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The WISCONSIN ENGINEER

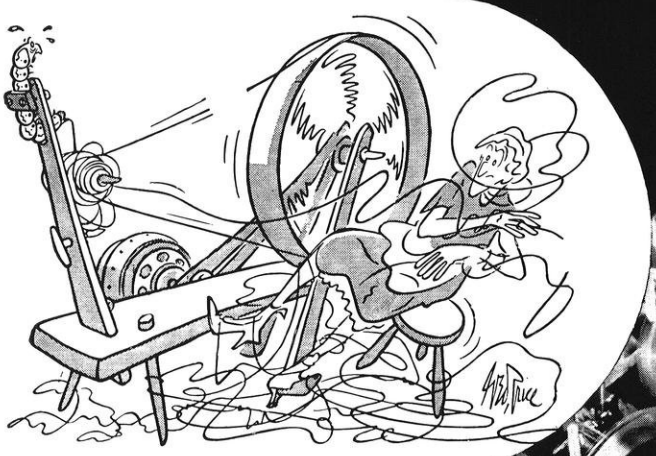
Presenting

The Civil Engineers

December, 1941

Roads ★ Submarines ★ Honoraries

RAYON . .
BY THE MILE



. . a continuous process aided by New Departure Ball Bearings

● The lowly silk worm has become old-fashioned indeed. Now, from liquid Rayon, finished thread is manufactured and wound in one continuous process—ready for the textile mill.

But the 100,000 reels and spindles of this great plant could not operate continuously without the friction-reducing, wear-avoiding qualities of the New Departure self-enclosed and lubricated ball bearings at more than 300,000 points. In fact, they make such a project commercially possible—simplify design, accurately locate rotating parts, eliminate periodic oiling and definitely reduce costs.

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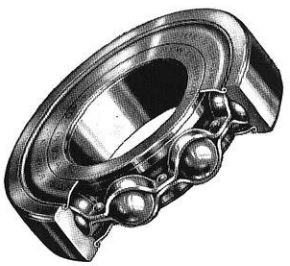

This self-enclosed ball bearing is only one of numerous "new departures," the result of New Departure's well known creative engineering. Engineering students should be interested in booklet "Ideas by New Departure Engineers," for the practical use of the machine builder. New Departure, Division of General Motors, Bristol, Connecticut.

New Departure

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TO INDUSTRY AND DEFENSE

TOTAL WAR...

Total war demands total service. The blast of bombs and the dead and dying at Pearl Harbor have driven upon all of us the realization that we cannot escape the conflagration of total war. Terrible and unnecessary as it all seems, we must face the ordeal squarely and in truth learn to make use of adversity. Out of the fires of sacrifice and suffering we must make sure that we forge not only freedom and opportunity for mankind but also those ideals by which freedom and opportunity may be properly used and protected.

The first step is to recognize that to meet total war we must indeed offer total service—each one of us as individuals. Simple and sane analysis should make clear to each student in the College of Engineering that he can offer no greater service than to prepare himself as best he can in the University to meet the country's need of highly trained engineers to develop, manufacture, and operate democracy's instruments of war. As never before he should strive to secure all "A" grades since "A" grades mean the highest degree of competence and thereby the greatest possibility of service.

Technical competence is not alone the total service each student can render. Never more than during the horrors and the grief of war and the distraction of the world's attention from the fine things of civilization is needed an elevation of personal standards, of generosity, and delicate feeling. If your service is to be total, indeed, you should re-evaluate your personal code as a man and a gentleman and as never before demand of yourself an adherance to your ideal. It is only thus that we may leave to others after us the principles which shall make the freedom and opportunities we win for men worth the total war we must wage.

Dean of the College of Engineering

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In This Issue . . .

FOR DECEMBER, we're taking you on the land, under the sea, and (in Static) up in the air. We've also given consideration to the co-operative system for engineering education, the honor societies, and the civil engineering department in general.

CONTINUING our series of introductions to engineering department heads, we give you the civils', **Professor L. F. Van Hagan,** who first recounts the beginning of engineering here at Wisconsin, then explains the importance of the civil's field of engineering.

SHOULD you care to know why **Wisconsin's roads** are as good or as bad as you think they are, take in **Gale Froemming's** highway analysis.

WE ALL know the importance of **submarines** in modern naval warfare, so this next article, on types and methods of construction, by one of last year's top graduates now helping build 'em, **Mac Fell,** should interest us all.

PERHAPS all of us at one time or another considered attending a **cooperative college** such as **Marquette.** The advantages and disadvantages of this system are discussed, and a survey of results made, by **Steve Serdahely, page 10.**

THIS IS going to hurt us as much as it is you, but the **finals'll** get you if you don't watch out. Check over the suggestions on **pages 12 and 13** and see if you are operating at maximum efficiency.

