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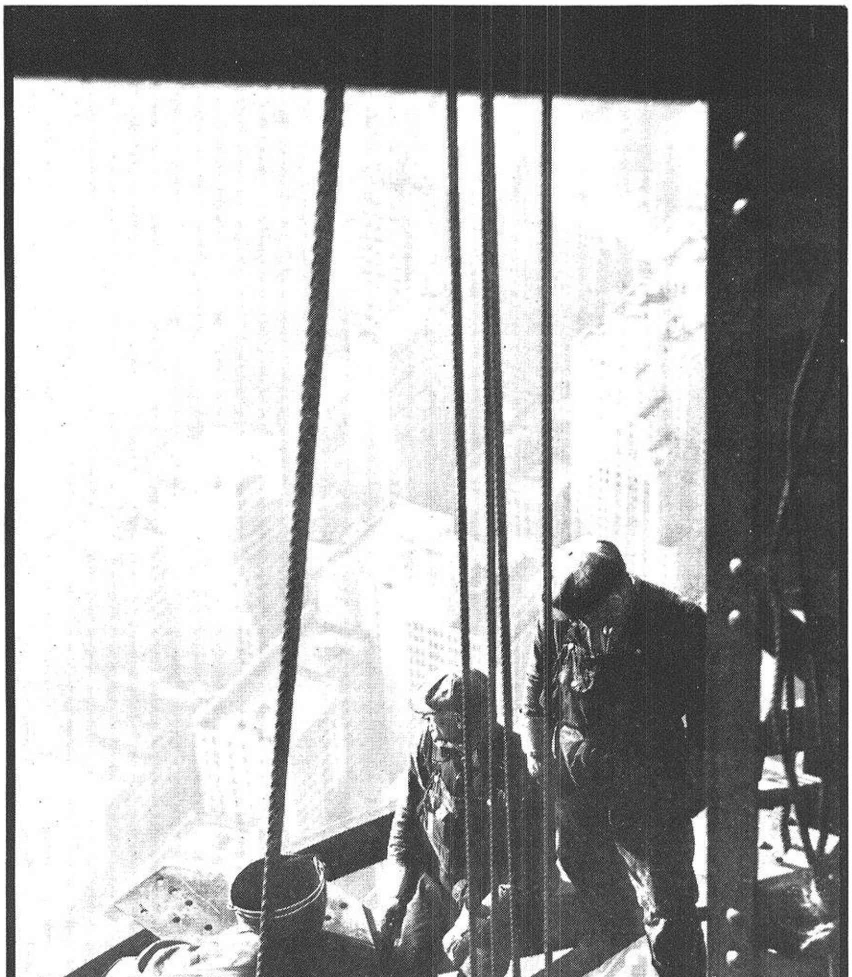
THE WISCONSIN ENGINEER



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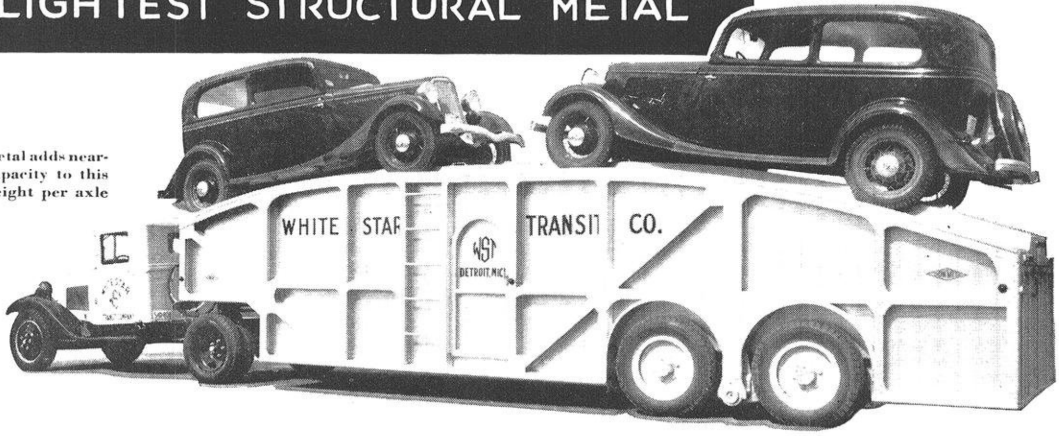

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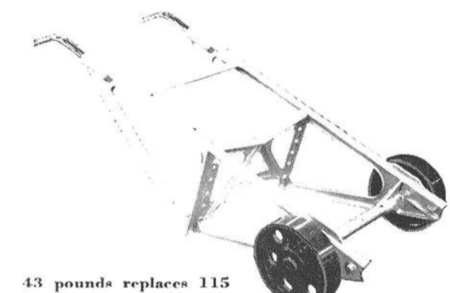

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BASCOM HALL

The WISCONSIN ENGINEER

VOLUME 38, NO. 3 DECEMBER, 1933

The E. C. W. in Wisconsin Uses

Models of Hydraulic Structures

In Flood Control Projects of 1933

By Lewis H. Kessler*

ABOUT seventy young Wisconsin Engineers were put to work last June designing and directing the work of 2400 unemployed men in the Citizens Conservation Corps Camps in Western and Southwestern Wisconsin. In these sections the elimination of waste of land, due to lack of flood control, has been a problem to the agriculturalists for many years. Deep gullies eat their way back up the valleys, and soil is eroded to the extent that farms are ruined. Occasionally these gullies are so numerous as to restrain the farmer from easily moving machinery about his farm. A short training course for the engineers was conducted in Madison, and practical experience in the building of the flood control structures was obtained by a week of work at Barneveld.

During the training period certain problems arose relative to the hydraulic design of the best type of structure, for little was known relative to the hydraulic performance of the proposed structures. The writer was requested to investigate these problems and for a period of six weeks conducted extensive experiments upon each type of structure by erecting models in the laboratory to find out the following:—

1. The type of design that would give the greatest discharge together with hydraulic tables for the selection of the size and type of structure.
2. The design that would safely dissipate the energy in the water before it was discharged from the structure.
3. Standard designs of the above items that would demand the least amount of steel and concrete.
4. Standard designs that could be built by unskilled labor.

These items were important because the farmer is required to scratch around for many yards of earth for the dams and the government instructions stressed spending money for labor rather than materials. All projects involve the construction of an earth dike or dam to create storage of flood run-off for short periods. Since an earth dam must not be overtopped by water, the structure must include a concrete spillway of some kind that will permit water to be discharged safely through the dam, over a weir section, or through a flume or channel. If the dam is successful, soil erosion ceases, as the gulley upstream from the dam silts up preventing the "eating back" of the gulley.

Experimental work was conducted on five types of structures which we chose to name as follows:—

1. Drop Inlet
2. Head Spillway
3. Energy Dissipator
4. Notch Spillway
5. Head Flume

It was believed that standard designs of these structures would assist in solving the problems presented by the various sizes of drainage areas and topography encountered.

The Drop Inlet—

Where the drainage areas are fairly small and a pronounced gulley is available for a dam of reasonable height, an earth dam with 2:1 slope is constructed around the concrete drop inlets as indicated in Fig. 1. This structure consists of a square or rectangular opening inlet, parallel to the water surface and located upstream from the top of the dam at an elevation four to five feet below the top of the dam. The corners of the inlet are rounded and the concrete is poured integral with the vertical riser or downspout. At the base of the riser, an elbow is formed to changed the direction of the flow of water to the horizontal where it enters a concrete pressure conduit or section known as the barrel.

Various *Inlet* designs built at one-sixth scale indicated the formation of a large vortex which prevented the structure from flowing full. A "Morning-Glory" design similar to an old type Edison phonograph horn produced good discharge capacity but it was not easy to form. Finally a simple "Head-Wall" of concrete, erected vertically from the riser at the downstream lip of the inlet, eliminated the formation of the vortex, the erosion around the inlet, and caused the riser and barrel to flow full under pressure. The increase in discharge over the first proposed design as

*Assistant Professor of Hydraulic Engineering.

transmitted to the writer, was about 110%. Discharges from the field structures as estimated by theoretical calculations checked the results obtained by the models to within 3%, after these experimental results were interpreted according to the laws of dimensional analysis. For example, if the large drop inlets were built of materials having similar friction factors to those of the models and the dimensions of the structures were exactly six (6) times those of the models (including the head on the drop inlet), the large structures should discharge $(6)^{5/2}$ or 89 times the water that is discharged by the models.

Similarly, the velocity of flow in the large structure should be $(6)^{1/2}$ times that in the model or 2.45 times the velocity in the model.

Energy Dissipator —

Fig. 3 is a sketch of the final model of the energy dissipator or what was called by the men in Prof. Shorey's camp, the "Acrobatic Outlet." Destructive velocities up to 35 feet per second through the drop inlets were to be expected occasionally, so the dissipator structure was made a part of the barrel of Fig. 1 and located at the toe of the earth dam. The water from the barrel strikes the deflector which directs the water upward to the top baffle beam. Back-water with tremendous eddies results. Energy is dissipated and the water flows through the outlet orifice under a reasonable head and at much lower velocities. Further studies will probably simplify this construction. Thus we find that getting the water to enter the structure was one problem, but releasing it safely, without too much scour, proved to be another one, involving more difficulties.

