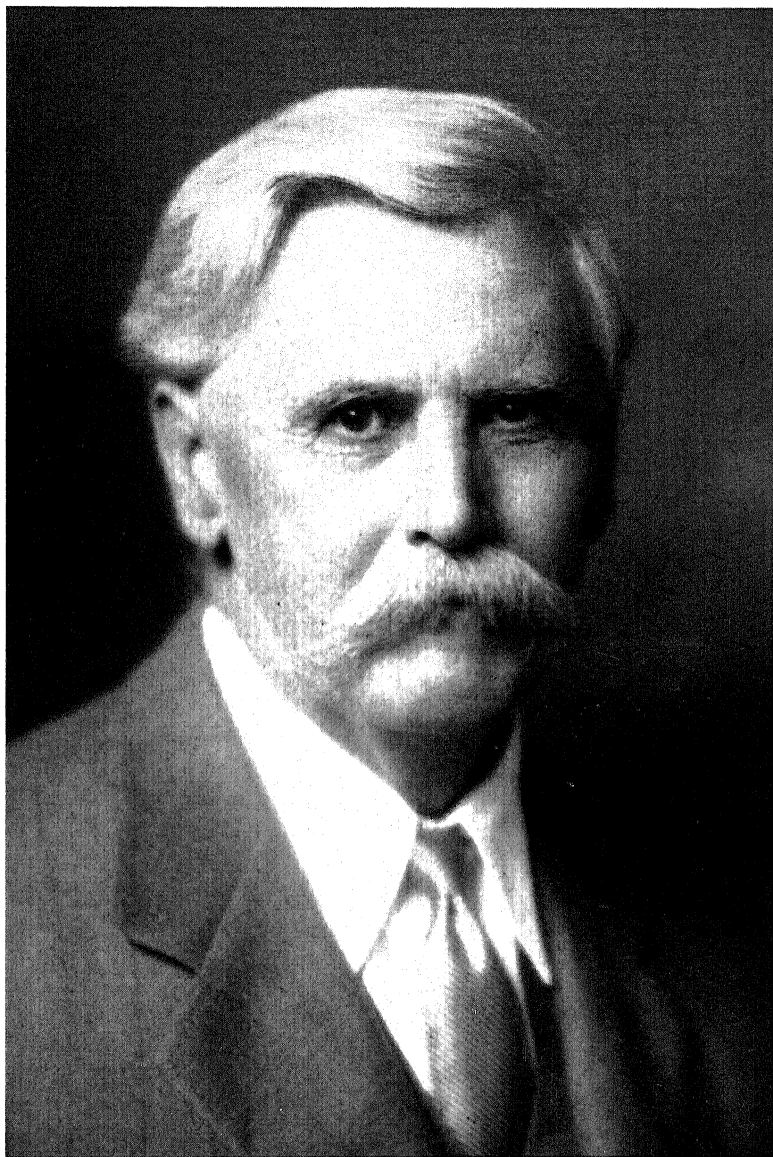
The **ALPHA CHI SIGMA**, honorary chemical engineering fraternity, the **CHI EPSILON**, honorary civil engineering fraternity, the **ETA KAPPA NU**, honorary electrical engineering fraternity, the **PI TAU SIGMA**, honorary mechanical engineering fraternity, and the **TAU BETA PI**, all engineering honorary fraternity, are essentially student groups the membership of which consists of carefully selected juniors and seniors who rank scholastically high, and who in the minds of their own classmates have given evidence of leadership by their active participation in student affairs. It is through the activities of these fraternities that the serious-minded student of engineering discovers that he has to cultivate a sense of responsibility by assuming obligations to manage, direct, or cooperate in team work.

The rapid progress of the engineering profession during the first decade of the nineteenth century was accompanied by a diversification of interests, aims and types of engineering projects which led to the creation of our national engineering professional groups such as the American Society of Civil Engineers, (A. S. C. E.), the American Institute of Electrical Engineers (A. I. E. E.), the American Society of Mechanical Engineers (A. S. M. E.), the American Institute of Chemical Engineers (A. I. Ch. E.), the American Society of Agricultural Engineers (A. S. A. E.), and others.