STRANGE as it may seem, all around the engine school is not manual labor. The rewards for diligent work are many—one of them is membership in the **natonial honor societies.** The societies, their requirements, their purpose, their activities, and their presidents are given in the next article, page 14. By **Blake Wheeler. Wheeler.**

NEXT come our regular monthly features, **Campus Notes, Alumni Notes, and Static.** Join the regulars and meet an old friend you probably haven't seen for quite a while. Who? See **page 26.**

AS THIS issue is devoted to the civils, it is fitting that the cover be given to them. The scene is the **Hydraulics lab,** with **Professor Lenz** and **Mel Ree** measuring the backwash of the model dam under test.

WE'VE OFTEN wished for super-highways while navigating some of the backwoods trails in Wisconsin. Our frontispiece is the entrance to one of the tunnels on the **Pennsylvania Turnpike,** super-highway deluxe. Courtesy of the **Westinghouse Engineer.**

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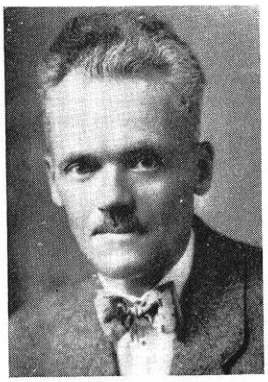
As we go to press our country is again at war —a war in which you engineers are exceedingly important. Next month will bring you news of the Wisconsin engineers' part in the Second World War.


ALLEGHENY MOUNTAIN



The Department of the Month

CIVIL ENGINEERING

by Professor L. F. Van Hagen

Chairman, Civil Engineering

THE TEACHING *of engineering at the University of Wisconsin began in 1868, when Col. W. R. Pease was detailed to the university to teach military tactics and was appointed by the regents professor of engineering. He was succeeded in 1870 by Col. William J. L. Nicodemus, who was appointed professor of military science and* civil *engineering. Col. Nicodemus, who served until his death in 1879, has been called "the father of technical instruction at Wisconsin."*

In the beginning at Wisconsin, all engineering that was not military in nature was civil engineering, the term "civil" being equivalent to "non-military." Civil engineering covered a wide range of engineering activities.

Specialties developed very quickly. There were soon courses in mechanical and in mining and metallurgical engineering. In 1889 the course in electrical engineering appeared. Chemical engineering evolved after the turn of the century. The tendency of engineering courses to multiply by fission is strong, as is evidenced by the numerous varieties of engineering that are appearing in the catalogues of engineering schools throughout the country. Each new kind of engineering tends in turn to break down into still more specialized variants. The tendency has both good and evil aspects.

In a strict sense, all engineering that is not military *is* civil *engineering, but the term "civil engineering," as used today, covers the following activities: Surveying, including land surveying, route surveying, and geodetic surveying; the design, construction, and maintenance of channels of communication, such as railways, highways, canals, and pipe lines; the design, construction, and maintenance of river and harbor improvements, including levees, sea walls, jetties, wharves, docks, piers, and lighthouses; the design, construction, and maintenance of such structures as bridges, buildings, chimneys, viaducts, aqueducts, tunnels, dams, and power plants; the reclaiming of waste lands, either by drainage or by irrigation; the supplying of water to cities, the treatment of sewage, the disposal of refuse, the paving of streets, and the planning for future growth of cities; and, finally, the testing of materials of construction.*

From 1871, when the first civil engineering student was graduated from this university, until 1900, when the college was first housed in a building of its own, the college was small and the graduates few in number. Since 1900, the number of civil engineering graduates each year has increased decade by decade. From 1900 to 1909, there were 248 graduates; from 1910 to 1919, there were 320; from 1920 to 1929, there were 359; and from 1930 to 1939, there were 390. In 1940 there were 46 graduates, and this year there have been 40.

Graduate work in civil engineering has been developing slowly, chiefly in structural engineering and in hydraulic and sanitary engineering. From 1931 to 1941, inclusive, the university granted 53 master's degrees in civil engineering and five doctor's degrees.

The hydraulic and sanitary laboratories have been active in the field of research. The hydraulic laboratory at Wisconsin is said to have been the first hydraulic laboratory in this country. It was built under the direction of Dr. Daniel W. Mead, who for many years was professor of hydraulic and sanitary engineering at this university. The sanitary laboratory, which is housed with the hydraulic laboratory, has been developing rapidly under the energetic inspiration of Professor L. H. Kessler, at present on leave of absence so that he may serve the federal government in connection with the water supplies and sanitary utilities for the army camps.

Instruction in highway engineering benefits by the presence on the campus of the materials laboratory of the Wisconsin Highway Commission, which is well equipped for research work.

A six-weeks summer camp at Devil's Lake gives civil engineering students an opportunity to acquire reasonable skill in handling surveying instruments and to apply their surveying knowledge to a wide range of practical problems.

Modern Highway Construction

by Gale Froemming, c'43

Photos Courtesy State Highway Department

BACK in the early days of Wisconsin's history horses and ox-carts cut through the brush on rude forms of roads. Today some of these roads are still being used, but happily, not many. The rutted lanes are a thing of the past.