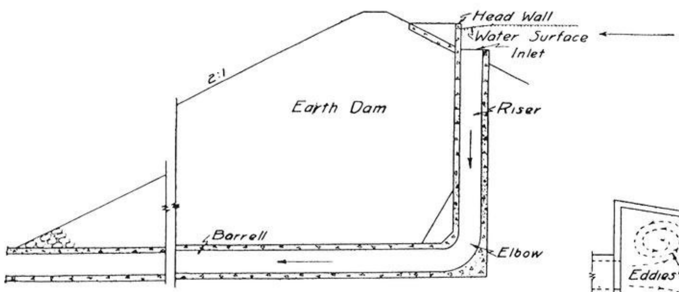
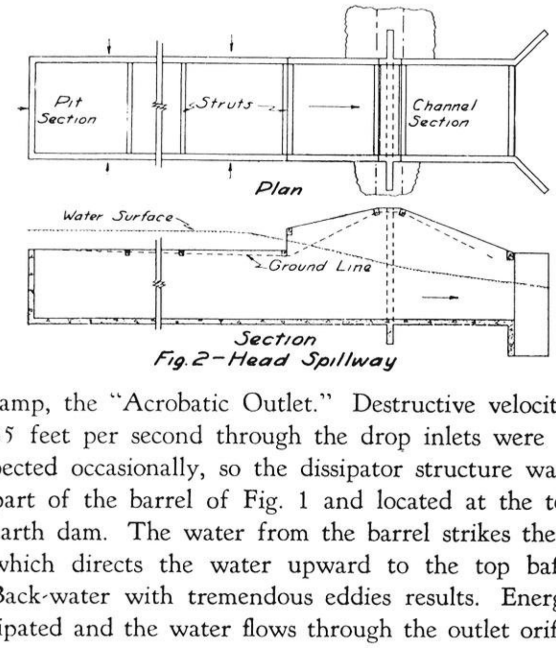
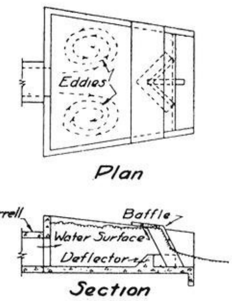


Fig 1—Section of Drop Inlet



Section
Fig. 2—Head Spillway



Section
Energy Dissipator
Fig. 3

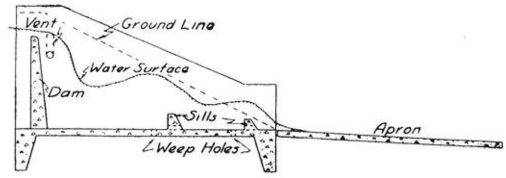
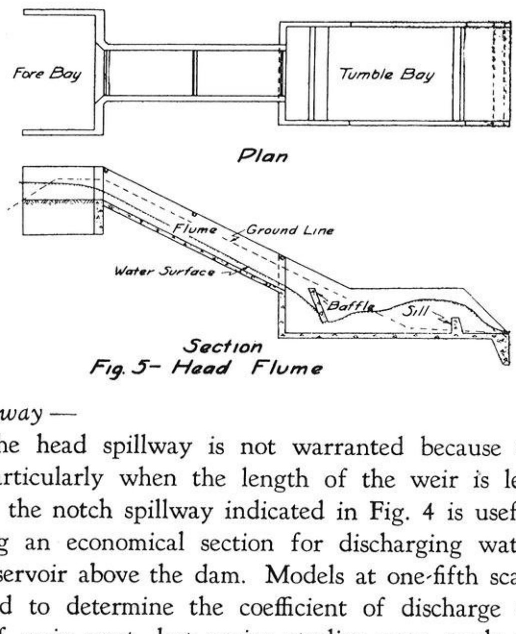


Fig. 4— Section of Notch Spillway



Section
Fig. 5— Head Flume

Head Spillway —

Where drainage areas are large and a low dam of long length can be used, a structure is selected similar to the plan and section of the Head Spillway of Fig. 2. This model built at 1/20 scale involved hydraulics more or less in between that of "Side Spillways," used considerably in irrigation and power work, and Wash Water Troughs of rapid sand filters in water purification plants. Surface water spills over the side walls and end wall of the pit section. It heads up in this section below the struts, and flows through the channel section which is built to protect the earth dike. The models indicated a maximum head of two feet of water would be permissable above the top of the pit walls. Different sizes and scales of models gave some indication of the downstream location of the "critical depths" of flow near or in the channel section. Coefficients of discharge were determined for the broad crested weirs of the pit section. The results from the models were used in the calculation of hydraulic tables of use in estimating the proper length of pit together with channel width and height. Control of the high discharging velocities was not solved and studies are now in progress. It is believed this new type of spillway may be also of interest to highway engineers.

Notch Spillway —

Where the head spillway is not warranted because of cost and particularly when the length of the weir is less than 9 feet, the notch spillway indicated in Fig. 4 is useful in providing an economical section for discharging water from the reservoir above the dam. Models at one-fifth scale were studied to determine the coefficient of discharge of this type of weir crest, but major studies were made to find out how the water could be compelled to leave the apron at low velocities. The sills or two low dams on the apron aided in the forming of the "standing wave" or "hydraulic jump," a natural phenomenon which accompanies dissipation of hydraulic energy. According to the models, moving these little sills in either direction just a foot on the large structure will produce undesirable results.

Head Flume —

The structure of Fig. 5 is used a the head of a gulley that has an abrupt drop or fall where conditions are such that earth is not available for the standard soil saving dam.

(Continued on page 48)

Development of the Microphone

By C. W. P. WALTER, e'34

THE revolutionizing of our means of communication was a result of the invention of the telephone by Alexander Graham Bell in 1874. The principle of the telephone or at least the means that could be used to transform the energy of sound waves into electrical energy were known almost four decades prior to Bell's invention. At Salem, Mass., in 1837, Dr. Page observed that sounds were emitted by a magnet if its magnetism were changed suddenly. Bourseuil in 1854, described a telephone as a device using a "make and break" transmitter, and considered that a smooth or continuous variation of current was unnecessary for the electrical transmission of sound. In 1861 at Friedrichsdorf, Germany, Philip Reis, a teacher of Physics in Garnier's Institute constructed what he called a telephone embodying the ideas of Page and Bourseuil. A magnetic receiver, constructed of a knitting needle surrounded by a coil of wire and mounted on a sounding board, was used. The transmitter was a platinum "make and break" device operated by a lever resting on a membrane. Tones were reproduced with this system but no success resulted in the reproduction of articulate speech. A point of interest is the fact that Reis used a baffle about 20 inches in diameter for one of his transmitters "to prevent interference between the front and back," a principle which is used quite extensively at the present time for dynamic loud speaker operation. Helmholz published his work on acoustics "Die Lehre von Tonempfindungen" in 1863 and this extended considerably the fundamental understanding upon which subsequent development proceeded. As far back as 1870, Varley discovered the emission of sound by a condenser when the polarizing potential was varied periodically. Within the last fifteen years this principle has been made use of in the development of the condenser microphone and the condenser loud speaker.

In 1874 Bell was a Professor of Vocal Physiology at Boston University and was busily engaged in the study of speech, hearing, and telegraphy. His interest at that time was focused on obtaining graphical records of sounds. One of his first steps toward this end was the contruction of a model of the human ear on the suggestion of Dr. Clarence Blake. Upon singing into this model, Bell obtained tracings on a smoked glass that moved rapidly underneath a stylus which was set in vibration by sound waves impinging on a membrane. According to a description of his experiments three years later, he stated that he "was struck with the remarkable disproportion in weight between the membrane and the bones that were vibrated by it." Bell further stated that "if a membrane as thin as tissue paper could control the vibration of the bones that were, compared to it, of immense size and weight, why should not a larger and thicker membrane be built to vibrate a piece of iron in front of an electro-magnet." This conception of "a membrane speaking telephone" seems to have been the basis for his first patent application on the familiar "Gallows Frame" transmitter constructed by Bell's enthusiastic assistant Watson and tested on June 3, 1875. Tests made on the response of these early instruments indicate that the reproduced sounds must have been quite weak, in fact just barely capable of attracting the listener's attention. Up to this point, Bell's development of the telephone was directed along the lines of varying the reluctance of a magnetic circuit to produce the current in an electro-magnetic receiver. His next experiments were confined to the principle of modulating a resistance to produce these current changes. To a membrane of gold beater's skin in a horizontal position was attached a small platinum wire which barely made contact with the surface of a small quantity of acidulated water in a metal cup. Motion of the membrane varied the contact resistance between the platinum wire and the liquid. This model, constructed and tested on March 10, 1876, was the first transmitter to successfully transmit a complete sentence: "Mr. Watson, come here — I want you."

At about this time there was much contesting in the courts as to the inventorship of the art of transmitting speech electrically, Gray, Reis, Dolbear, Blake, Drawbaugh, and others, all claiming inventorship. The ensuing court cases continued until 1896 during which time Bell's claims were investigated and finally made valid by the United States Supreme Court.