Realizing that the engineering profession of the future depends upon the technical colleges and the engineering student of today, these societies have fostered the establishment of college branches where students of engineering would be given an opportunity of gaining a perspective of the profession and of its manifold problems which cannot be obtained in routine class work. Each of the above mentioned professional societies has a student branch in the College of Engineering of the University of Missouri. They form the connecting links between the College and the profession in its diversified activities. Through these student branches the student is given the opportunity to learn the function of his profession, its achievements, its ethics, its duties to society. Through these student branches our students learn to think of themselves as a part of the profession and acquire what is generally referred to as professional spirit.

The national societies foster the development and growth of these student branches. The student members of these professional societies are encouraged to participate in the technical programs of their conventions and to attend the annual student conferences which are staged for their benefit. The College branches of the national engineering groups are thus justifiably thought of as the training grounds of the future engineers of the nation.

CURRICULA EXPANSION. The present administrative and faculty organization of the College of Engineering is practically identical



Luther M. Defoe



to that immediately following its severance from the College of Agriculture. Several courses of study were added from time to time as the demand for more specialized training grew. The fundamental courses in surveying remained for many years the backbone of the curricula in civil engineering, and were taught for over thirty-five years by Walter S. Williams, of the class of 1885. He supervised also the construction of all the University buildings from 1908 until 1930, and the soundness of their construction is a credit to him. Walter S. Williams, now Professor Emeritus and whom a host of alumni will remember lovingly by his nickname, is now in good health and enjoying the rewards of work well done.

A basic course in sanitary engineering was embodied in the curriculum of civil engineering in 1902. Its objective of training students in the fundamentals of design and construction of water supply systems and sewage disposal plants has been gradually extended to include sanitation problems of rural schools, state institutions, and resorts. At present the work in sanitary engineering is in close cooperation with the State Board of Health, whose chief, Dr. W. Scott Johnson, is visiting lecturer on sanitation. A "trailer laboratory" fully equipped for research in the field is part of the facilities available in the cooperative program with the State Board of Health.

Fundamental courses in hydraulics and hydraulic engineering, taught for many years by Thomas J. Rodhouse of the class of 1897 were also first organized in 1902. Rodhouse is now Professor Emeritus of Hydraulic Engineering.