As a result of Bell's first successful transmission of speech described and demonstrated in his numerous lectures in both the United States and England, many other inventors appreciating the importance of this invention, attacked the problem of converting sound into electrical energy in every conceivable manner. At Washington in 1877, Emile Berliner observed that contact resistance varied with pressure and constructed instruments utilizing this principle. During the same year Edison patented a transmitter of the varying resistance type with a button of solid carbon. He also experimented further, using a very wide variety of substances in his search for one whose resistance change would be greatest for small changes in pressure. He found that a button of lamp-black compressed into a solid disc was most efficient in performing these requirements. In Europe, considerable development was made in the utilization of a carbon pencil, sharpened at both ends and resting loosely in carbon supports. Hughes in England and Ader in France were responsible for the development of these microphones. One of the most popular attractions at the Paris Electrical Exposition of 1881, was a demonstration of the transmission of singing and orchestral music at the Grand Opera by means of the Ader microphone. Many of these microphones were placed among the footlights. In listening, two receivers were used for each person. The receiver for the left ear and the receiver for the right ear were connected to separate microphones on the left and right sides of the stage respectively. Mr. Ader describes "the new acoustic effect" discovered, as one which "took on a special character of relief and localization which a single receiver could not produce. The singers placed themselves, in the mind of the listener, at a fixed distance, some to the right and others to the left. It was easy to follow their movements, and to indicate exactly the imaginary distance at which they appeared to be each time that they changed their position." This probably marks the first record of what is now known as the binaural system of reproduction which was recently demonstrated at the Century of Progress.

An English clergyman, Hunnings, patented a telephone transmitter in 1878 using a button partly filled with pulverized engine coke. American rights to this invention were later purchased by the American Bell Telephone Company, and the device was developed into a more suitable form for practical use. In 1879, Gilliland made application for a patent on a combination of a Bell receiver and a Blake transmitter with a common diaphragm. This clearly shows the early recognition for the need of an amplifier so that speech could be transmitted greater distances. The first repeaters used in long distance telephoning were of this type, — a combination of a carbon button microphone and a receiver. Edison first applied for a patent on a transmitter filled with granules of carbonized hard coal (1886).

It is to be noted in this history of the development of the telephone, that the tendency was toward the variable resistance carbon type. Other types have been tried however, including devices utilizing the thermal differences caused by sound waves, the change in resistance of an electric arc by sound, the variation in resistance of a glow discharge in open air, pressure modifications of a flame, etc., all being used to control electrical effects. The photoelectrical cell, a more recent development, which operates on changes of light intensity, is being used quite extensively in the talking pictures. A magnet vibrating outside of a vacuum tube serves to modify the flow of electrons. The condenser microphone, originally devised by DuMoncel, Varley, Wente, and others, has been perfected to quite an extent in the last decade. Magnetic microphones have also been constructed whereby the permeability of a magnetic core of nickel is changed by sound waves.

With the advent of the vacuum tube and amplifiers, research and development of telephone transmitters turned to devices that were previously considered impractical due to their low output compared to the carbon microphone. In 1917, Wente published his work on the condenser microphone and since that time there has been an increasing demand for microphones that would reproduce sound over a large frequency range. The output of the condenser microphone is quite low, necessitating the use of an amplifier at the point of its use, but despite this disadvantage the instrument is used quite broadly because of its faithful response over a large frequency range. The double-button carbon microphone which is still used to quite a large extent is by far one of the most efficient microphones. Its construction consists of a duraluminium diaphragm stretched between two buttons which are almost completely filled with granular carbon. The motion of the diaphragm in one direction causes the carbon granuales in one button to be compressed thus changing its resistance, while motion in the other direction affects the other button in a similar manner. Contributions to the theoretical and experimental technique of this microphone have been made by Poincare, Kennelley, Wegel, Wente, Crandall, Jones, as well as many others. Similar is true of the double-button carbon microphone use in this country, the carbon noise of which reaches quite an objectional level at high gains. In both cases mentioned above the use of the condenser microphone is preferable. Within the last few years the moving coil or electrodynamic microphone has been developed for practical use. It is more efficient than the conventional form of the condenser microphone, and its characteristics are unaffected by the changes in temperature, humidity, and barometric pressure. Unlike the condenser microphone it may be used at a distance from the associated amplifier without a sacrifice in its efficiency. Owing to its higher efficiency and lower impedance it is less sensitive to interference from nearby circuits. This instrument is the latest development in microphones but it does not necessarily replace the other types that are being used. Condenser microphones have recently been constructed as small as a dime for the purpose of acoustical research. The small size of the instrument does not modify the sound field in its vicinity as does the commercial instrument which is about three inches in diameter. The diaphragm of the transmitter is only one-quarter of an inch in diameter, with practically no cavity above the diaphragm. In the larger instrument the presence of the cavity causes acoustical resonances that affect the frequency response, and the large diaphragm produces a phenomena known as "pressure doubling" above 2000 cycles. These conditions do not exist to an objectional extent in the smaller instrument.

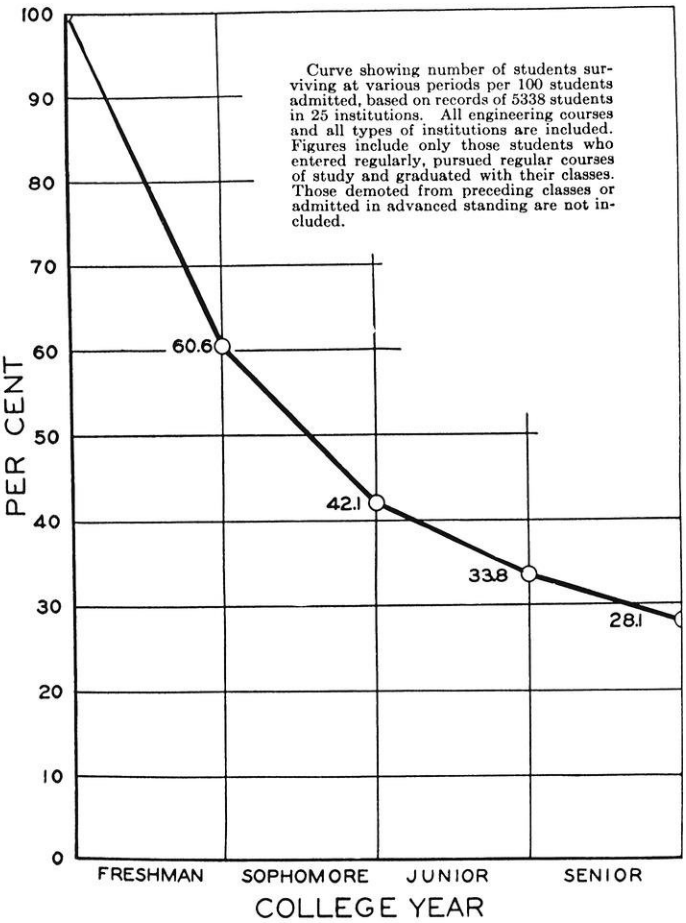
If the question were asked, "Along what lines will the future development of the microphone be made," the answer could not be a direct one. In the past years the microphone did not have the wide range of application that it has at the present time, and in future years it will undoubtedly have a still larger field. Specifications for transmitters used in airplanes require that the instruments be unaffected by the noise of the propeller. Since the transmitter cannot differentiate between noise and speech or music, all of which may be in the same frequency range, it is necessary to find some means of preventing the noise from entering the transmitter or at least, from being objectional. Bank vault detectors which are a form of transmitter must operate under certain conditions of vibration, but must be unaffected by street noise and normal vibration. Some microphones used in open air work are required to be directional while others must not have this quality. Thus it is obvious that many different types of microphones will be required in the future and designs will have to be made in accordance with the specifications as to their use.

[1]A Tentative Revision of the Engineering Curriculum

By Robert E. Moe, e'33

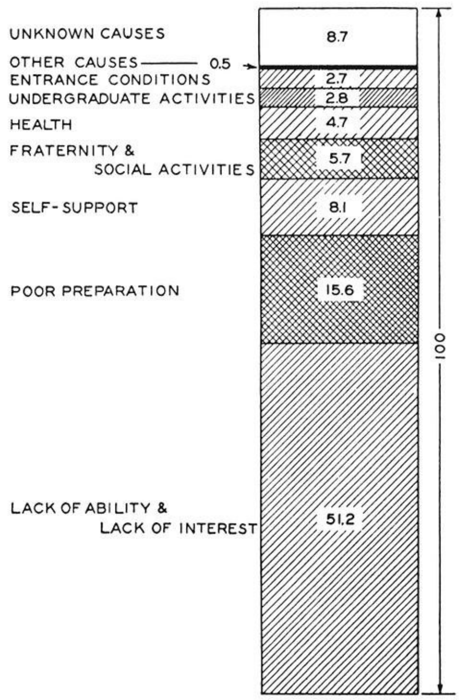
JUST what is wrong with the present engineering curriculum? That something is wrong is shown by the accompanying graphs, where it is seen that only about a third of the freshman class ordinarily survive until graduation. This high "mortality" is the result of many causes, but the major one is scholastic failure, and of this, over fifty per cent is due to lack of ability or lack of interest.

The natural tendency is to lay the blame for scholastic failure directly on the student, whereas a good deal of the lack of ability is caused either by the student being unsuited for engineering, or by lack of proper analytic training in preparatory schools. The lack of interest can also to a great extent be ascribed to the failure of most courses to link up theory with practical cases in engineering which are samples of the kind of work the graduate engineer will be called on to do. If this fails to interest the student, he manifestly had a wrong conception of engineering and could spend his time to greater advantage in some other branch of education.



Curve showing survival of engineering students
Figure I

There is, of course, a certain percentage of students enrolled in modern engineering courses, as in other courses, who are not natural students, who entered engineering to make a living, and who are better suited to work with their hands than their brains. In some cases it seems that no matter how hard they study, their grades are only fair and they impede the progress of the rest of the class. Yet when exclusion by more rigid entrance requirements is suggested, the cry arises that every one should have his chance at a tax-supported institution.



Causes of scholastic failure per 100 cases.
Figure II

II

Since it is the conclusion of many prominent educators[2] that engineering education "will continue to be dominantly collegiate in character," the remedy for the conditions described above must necessarily be provided as far as possible by changing the present engineering curriculum.

Various suggestions have been offered concerning the form of revision, and one of the oldest is the proposal that engineering students, like those in medicine and law, should have at least two years in the humanistic arts sometimes called "letters and science," before entrance into the college

[1]Reprinted by courtesy of *The Bridge of Eta Kappa Nu.*

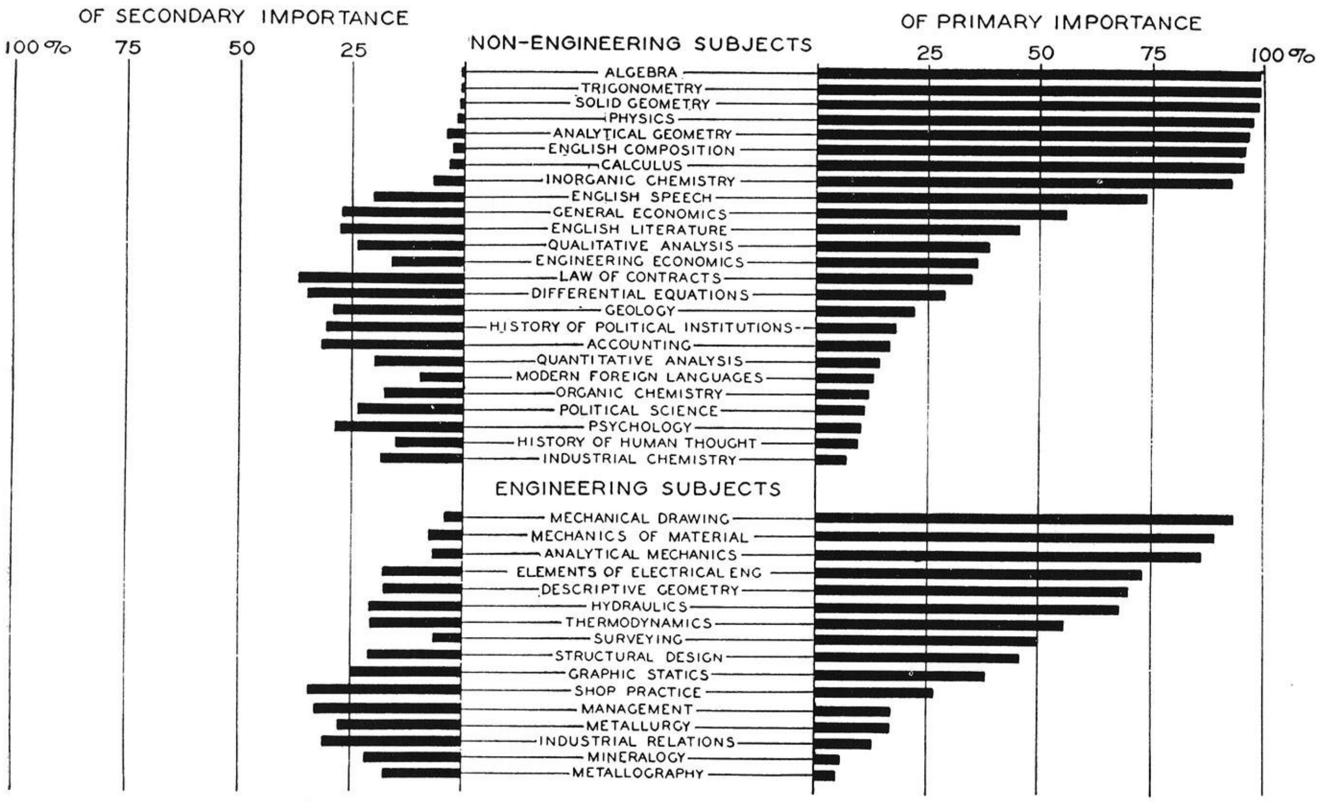
[2]Society for the Promotion of Engineering Education, Report, 1923-29, Volume I, page 208.

of engineering. The object of this extension was to give the engineer a broader and more cultural education, leaving the advanced and specialized studies until the fifth year. This process has been tried at Harvard, Missouri, Wisconsin, California and Minnesota, and there are only two at the present time, Dartmouth and Columbia, which do not give a degree after four years of this sort of program. Apparently the interest factor in this type has been neglected, since it was evident that such a curriculum lacked drawing power and enrollment fell off considerably in comparison with other schools. Ordinarily the average engineering student would like to get at the "real stuff" as soon as possible, and two years of the modern cultural course would, in the writer's opinion, be enough to make any engineer give up the ghost.

Apart from its academic objections the above proposal meets with considerable opposition on financial grounds. The student is spending a good deal of money and the best years of his life in college, and general opinion seems to indicate that four years are enough. There is a scheme which has been growing in popularity and is now in use at M. I. T., Northwestern, Marquette and many others whereby the student, over periods of about a month, alternates his school work with relevant factory work. This "cooperative" system allows him to earn a large portion of his expenses while gaining practical experience in industrial work, and it means only one more year of the combined work to complete the ordinary four-year course. Much has been said for and against this system, but the fact remains that it is well established in a good many schools and is probably here to stay. Obviously, if the student is enabled to work in the branch of industry for which he is training, his interest will be held very closely and he need not wonder "what it is all about." Further, such work will indicate very soon how the student is fitted to pursue a course in that particular branch of engineering, and since positions in such work are at a premium, the job-holders soon are whittled down to the ones who have shown themselves worthy of remaining.

Unfortunately, such a system can only be employed when there are sufficient industries near the college to absorb all the students of the different branches of engineering. This is the case, however, with only a few large universities, since most of them, being state institutions, are located at the capital of the state, which seldom boasts such expanded or diversified industries.

Another plan for revision of the curriculum advocates more differentiation between the various branches of engineering, and with the consequent freedom from overlapping, a higher degree of specialization in each branch. From the student's point of view specialization in the subject he has chosen is exactly what he wants. For the electrical engineer who wants to study radio, for example, the less there is of dreary thermodynamics the better he likes it. However, general opinion gathered from both teachers and practicing engineers indicates that the various branches should be differentiated only moderately if at all, in order to allow the student as much time as possible in choosing the specific branch he is interested in, and to prevent him from receiving intensive training in a specialized program for a profession which he may not be able to follow or make his life work. Many engineers have found that their



Opinions of teachers as to subjects which should be included in all curricula in the principal divisions of engineering. (Percentages are based on number of teachers who indicated each subject.

Figure III

Data by courtesy of the Society for the Promotion of Engineering Education.

college training did them practically no good in the positions in which they spent most of their years of experience. The present tendency is shown graphically in Figure III, which lists the subjects that should be included in all engineering curricula, basing the percentages on the number of teachers who indicated each subject.

The most promising suggestion is one made by the late B. G. Lamme, former chief engineer of the Westinghouse Company, who advocated[3] dropping back one year in mathematics, and giving a course "largely in application of algebra and trigonometry." The problems should be of the descriptive type, forcing the student to set up and solve his own equations.

The tendency is all too evident in high-school students to grab the first two numbers given and "do something with them," and if the student uses good judgment he gets the right answer. Such a process hardly develops analytical ability, and it is with just such ability in view that Mr. Lamme suggested this course, since the engineer *must* be able to analyze a problem correctly. By working problems based on industrial practice, the student is familiarized with engineering, and his fundamental lack of analytical ability and consequent unfittedness, if any, is at once shown up. If such a course were generally employed, the ones who really should be engineers could quickly be segregated and the subsequent "mortality" reduced enormously. The reason for all this is that the author of the suggestion found the average engineering student unable to *use* everyday mathematics. An an extreme case, the writer attempted to coach in college algebra a friend who was not even able to add fractions correctly!