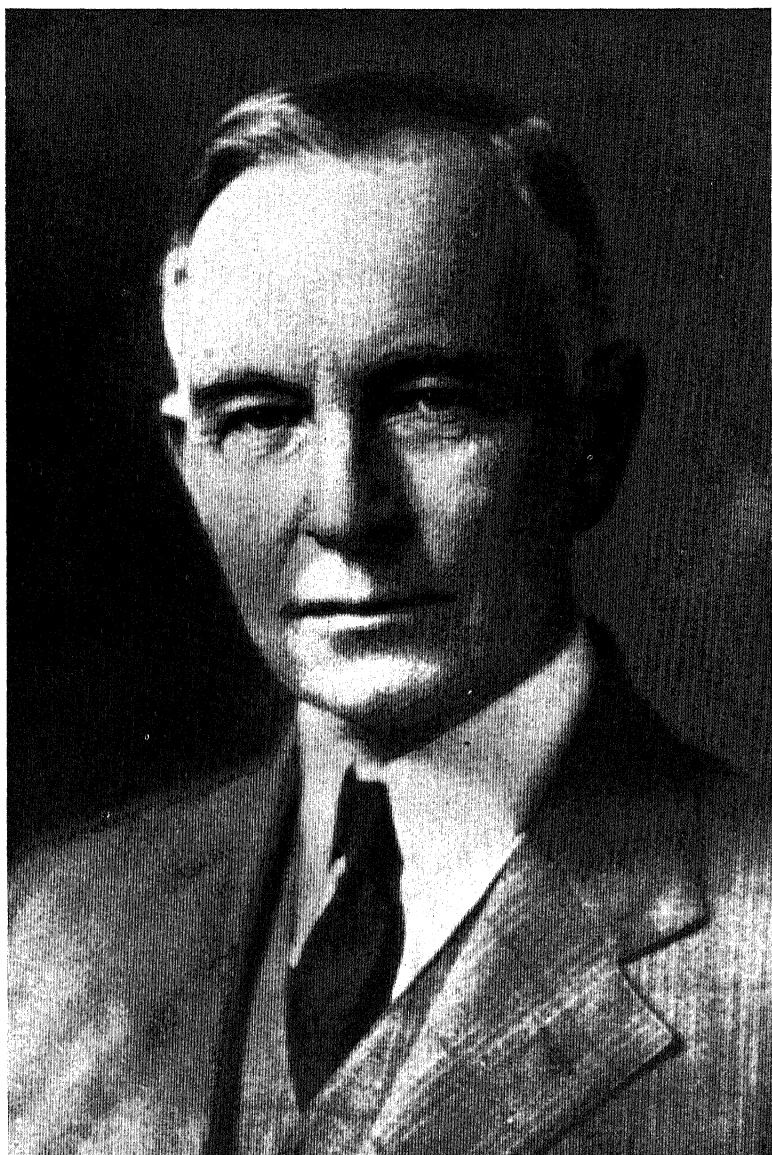
The course in mathematics of engineering, now split up into statics and dynamics, was organized in 1903 by the late Luther M. Defoe, who previously held the chair in mathematics, and who, known all over the campus as "Daddy Defoe" was the most beloved teacher and adviser of students. It is a pleasure to record here that the University's newly built dormitory for men has been officially named by action of the Board of Curators on April 2, 1940, "The Luther Marion Defoe" Hall in honor of this beloved teacher and friend of students. The Board's resolution

to so name this building states in part that "he acted as unofficial adviser for students, and during this long period came into contact with many University students because of his friendly and sympathetic understanding of students' problems. He radiated a geniality which drew students and grown-ups alike to him . . ." The memories of this grand old man with his twinkling blue eyes, shaggy eyebrows and drooping mustache seen about the campus with his heavy walking stick will live as long as the last man who knew him. Professor Defoe was connected with the University for more than fifty years. He came here as a student in 1881, received a certificate in pedagogics in 1886, an A.B. from Harvard University in 1893 and later spent a year at Cambridge, England, where he studied under Sir William Thompson, better known as Lord Kelvin.

The first organized course in Structures basic to the study of bridge engineering was introduced in the civil engineering curriculum by A. Lincoln Hyde, now Professor Emeritus of Bridge Engineering. Professor Hyde, a graduate of Yale University, came to the University of Missouri in 1903 after having been for several years with nationally known bridge builders.

Orientation courses in the engineering curricula were first introduced by the late H. Wade Hibbard, who came to Missouri from Cornell University in 1907 as successor to Professor A. M. Green who, as stated previously, resigned that year to go to Rensselaer Polytechnic Institute. The courses in engineering management and personnel administration were organized about the same time by Professor Robert W. Selvidge, chairman of the department of mechanical engineering until 1940. Of those who joined the staff in mechanical engineering during this period of rapid expansion, James R. Wharton is still with us, while E. A. Fessenden, who first organized the course in machine design is now head of the department of mechanical engineering at the Rensselaer Polytechnic Institute. Guy D. Newton, better known to his students as "Happy," retired in 1932 and is now a Justice of the Peace in his native town, Watervliet, Michigan.

The growth in the field of mechanical engineering has demanded



Thomas J. Rodhouse

the expansion of the curricula in this department with the inclusions of comprehensive work in thermodynamics, internal combustion engines, refrigeration systems and later heating and air conditioning of homes and industrial establishments.