This suggestion has met with favorable comment from a good many college educators and is recognized as a step in the right direction, i. e., toward securing the foundation "upon which to build the superstructure of knowledge." The only objections encountered are of a practical rather than theoretical nature, in that difficulties arise when such a proposed readjustment is attempted. The inclusion of a new course means the dropping of some other in the already full four-year curriculum and in this case special objections are raised, since it would delay the teaching of calculus a year and with it all the fundamental courses in thermodynamics, electrical engineering and physics, whose mathematics are based on the calculus of variations. The author of the plan realized this, but was of the opinion that after even one semester of such work the students remaining would be so far ahead in mathematical ability that the deficit could easily be made up within the regular two years.

The advice of so many practical engineers is: "Teach them the fundamentals and we'll give them the rest." The question is: What are the fundamentals? Do they mean the fundamentals of algebra, calculus, alternating current theory or power distribution. Probably the reason why the limitations of fundamentals are so hard to define is that what would be considered basic, for example, in high-frequency electrical phenomena at the present time would have been termed "highly specialized" eight years ago and will probably be laughable ten years from now. The point is that even though a good many concerns can afford to educate college graduates in a special school of their own under pay, the student should not be entirely ignorant of the type of work he is going into and should know the basic principles and calculations involved. Necessarily these vary with the technological advancement of the art. The schools try to keep up as best they can, and viewing the evolution of the courses it is seen that electrical engineering is tending to include more and more of its own subjects, whereas all the other branches except mechanical engineering have declined in this respect. One major obstacle to keeping abreast of the times is that changing the type of instruction necessitates a different attack from the laboratory standpoint. This means revised technique, new instruments and sometimes expanded facilities, and any such change involving the "vested interests" of the department is liable to arouse little enthusiasm when funds are so scarce and their controllers so tight-fisted.

III

There are some particular ways in which the present engineering curriculum here at Wisconsin could be improved. It is by no means typical of the electrical engineering courses offered throughout the country, but the criticisms may be applicable in some instances.

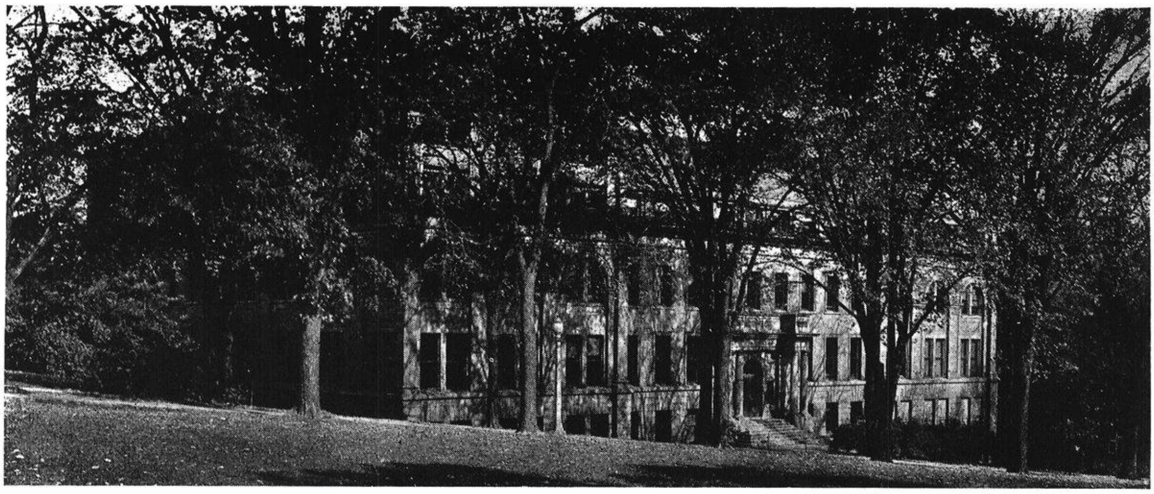
In the first place, the engineering school has no control over the physics department, and the resultant overlapping of material and confusion of methods and units is quite pointless. For instance, the simple physics courses of the sophomore years are covered in a good deal more thorough manner in the junior year under separate courses of mechanics and thermodynamics, while optics is again taken up in a special course in the senior year. Further, there is a physics course dealing with electricity and magnetism whose laboratory work practically duplicates that of the engineering school, and which uses an entirely different system of units than the engineer is taught under the excellent direction of Professor Bennett.

The mathematics courses leading up to calculus could very well be adapted, under Mr. Lamme's suggestion, to include at least a semester of practice in setting up simple algebraic or trigonometric equations from worded problems, an excellent training in analysis. For those students who show promise of ability in business methods, as indicated by their response to an improved and intelligently modern course in general economics, this mathematics could well be followed by a course in general accounting. A misguided attempt to include a simplified form of bookkeeping in the curriculum as an engineering subject has been made here, but the opinion of the economics department — and it is in a position to know — was highly uncomplimentary.

Considerable controversy[4] has arisen, mainly between the large telephone companies' engineers and certain of the teachers of electrical engineering, as to the place of communication courses in the curriculum. The engineers think them very undesirable because they narrow the student's training to one particular vocation in which he may or may

(Continued on page 48)

[3]Journal A. I. E. E., 1922, page 406.
[4]Bell System Conference (August, 1924) Notes, Sec. 8.



« CAMPUS NOTES »

ENGINEERS ELECTED TO PHI KAPPA PHI

Eleven senior engineers were recently elected to Phi Kappa Phi, all University Honor Society. Elections to Phi Kappa Phi are made solely from among the seniors, and are based upon high scholastic standing and participation in worth while extra-curricular activities.

Mr. M. O. Withey, Professor of Mechanics, will be presented to the chapter by Dean F. E. Turneaure at the initiation banquet. The banquet will be held at the University Club on Monday, December 18. Dean G. C. Sellery will speak on "Intellectual Developments of the Renaissance Period."

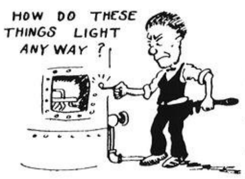
The engineers honored by election to the society are:

John Brennan, m'34
C. O. Clark, c'34
R. L. Engelhardt, c'34
Joseph Ermenc, m'34
Herman Hoerig, ch'34
A. B. Magidson, c'34
H. Leroy Mohn, m'34
Wayne K. Neill, ch'34
Robert Schiller, c'34
Melvin Stehr, e'34
Robert Stoessel, m'34

The society elected forty-seven persons, of which eleven, or 23.4%, are engineers.

SENIORS GET THEIR EARS DIRTY

The Steam and Gas Department's annual heating plant test was run from 9:00 a. m. Friday, December 1, to 12:00 a. m. Saturday noon, December 2. The mechanicals were given the tough jobs, and the civils, being considered generally uneducated by the Steam and Gas Department, were set to reading the simpler gauges. The civils thus had time to look the plant over, and then later to tell the mechanicals what it was all about.



SIDELIGHTS

The plaudits of the hour go to Charles (Cully) Bloedorn, m'34, whose picture stands on the desk of one of the photographic studios downtown. We don't blame the studio for selecting an engineer's picture, but, after all, why a mechanical?

—o—

Polygon gets a full dish of razzberries for inviting "even lawyers" to its dance on Friday, December 1. It's true that the engineers do not, as a rule, gad about socially as much as they might, but that's no reason for inviting the lawyers to "stoop" to paying their way in, for a change.

GOOD LUCK, RANDY!

Dedicated to a Phy. Ed. by Burr Randolph, c'34

SURVEY OLD NEWSPAPERS
214 Years of American Newspepers Picture History for Students

A recent survey of the 30,000 bound volumes in the newspaper files of the University historical library revealed the fact that the files date back 214 years to 1719. The collection is fairly representative of nearly every state in the Union, and of many of the leading countries in the world. Among the ancient files is represented nearly every political party in this country's history.

Many of these earlier files were obtained by purchase or exchange by the State Historical Society. The oldest American newspaper on file is the Boston "Gazette" of the year 1719.

FACULTY HOLDS RESEARCH CONFERENCE

The first of three research conferences to be held in 1933-34 was held in the Mechanical Engineering Building Tuesday evening, November 28. The research conferences are held to give the members of the faculty who are engaged in research an opportunity to make a report of their progress, and an opportunity to discuss their experiments with the rest of the faculty as a unit.

Mr. L. O. Hanson, instructor in Mechanics, gave a summary of a series of extended tests on the weathering of concrete. His report indicated that the use of the sodium thiosulfate test for accelerated freezing and thawing of concrete was a satisfactory test to use. His investigations also were concerned with the weathering qualities of concrete made with various aggregates.

Mr. C. C. Watson gave results of a series of tests on the effects of viscosity on discharge coefficients for square edged circular orifices.

Mr. Elmer Kaiser gave a summary of tests and investigations in the field of coal briquetting without binder. Mr. Kaiser announced his intention of investigating further this new and necessary field of research.

PI TAU SIGMA HOLDS INITIATION

Pi Tau Sigma, honorary mechanical engineering fraternity, held its semi-annual initiation banquet on November 21 in the Memorial Union. The men honored by election to the fraternity are:

Seniors

C. W. Bloedorn
H. W. Leu
H. C. Mittelstaedt
G. W. Quast
A. J. Simpson
R. G. Thern
W. F. Wilson

Juniors

L. G. Ahrens
C. B. Kniskern
W. J. Van Ryzin

Professor Pat Hyland acted as toastmaster at the banquet. Mr. H. L. Mohn, President of Pi Tau Sigma for the current semester, extended the traditional President's Welcome to the initiates, and Mr. A. J. Simpson responded in behalf of the initiates.

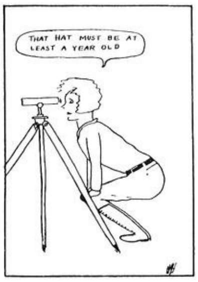
Professor G. L. Larson delivered a short message to the initiates. The speaker of the evening was Professor J. H. Mathews.

CONCERNING CAMPUS NOTES

The aim of this department is to print short items of interest to engineers. We will welcome any contributions of such a nature, either personal or scientific. We wish to thank those individuals who have, in the past, contributed such items.

"WIMMEN" AGAIN

In recognition of a general interest in the subject, we give the following information. The young lady who has been galloping around the campus in riding pants, playing surveyor, is Miss Jean Witmer. Unfortunately she is a senior in the Ag school and will not attend summer camp. So, it's back to the North End of Devil's Lake again. Sorry!



STUDENTS SPEAK AT A. S. C. E.

The American Society of Civil Engineers, Junior branch, met in the Old Madison Room of the Union on December 12. Mr. Max Werner, c'34, spoke on "The Use of Natural Gas in Italy." Mr. H. J. Behrens, c'34, spoke on "Fox Farming."

WISCONSIN SURVEYORS GET STATE WORK

The U. S. Coast and Geodetic Survey has appointed Professor Ray S. Owen as its representative in the State of Wisconsin to have charge of the state surveys, which will be financed by the Public Works Administration and the Federal Emergency Relief Administration. The survey work will consist of triangulation, precise traverse, and levelling. The plan is to begin the work immediately.

It is planned to employ a maximum of 320 men from those local Civil Works Administrations most convenient to each location near which the work will be conducted, insofar as that may be practical. There will probably be employed about 9 engineers at $36 a week, 90 second engineers at $33 a week, and 221 others at $15 to $30 a week. The selection of the engineers will be made by this office from the list of available persons furnished by the Civil Works Administrations of the various counties.

STAKE HONORED AT CHI EP STEAK DINNER

Chi Epsilon, honorary civil engineering fraternity, held its initiation banquet on November 28 in the Memorial Union. The men initiated were:

J. Everett Henry
Paul H. West
Laurence E. Bidwell
James A. Rhodes
Edward K. Neroda

The banquet was held on Nov. 28 in honor of the century-old, quarter-section marker now in the keeping of Professor Ray S. Owen. The stake was originally placed in a marsh in southern Wisconsin. The stake, part of an oak tree, was replaced in 1845 by a stone monument, but the owner of the land preserved the stake as a curiosity. It is the oldest white man's relic in Wisconsin.

Colonel Owen, Professor of Topographical Engineering, presided as Toastmaster. Mr. Bert Long, Deputy Surveyor of Dane County, a graduate of 1893, gave a brief historical account of early surveying in Wisconsin.

Mr. Charles Brown, of the State Historical Museum, whose father was one of the early engineers in Wisconsin, told of his personal contacts with the early surveyors in the State. His father was the first engineer for Milwaukee, and in that capacity designed such lasting works as the reservoir, sewer system, first waterworks, old North Side watertower, and like projects.

Mr. Brown stated that the first engineers in Wisconsin followed closely after the military engineers at the close of the Blackhawk war. These first engineers not only staked out the section lines, but also made surveys of the natural resources and archeology of the regions through which they passed. Their notes enabled Mr. Brown to complete an Indian Trails map of Wisconsin, and it was from their data that many Indian mounds were located and preserved in State Parks.

Colonel Owen announced that the year of 1934 will bring with it the one hundredth anniversary of the first surveys made in Dane County. On the date on which the section corner was first placed where Bascom Hall now stands, Chi Epsilon, in conjunction with the State Historical Society and several of the Civic groups in Madison, will sponser the 1934-35 Engineer's parade.

« ALUMNI NOTES »

ARTHUR M. DAHLBERG, erstwhile instructor in the machine design department — to be exact from 1920 to 1929 — was recently appointed an economic advisor to the National Recovery Administration.

Dahlberg is an M. E. graduate of Michigan, but while instructing here took courses in econ and sociology which led to a Ph. D. in 1931 . . . won a scholarship of the New York School of Social Sciences and was sent abroad to make a study of international trade conditions . . . in the meanwhile his book, "Men, Machines and Capitalism," was published which stirred comment from thinking people and was undoubtedly a factor in his selection for the advisory position to the NRA . . . concerning his position he writes his former chief, Prof. Hyland, "I am supposed to be planning, but I am just doing what I used to be doing for nothing, and what I would be doing if I had nothing to do" . . . he invented the new type of fountain pen which is being manufactured by a large pen concern . . . single . . . about 31 . . . eventually wants to get into teaching.

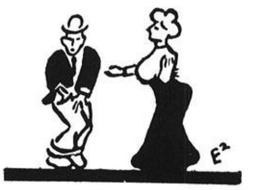
CIVILS

BAMBERRY, James E., '28, is junior engineer in the U. S. Engineer Office at Appleton, Wisconsin.

DOHM, JOHN W., '11, president of the Dohm Building Co., and the Dohm Mining Co., at Hibbing, Minn., died February 14, 1933. He was also a director of the Duluth Steam Corporation, which he built in the summer of 1932. He is survived by his widow, Irma M. Clarke Dohm, '16.

HUNTLEY, LEE H., '08, was appointed construction superintendent for the General Joe Wheeler Dam on the Tennessee River, about 15 miles upstream from the Wilson Dam at Muscle Shoals, by the Tennesee Valley Authority recently.

While in school Huntley specialized in hydraulics and hydro-electric engineering. At one time he was engaged in the development of hydro-electric projects in Wisconsin; later along the Cheoah and Little Tennessee Rivers in eastern Tennessee and western North Carolina. He also did preliminary work on the Columbia River project in Oregon, and later engaged in irrigation work in Mexico and Chile. Huntley hails from Neillsville, Wisconsin.

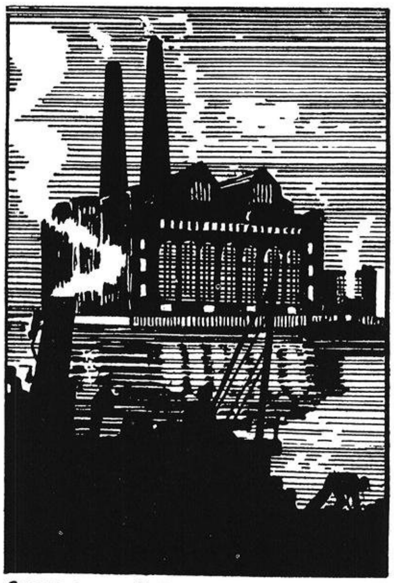


MaGEE, KENNETH L., '31, was married on October 31 at Galena, Illinois, to Miss Potter of Racine. Magee spent the past summer on soil erosion control at Darlington, Wisconsin. On November 1 he was transferred to the St. Paul office of the Army engineers for work on the Mississippi River.

MARGOLES, HARRY, '21, is field engineer for the Supervising Architect's Office of the U. S. Treasury Department, engaged in the construction of federal buildings. He has been resident engineer for the new building at Monroe and has visited Portage in connection with the layout of the new post office there.

TSCHUDY, L. C., '23, has been made Supervising Engineer in the Bureau of Agriculture Engineers, with headquarters in La Crosse, Wisconsin.

WASHA, GEORGE W., '30, instructor in mechanics at the University of Wisconsin, is the author of a report on "The Efficiency of Surface Treatments on the Permeability of Concrete," that is published by the American Concrete Institute. A brief summary of the report has been issued by the University of Wisconsin Engineering Experiment Station as Reprint No. 31. The experiments upon which the report is based covered a period of eight years. Mr. Washa conducted part of the experiments and assembled all of the data for the eight years. Eighteen different compounds were investigated.



REPRODUCED BY E. ERMENC BY PERMISSION OF "MECHANICAL ENGINEERING"

WICKESBERG, ALFRED W., '31, is with CCC Co. 685 at Gwinn, Michigan, as first lieutenant in command. He writes: "We are established in our winter quarters (the buildings of the abandoned Archibald Iron Mine) and I am sure that I will enjoy it. I am establishing an educational program. I will teach mathematics and English and will find some others to teach courses like forestry and geography. This educational program will utilize the many long winter evenings. The boys, 200 of them, seem to be quite interested."

RUFF, RICHARD J., '33, is an instructor at the Detroit Institute of Technology. He is teaching college algebra, plane and solid geometry, trigonometry, college physics, besides several evening high school classes.

ELECTRICALS

ANDERSEN, CARL J., '21, is a planning engineer for the T. M. E. R. & L. Company in Milwaukee.

BAKER, JAMES S., '22, is traffic engineer for the National Safety Council in Chicago.

BLAISDELL, CHARLES O., '24, was married to Helen A. Vojacek, Chicago, on May 19 at Oak Park. They reside at 347 S. Harvey Avenue, Oak Park.