The electrification of American industries, the use of high voltage for transmission of electric power to fast growing industrial centers, the extension of telephone communication over longer and longer distance in the first two decades of the twentieth century, the astonishing growth of radio communication in the past twenty years meant newer basic courses that had to be added to the curriculum in electrical engineering. Allan Estes Flowers, who came to the University in 1904 from Cornell was the first to organize a course in alternating current machinery. He has been for the past twenty-five years a research engineer with the Laval Turbine Company. The author of this chronicle who joined the faculty of the College of Engineering in 1907, organized the courses in electric power transmission and distribution. Edward W. Kellogg, a graduate of Princeton, and for the past twenty years on the research staff of the Radio Corporation of America, was the first to offer a comprehensive course in telephone communication in 1912.

The history of the College of Engineering during the first quarter of the twentieth century is particularly conspicuous by the expansion of its curricula and its adaptation to the needs of the profession and the demands of the industries. This expansion of the engineering curricula, the attempts of synchronizing it with the progress of the profession and at the same time coordinating it with cultural subjects such as economics, history, the social sciences, all essential to would-be leaders in a democracy, was no simple task. It required careful study of the comparative importance of proposed courses of study, and courageously meeting the continuously growing difficulty of overcrowding the established four-year collegiate program. What seemed to be an adequate solution to this problem was reached in 1910 when the four-year curricula was abandoned and a five-year program adopted. Under this new program, the entrance requirements to

the College was raised to two years of Arts and Science including fundamental courses in mathematics, physics, and chemistry. The last three years were to be devoted to technical and humanistic studies which were considered of serious importance to the professional engineer. The degree was also changed from that of B.S. with designation to the respective professional degrees of C.E., M.E., E.E., and Ch.E. The more or less expected effect of this progressive action of the faculty of the College of Engineering was a decrease in enrollment from 411 in 1910-1911 to 145 in 1913-14. In 1915 the College had to return to the generally recognized and more firmly established four-year program with a fifth year leading to the professional degree. The enrollment promptly increased fully 100 per cent. This program was in effect until 1934 when the professional degrees were abolished and the Graduate School assumed the administration of the advanced studies offered by the College of Engineering.

THE ENGINEERING EXPERIMENT STATION. The service of the College to the state and to the industrial interest in particular was enhanced by the establishment of the Engineering Experiment Station July 1, 1909, through the efforts of Dean H. B. Shaw. Research in the College was thus organized upon a more satisfactory basis and thirty bulletins were published up to the present. The bulletins cover a variety of projects including water resources and road materials of Missouri, investigation of Missouri granites, economics of rural distribution of electrical energy, chemical and physical properties of lubricating oils, water supply for country homes. The activities of the station were practically suspended during the depression years from 1931 to 1938. They were resumed recently, however, when greater financial support came from the state. About twenty research projects covering a wide range of problems are under way at present. Among these are waste disposal of rural schools, turbidity treatment of water supplies in Northern Missouri, power factor measurements in unbalanced polyphase circuits and others.



Guy D. Newton

THE ENGINEERING LIBRARY. In addition to the main library located about a block from the Engineering Building, the University maintains an up-to-date engineering library located on the second floor of the new Engineering Laboratories Building. Established in 1906 and successfully managed from 1913 to 1938 by Mrs. Jane A. Hurty, it has grown steadily. At present it is one of the best equipped engineering libraries in the Middle West with over 15,000 technical books, reference material and periodicals published here and abroad.

THE DEPARTMENT OF AGRICULTURAL ENGINEERING. This department was established in 1917, three years after E. J. McCaustland assumed the deanship of the College. Since an agricultural engineer must have proper training in the field of agriculture to understand its manifold problems, and also sufficient engineering education to enable him to solve these problems in a scientific as well as economic manner, this last established department is administered jointly by the Colleges of Engineering and Agriculture. The engineering group of studies in the agricultural engineering curriculum is planned to prepare the student to design and operate farm machinery, superintend irrigation, drainage and erosion control projects, design and construct farm buildings. Through teaching and research, this department has contributed substantially to making life on Missouri farms less severe, more enjoyable, and decidedly more profitable.

A QUARTER CENTURY OF PROGRESS. The deanship, vacated by H. B. Shaw on his appointment to the membership of the State Public Commission, was filled in 1914 by E. J. McCaustland, for many years professor of sanitary engineering at the University of the State of Washington. Professor E. A. Fessenden, now head of the department of mechanical engineering at Rensselaer Polytechnic Institute, was acting dean for one year. The vacancy created by the resignation of Shaw as professor of electrical engineering was filled in 1915 by A. C. Lanier, a graduate of Harvard, who for many years headed a design department of the

Westinghouse Electric and Manufacturing Company. Harry Rubey, a graduate of Illinois University came from the University of Washington to fill the vacancy created by the death of Professor Spalding in 1923.

The twenty-year period of Dean McCaustland's administration is characterized by the establishment of a standardizing laboratory well equipped for the testing of the reliability of electric, gas, and water meters. This laboratory was put in the service of the State Public Service Commission in the adjustment of differences between public utility companies and their customers. A coal-testing laboratory was equipped for the determination of the heating value and ash content of all kinds of coal. A material testing laboratory was established for the investigation of the physical and chemical properties of building materials. This laboratory in the charge of Professor H. A. LaRue cooperates with the State Highway Department in testing the quality of materials used in state highway construction. The modern Civil Engineering Laboratories housing the materials testing and hydraulic equipment were also built during Dean McCaustland's administration.

A well-equipped communications laboratory was established in 1929 through the generosity of the American Telephone and Telegraph Company and its associate, the Southwestern Bell Telephone Company. The equipment comprises valuable apparatus for the experimental study of circuit behavior. A collection of well-selected electric power apparatus and measuring instruments was donated in 1931 to the electrical engineering department by Mr. and Mrs. J. E. Porter of Kansas City in memory of their son Ralph E. Porter, of the class of 1926.

One of the most important changes in the educational policy of the college during McCaustland's deanship was the abolishment in 1934 of the professional degrees, and the assumption of the administration of the graduate work in engineering by the Graduate School. The present degree for satisfactory completion of one year of graduate work in engineering is the M. S. with designation.



Elmer J. McCaustland

Because of the economic depression, the College of Engineering of the University of Missouri, like so many other similar institutions in the country, suffered a severe setback during the years from 1930 to 1934. The decline of the industrial activities in the country which resulted in wide-spread technological unemployment, reduced the enrollment in the College to about fifty per cent of the normal. The teaching staff was depleted to a bare minimum. The physical plant of the College and the laboratory equipment deteriorated because of inadequate maintenance. Fortunately, the situation improved the following year when federal grants were made available for public buildings.

The modern fire-proof structure west of the Engineering Building and joined to it by connecting corridors was the first of over a dozen new buildings erected during the past five years on the University campus. Officially known as the Engineering Laboratories Building, it was built during the first year of the administration of F. Ellis Johnson, who became dean of the engineering faculty on the retirement of Dean E. J. McCaustland.

This building, 195 feet wide, consists of a three-story section 50 feet deep and a one-story section 90 feet deep. The one-story section of the building is divided into three parts, housing the mechanical, electrical and chemical engineering laboratories. The three-story section is used for class rooms, offices, and research laboratories. A unique feature incorporated in the construction of the building is the possibility of converting class rooms into laboratories should rapid expansion of the research program demand it.

This new building which provides adequate laboratory space for engineering work in all its ramifications, coupled with a generous state appropriation for much needed additions to laboratory equipment, injected, under the leadership of Dean Johnson, new life into the College and restored the almost lost enthusiasm of the teaching staff. By re-establishing contacts with the junior colleges and high schools in the state, Dean Johnson was instrumental in increasing substantially student attendance. He received active support from the University administration to

increase the teaching staff commensurate with the growth in student numbers, and was vigilant in the selection of teachers of high qualifications both as to scholarship and practical experience. With the full cooperation of the faculty, he raised the standard of admission, reorganized the curricula in the various departments and increased the requirements for graduation. The newly created Engineering Council for Professional Development, representing all the technical societies in the country gave its full approval to all the courses of study offered by the department of civil, mechanical and electrical engineering during Dean Johnson's administration. The work in the department of chemical engineering was approved in 1940. Dean Johnson resigned in the spring of 1938 to take a similar position at the University of Wisconsin, of which he is an alumnus.