BOERNER, THOMAS J., '28, is with the RCA Communications, Inc., at Rocky Point, Long Island, New York.

DAHM, PAUL E., '13, is assistant circuit engineer in the telegraph and signal department of the Pennsylvania Road. His address is 115 West 3rd Avenue, Roselle, N. J.

CLARK, LEMORE W., '23, was married to Pauline H. Maher, Detroit, on January 31, 1932, at Detroit, and is at home in that city at 15046 Penrod. Mr. Clark is with the Detroit Edison Co.

HARTMEN, FRED, '31, is in the testing laboratory of the Milwaukee Gas Company.

MINNSHALL, ETHAN E., '25, is transmission engineer for the Wisconsin Telephone Company at Milwaukee.

RUSCH, HUGO, '23, has recently been elected vice-president of the Northern Pump Company, national firm with headquarters in Minneapolis, Minn. Prior to his present appointment as eastern sales manager he served as a supervisor in the engineering department of the Johns-Manville Corporation. While in the university Mr. Rusch was a member of Tau Beta Pi, Eta Kappa Nu, Phi Kappa Phi, and Alpha Kappa Lambda fraternities.

Hugo Rusch

CHEMICALS

BASH, F. E., '16, Ch. E.'19, writes he is manager of the Technical Department of the Driver-Harris Co., Harrison, New Jersey, manufacturers of heat resisting alloys.

BEYERSTEDT, RALPH, and **SCETTUER, ROBERT O.** '33, found employment in the Du Pont dye plant at Carrollville, Wis.

BRABENDER, GEORGE, '25, of the technical staff of the Marathon Paper Mills, Wausau, Wis., called at Homecoming.

HANSEN, PETER S., '33, has been engaged by the Central West Coal Co., Marinette, Wis., to work out better efficiencies in burning lime.

JARRISON, JARRIS, '33, succeeded in getting a job with the Globe Steel Tube Company, Milwaukee.

PETERS, ADOLPH, '33, finds the Siviger Steel Co., Milwaukee, a good firm to serve.

RUNDORFF, ROBERT L., '23, now in Fairibault, Minn., has charge of the project of changing over the gas supply from manufactured to natural gas.

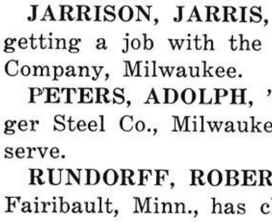
SUTHERLAND, ROBERT, '33, is working on a sewage disposal construction at River Falls, Wis.

TRUEBLOOD, W. D., '23, makes his headquarters at Chicago in connection with his sales work for the Leeds & Northrup Company, makers of the pyrometer and other electrical measuring devices.

VOIGHTMAN, EDWARD, '30, one of the first class of four men to earn the degree of Doctor of Philosophy at the Institute of Paper Chemistry, Appleton, Wis., is working for the Kimberly-Clarke Corporation, Neenah, Wisconsin.

MECHANICALS

CALDWELL, EARL, '24, who has been with the government lighthouse service in Philadelphia for two years, was transferred to St. Louis. He is now living at 811 Tuxedo Blvd., Webster Grove, Mo., with his wife, Mary Ball Caldwell, and his daughter, Carolyn.



CASBERG, CARL H., '16, M. E. '24, is professor of mechanical engineering at the University of Ill.

GILES, MERRITT, '22, is distribution engineer for the Ohio Public Service Co. He and his wife, the former Ethel Zimmerman, '23, are living in Elyria, Ohio.

HANSEN, CLARENCE F., '20, is assistant chief engineer of the El Segundo Refinery of the Standard Oil Co. of California.

HENRY, L. L., '15, is an instructor in the school of engineering of the Detroit Institute of Technology.

ISDAHL, EINAR, '23, who is chief engineer of the Oslo, Norway, Street Railway Co., spent July and August in the United States studying bus transportation and bus maintenance.

MILLER, MERLE W., '25, of Baraboo, was married to Frances McLaughlin of La Crosse, April 8. They are living at 308 North 22nd Street, La Crosse. Mr. Miller is a mechanical engineer with the Trane Company.

MITCHELL, NORMAN M., '23, is industrial engineer for the Ed. Schuster & Co., Inc., at Milwaukee.

PARSONS, OLIVER, '31, is in the research laboratory of the A. O. Smith Corporation, Milwaukee.

MINERS

HARRIE, SAM E., M. S.'33, is foreman of the heat treatment department, Chain Belt Company, Milwaukee.

SCHULTE, WILLIAM C., M. S.'33, is research fellow in the Department of Metallurgy, Lehigh University, Bethlehem, Pennsylvania.

REPRODUCED BY E. ERMENC BY PERMISSION OF "MECHANICAL ENGINEERING"

HIEMKE, HUGO W., M. S.'33, is in the research laboratory of A. O. Smith Corporation, Milwaukee.

ANDERSON, DONALD W., m'33; **MEYER, EUGENE C.**, e'33; **MINSHALL, NEAL E.**, c'24; **PALMER, VERNON J.**, c'33; **RASMUSSEN, WALTER S.**, c'33; **TOOLE, ROLAND**, c'28; were engaged during the past summer on soil erosion work at Independence, Wisconsin.

Your January "Engineer"

The January issue of the *Engineer* will contain an interesting article on research now being conducted on gas turbines in the mechanical engineering department. The writer, Geral E. Kron, m'33, Milwaukee, is conducting tests as a part of his work in the graduate school.

The editorial staff again wishes to impress students and faculty that suitable contributions will receive due consideration for publication. Should difficulty be encountered in writing an article the cooperation of a staff member will gladly be placed at the disposal of anyone desirous of organizing an original topic for publication. The experience gained by writing articles for publication is far more than most students realize.

This Is the True Joy of Life:

To be used for a purpose recognized by yourself as a mighty one; to be thoroughly worn out before you are thrown on the scrap-heap; to be a force of nature instead of a feverish, selfish little clod of ailments and grievances complaining that life will not devote itself to making you happy.—George Bernard Shaw.

« « EDITORIALS » »

Vocational Guidance in Engineering Lines. Sponsored by the American Association of Engineers. For sale by Mack Printing Company, Easton, Penn. Single copies $2.50; in lots of 10 or more, $2.00 per copy.

Reviewed by F. E. Turneaure

This work of about 500 pages represents a serious effort to present to the young man a realistic picture of the work of the engineer in his various fields of activity. Under the sponsorship of the American Association of Engineers, Dr. J. A. L. Waddell, consulting engineer, acting as chairman of a committee on Vocational Guidance of the Association, secured the cooperation of some fifty practicing engineers and engineering educators in preparing the material for this work. The first 19 chapters discuss the various general fields of engineering practice, together with questions of vocational guidance, compensation of engineers, and other matters of great interest to the young man. Then follow 40 short chapters describing briefly the kind of work involved in many specialized branches of engineering such as the practitioner is likely to develop after some years of experience. These chapters give a clear picture of the great variety of problems demanding engineering skill and serve to amplify the general descriptions given in the early chapters.

This interesting and valuable work is the result of the free contribution of all concerned who have been prompted by their desire to assist young men in choosing their vocations. It is a work that should be of the greatest value to all engineering students and to those who are considering an engineering course of study. A fair knowledge of the field which one is considering for his life's work is a most important matter, and one to which serious consideration should be given before entering college. In reaching a decision on this question, the book will be of gerat help to student, teacher, and parent, and it is strongly recommended that a copy be added to the libraries of all preparatory schools.

Editor's Notes—*The interest in vocational education fostered by this magazine in a previous editorial is continued by presenting a recent book to the attention of engineers. This book, directed to our attention by Dean Turneaure, has been placed at the disposal of students in the reading room of the engineering library.*

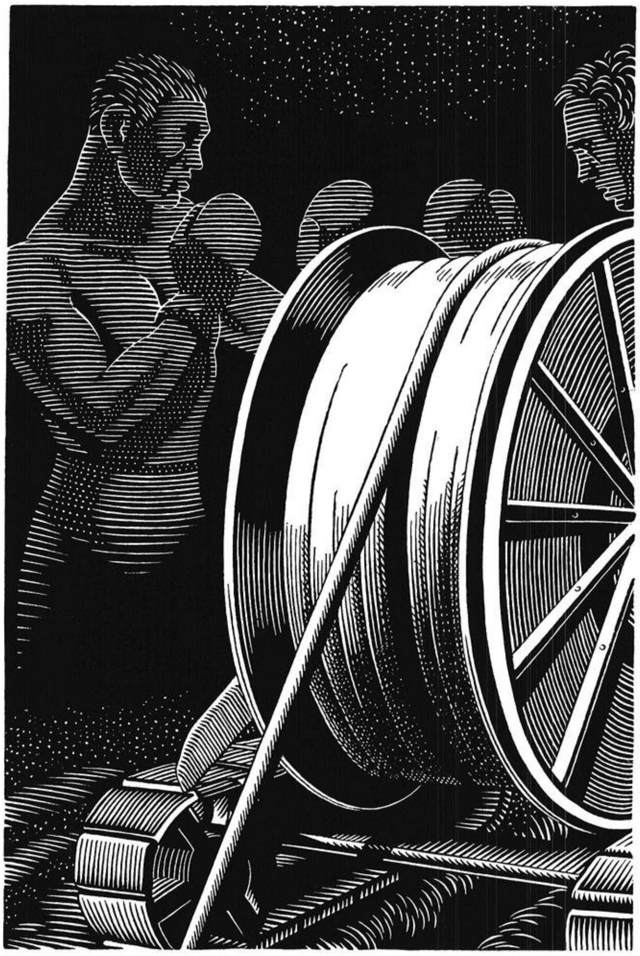
STICK YOUR NECK OUT Western editor Innes of the *Electrical World,* speaking to sixty delegates at the recent E. C. M. A. convention, conveyed the thought that the engineer should 'stick his neck out'. Practically every engineer earnestly tries to do that very thing but the net result does not indicate complete success. It is unfortunate that the engineer, who has championed rational and straightforward thinking is often restrained from displaying his wares to his fellowmen by the fact that modern mass production prohibits revolutionary change in its machinery even though such a change would instrinsically benefit everyone concerned.

Every day instances come to our attention wherein new ingenious developments have been perfected and subsequently filed away on the shelves of the 'waiting room' where they must await their day. The very lives of some engineers are stored away in models, pencils, prayers, drawings, hardships, and hopes on that shelf marked *For Future Reference.* When that future comes into being, the opportunity for the engineer to 'stick his neck out' has passed.

Perhaps this condition will prevail until a more stable amalgamation between the liberal and conservative factions of our civilization is effected. In that respect time is the enemy of those of us who are destined to live for only today. That is all the more reason why the capable engineer should pave the way for his successors by doing his best to 'stick his neck out' whenever conscience can conquer the will of his false modesty.

People differ in the degree of ability which they have, but nearly everybody has more ability than he ever puts to work. Mental indolence is the answer to most failures.

The manly art of self-defense



. . . now applied to telephone cable

Western Electric, manufacturing unit of the Bell System, now makes a tape armored telephone cable ready to meet all comers. When laid directly in the ground, this cable defends itself against moisture, grit, corrosion and other enemies.

Besides the usual lead sheath, the tiny copper wires in the cable are guarded by seven layers of paper, jute and steel tape—all saturated or covered with asphalt compound.

In pioneering and producing improved apparatus, Western Electric contributes to the year 'round reliability of your Bell Telephone.

BELL SYSTEM

WHY NOT TAKE A TRIP HOME BY TELEPHONE?
— TONIGHT AT HALF-PAST EIGHT

MODELS OF HYDRAULIC STRUCTURES

(Continued from page 36)

The drainage water discharges down the concrete chute or flume and the models at 1/5th scale indicated it follows the hydraulic laws underlying flow in a "canal with steep slope." At the bottom of the flume, high velocities are obtained. Most of the effort was spent on determining the width of the tumble bay below the flume and the correct angle and location of the baffle. The operation of the tumble bay in producing energy dissipation is quite different than the dissipator shown in Fig. 3, but the control of scour was apparently quite effective.

An interesting fact observed during these studies was that experimental results recorded in technical publications were largely on structures so located that tail-water depths are appreciable, that is, the water heads up in the stream and tends to submerge the apron of the structure during floods. In this work, the spillways were located at the head of gullies where considerable slope or fall is available below the structure with practically no tailwater condition. It was a new field of research and the hydraulic laboratory is now the scene of considerable activity on further experimental work along these lines under the Civil Works Administration.

The standard designs as recommended by the writer in his report to the Federal government, were modified to meet certain local conditions and several special designs not mentioned in this paper were made by engineers of the various camps. All of the Emergency Conservation Work, Flood Control Division, was under the Field Director, Professor E. R. Jones, of the Department of Agricultural Engineering. His many valuable suggestions enabled the work to progress with rapidity. The writer wishes to acknowledge the assistance and services of Messrs. L. Berg, H. C. Cortright, O. J. Knechtges, J. Orne, former students, Prof. O. R. Zeasman, U. W., and Prof. F. M. Dawson, and Mr. J. S. Bowman of the Department of Hydraulic and Sanitary Engineering, and Prof. R. C. Johnson of the University of South Carolina enrolled in summer session.

A TENTATIVE REVISION OF THE ENGINEERING CURRICULUM

(Continued from page 41)

not find a job, and because, from the industrial viewpoint men are often needed capable of applying their training to a special job for which there could be no specific preparation in college. The teachers' reply to this is that at present all the electrical subjects concentrate on low frequencies and power equipment, which is just as bad in another direction. The ideal remedy would be to modify the courses so as to include high-frequency phenomena and apparatus, but as long as the present texts are used, separate courses must be employed. The latter are not intended to be highly specialized, but rather to cover only some of the basic principles in high-frequency communication and in the construction of its equipment. The courses here at Wisconsin are rapidly becoming inadequate, and a change to a broaded and more up-to-date course is contemplated in the near future.

It is unfortunate that the average engineer receives only a year of freshman English, and in spite of the fact that executives and practicing engineers place increasing emphasis on its importance, there is now a simplified English course for freshman engineers, to respond to the persistent student clamor that "engineers don't need no English." There is always this compromise between what the student wants and what is really good for him according to the opinions of teachers and alumni. On the one hand is his lack of interest in an unduly long formal training, and on the other hand is the sorry picture of a graduate stuffed full of useless facts, lacking the ability to think properly and trained only for a particular vocation.

It is the writer's belief that interest could be combined with utility in following the above suggestions, and although a rigid adherence to high standards in the mathematics course proposed would increase the "mortality" among the freshmen, it would certainly leave the survivors better fitted to cope with subsequent courses and thus enable the university to turn out a larger percentage of them well equipped in the matter of fundamental principles and the ability to think.

"The true engineer is one who sees visions and follows his visions beyond the beaten path of common practice, and does something that has not been done before, or does it in a better way." — BOWSER.

G-E *Campus News*

CENTLESS CIRCUITS

Conspicuous in nightmares of power company officials are ingenious, economical human beings who tinker with electric circuits, who rig up outlandish but convenient wiring. As a crowning touch to their handiwork, when fuses blow they use a penny. Lights go on. Protection goes out the cellar window.

To foil these handy-men-about-the-house, and to end blown-fuse troubles forever, G.E. has developed an ounce of protection—a little circuit breaker to replace the old-fashioned fuse box. It looks very much like an ordinary lighting wall-switch. When a "short" occurs, the arc is interrupted inside a small, closed, metal chamber in 0.008 of a second. A mere flip of the handle restores service.

Protection? The performance is so mild you can hear nothing and see nothing, even when 5000 amperes are being interrupted. And the breaker is safe and foolproof, too. The complete line will include ratings from 15 to 600 amperes. Let no more bridged-fuse bogeys disturb anyone's slumbers.

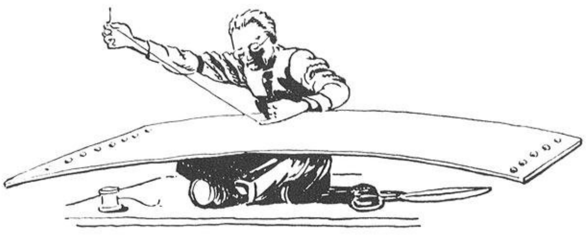
J. W. Seaman, Antioch College, '29, was very active in this development.

HATS OFF TO THIS ONE

The Sutorbilt Corporation of Los Angeles had a problem — to remove dried cocoanut meat (it's copra in the tropics) from a ship's hold to railroad cars at the rate of one ton every 60 seconds. That sounds like a lot of d.c.m. to most people — but it had to be done.

They built a machine with an 8-inch flexible metal throat and an amazing appetite. Not content with devouring copra, this machine gobbles up shiploads of potash, soda ash, borax, shale, grain, nuts — and even nibbles at the shirts, trousers, and hats of bystanders.

How? A G-E compensator starts a 150-hp. motor. An air compressor comes up to speed. Nature begins to "abhor a vacuum," and up comes everything but the bottom of the ship. If you have a cellar full of copra to be moved — or any similar problem — let us know.



STITCHING STEEL

Why not use vacuum tubes for speeding-up welders? So thought our engineers as they were working on the problem of stitching steel plates together with the rapidity of a sewing machine.

Thyratron-tube control for resistance seam welders resulted. H. W. Lord, '26 graduate of the California Institute of Technology, received a Charles A. Coffin Foundation Award* for developing an accurate timing circuit using Thyratron tubes — an important part of the control. Industry obtained a new high-speed product on tool.

This control, when applied to line- or spot-welding machines, permits 1200 current interruptions per minute. Thus, it makes possible the stitching together of thin metal sheets to form gas-tight and water-tight seams. Thyratron-controlled machines will weld stainless steel, mild steel, chromium- and cadmium-plated steel, aluminum alloys, and many other materials. Steel barrels, pails, milk cans, and gasoline tanks are just a few of the many products now produced faster as a result of Thyratron welding control.

*A highly-prized company award, named after one of the founders of General Electric, that is awarded annually to selected employees for meritorious service.

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