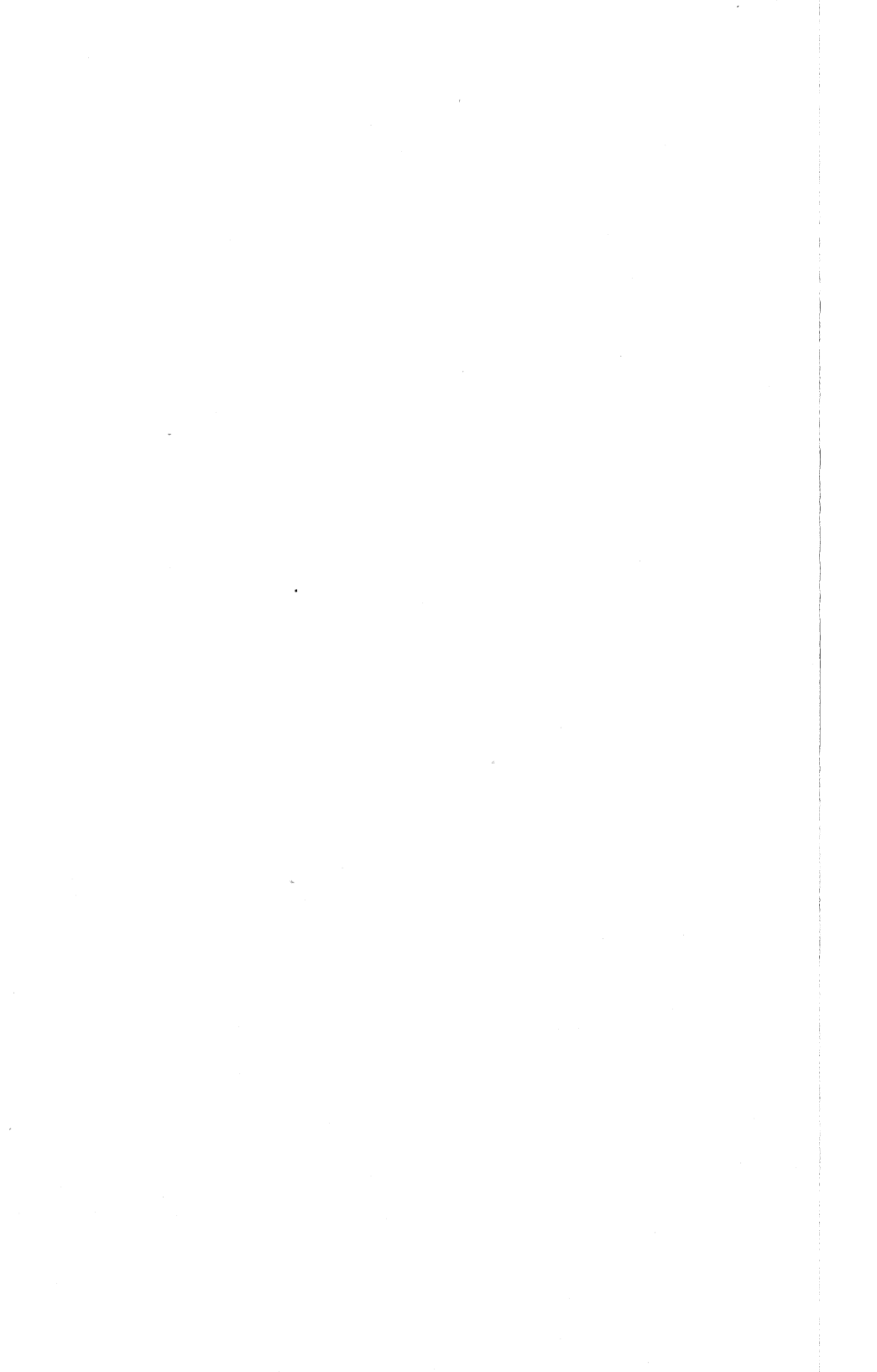
The University was very fortunate to secure as successor to Dean Johnson a widely known chemical engineer, Dr. Harry A. Curtis, who assumed the offices of dean and professor of chemical engineering in October, 1938, with Professor A. C. Lanier as acting dean in the interim. With extensive experience as superintendent and manager of chemical industries, and as Chief Chemical Engineer of the Tennessee Valley Authority for the past five years, Doctor Curtis is also at home in the field of education. He has served on the faculties of Colorado, Northwestern and Yale Universities. There is no doubt that under his leadership with the sympathetic cooperation of President Middlebush and the Board of Curators, the College of Engineering will continue to grow and attain a position of increasing prominence among the technical institutions of the Middle West.

THE PRESENT FIVE DEPARTMENTS. The present teaching staff of the College of Engineering consists of men who have had their technical education in various universities and colleges. The majority have had extensive practice.

In the department of agricultural engineering, we have Professors J. C. Wooley and M. M. Jones, assisted by two instructors. The department offers eighteen courses covering studies



F. Ellis Johnson



of the mechanical equipment used or that could be used on farms, principles involved in the planning and construction of farm structures and buildings, methods of irrigation, drainage and erosion control.

Seventeen courses of graduate and undergraduate studies are offered by the department of chemical engineering in which in addition to Dean Harry A. Curtis we have J. R. Lorah, Associate Professor, and R. H. Luebbers and D. J. Porter, Assistant Professors. The studies in this department cover the design of equipment and the utilization of the fundamental processes used for mass production of chemical products.

The department of civil engineering, headed by Professor Harry Rubey, consists of H. A. LaRue, R. B. B. Moorman, and H. W. Wood, Associate Professors, J. A. Logan, Assistant Professor, and two instructors. This department lists forty-four courses which include surveying, fundamentals of structure design, hydrostatics and hydrodynamics, drainage and irrigation systems, sanitary engineering, highway structures, waterways and railways. A large portion of these courses are designed for graduate students.

The work in the department of electrical engineering is covered in twenty courses of graduate and undergraduate studies which include the fundamentals of circuits, machinery, transmission and distribution, wire and radio communications and electronics. This department headed by Professor A. C. Lanier includes M. P. Weinbach, Professor; C. M. Wallis, Associate Professor; R. B. Vaile, Assistant Professor and two instructors.

The department of mechanical engineering, headed until recently by Professor R. W. Selvidge, has a staff of ten including E. C. Phillips, Professor; J. R. Wharton, E. S. Gray and R. L. Scorch, acting chairman, all associate professors; R. H. Sogard, Assistant Professor and four instructors. The graduate and undergraduate work in this department includes the basic courses in drawing and metal processing, the fundamentals of thermodynamics and kinematics, heat and internal combustion, refrigeration and air conditioning systems, industrial management and administration.

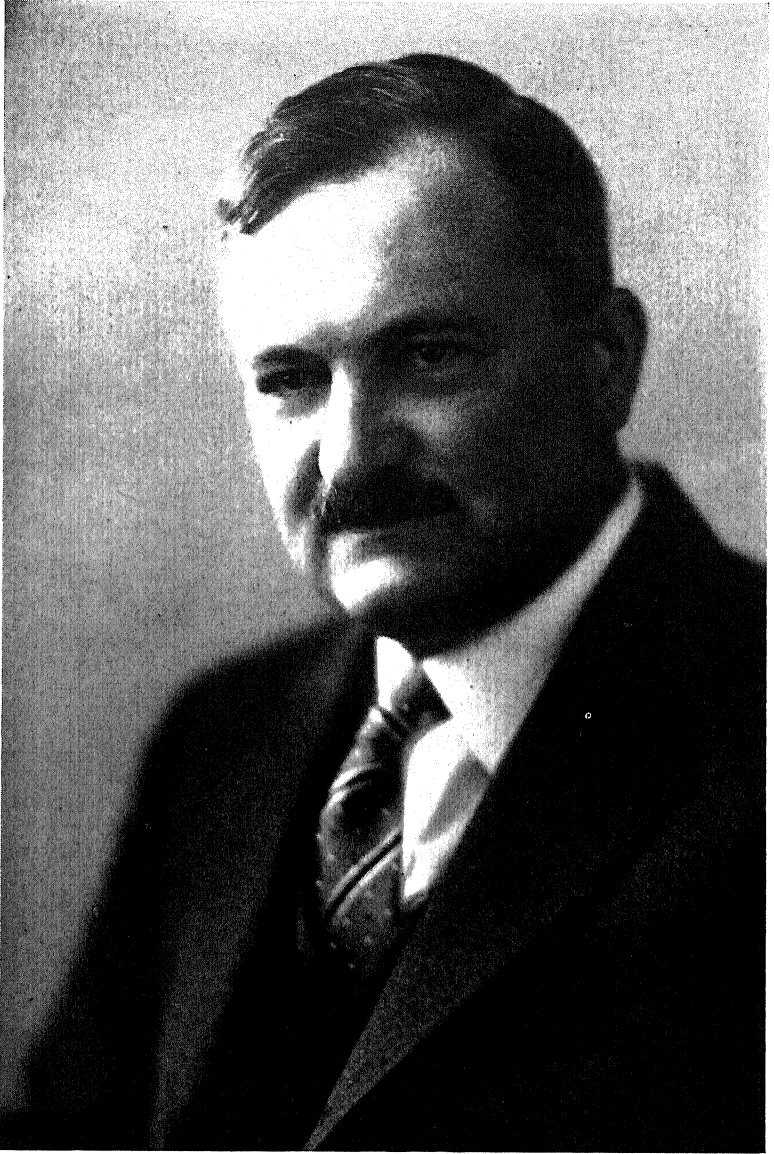
It takes thirty-five courses to cover the graduate and undergraduate work given in this department.

In addition to this regular staff of thirty teachers the College has at present twelve *assistants* who either assist in teaching, or have research duties and who are enrolled in the Graduate School working for the Master's degree.

The principal requirement for the B.S. degree with the designation of the particular department in which the student takes his major work is at present 138 hours, distributed normally over a period of eight semesters. Twenty-seven per cent of this time is devoted to courses of study such as mathematics, physics, and chemistry which are basic to engineering. Fifteen per cent is devoted to cultural subjects such as English, economics, history and fifty-eight per cent is devoted to professional work in engineering. Only two-thirds of this fifty-eight per cent or a total of 38 hours is devoted to specialized training in the department in which the student takes his major work.

Like most of the technical schools in the country the College of Engineering of the University of Missouri concedes that it is not in a position to turn out experienced engineers, capable of handling engineering problems or projects of any degree of magnitude. All our College can do and does attempt to do is to give our students a thorough understanding of the principles fundamental to their profession and an acquaintance with methods of attack of engineering problems.

CONCLUSION. The primary objective of the University is the education of the youth of the state into honorable and useful citizens. The College of Engineering has played and is playing its part in this fundamental aim of an institution of higher learning. It has sent forth well trained and motivated young men who have reached positions of prominence and usefulness. They occupy executive positions of responsibility—managing large industries, designing bridges, constructing good roads, operating public utilities, directing research laboratories and teaching the profession.



Harry A. Curtis

The work done by an institution is usually gauged by the success of its alumni, and by the research and publications of its faculty members. From this point of view the College of Engineering of the University of Missouri has contributed a substantial share to the general progress of the state and nation.