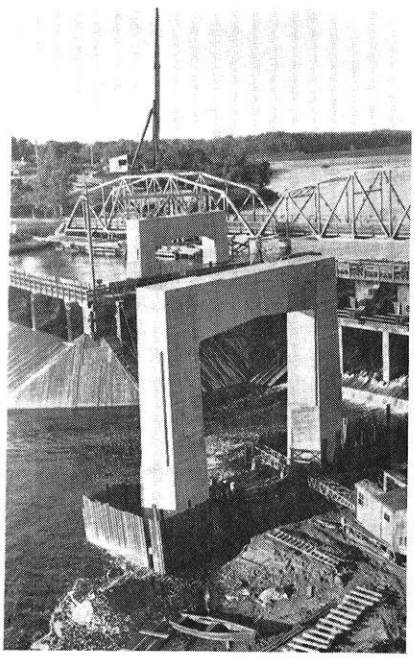
Highways and highway construction today are as different from the old methods as the superb motor cars of today are different from the horse and buggy of yesterday. Fast disappearing are the muddy trails which wound through the country-side. In their place has grown up a network of straight ribbons of hard-surfaced highways, reaching and connecting the large and small cities of the state.

Today it is possible to travel from any fair sized city in the state to any important region of the United States without ever leaving concrete highways.

Almost as marvelous as the results which appear all around us are the methods through which these results are obtained.

Gravel surfacing for years has been a hit and miss proposition. Essentially the idea was to locate a gravel deposit, spread the gravel somewhat evenly onto the highway, and open the road to traffic. The cars slid about on the loose gravel, spreading dust over the country-side, and spreading death and serious injury as well, until eventually, in most cases, the road set-up and the surface became satisfactory.

Today the state engineers have discovered what makes gravel set up to form a good surface, and the conditions which exist when this setting up takes place. These conditions are the result of graded aggregate.



Bridge Construction at Menomonie

A sample of the gravel as it is found in the pit is now sent to the testing laboratories in Madison, where it is analyzed to determine the P.I. and the gradation of the material. In addition to this information, the correction which should be made to the material to bring it up to the specifications and the per cent of moisture which should be present to produce maximum density is determined.

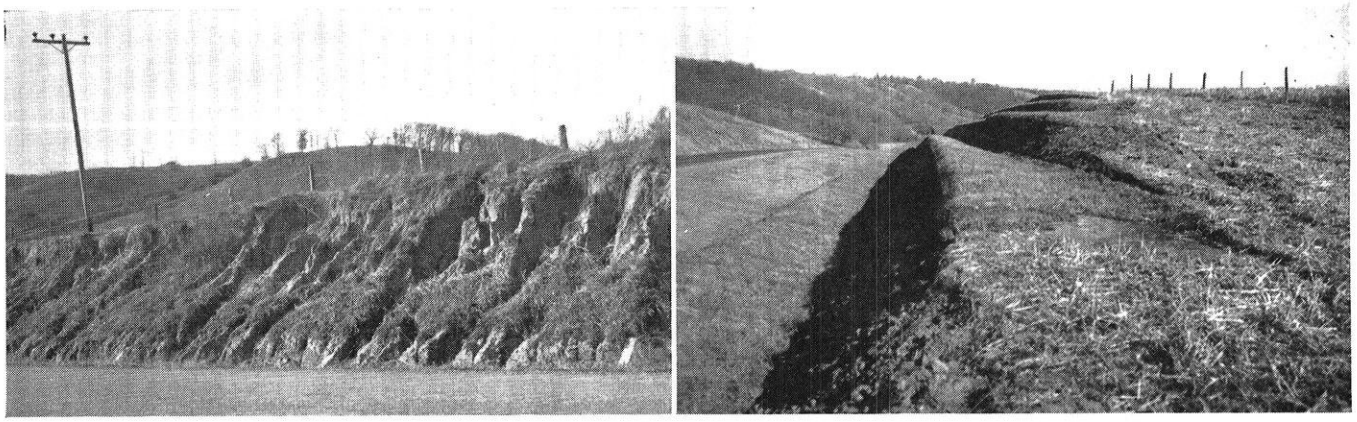
This information is then sent out to the job, where under the direction of the State Engineer a plant is designed to produce the required material and make the proper additions. Rock is crushed, sand, silt, and in some cases, cement, are added, and the moisture content is regulated. After considerable experimentation, the various constituents come within the tolerances of the specifications (a three per cent range for moisture is common) and preparations are made for surfacing.

A fleet of trucks rushes the material out to the job at the rate of forty to sixty yards an hour, the material is laid and bladed to the exact cross section required, and hit by a heavy rubber tired roller. The same day, in fact, while the road is being laid, the cars are travelling over a hard, dustless surface, as smooth as a concrete road. The picture showing the heavy rock cut is an example of the appearance of a surface of this type.

Two layers of this graded aggregate applied to a road and covered with a penetrating oil will hold the road until the following season when a heavy black top mat can be laid. The entire surfacing costs about $5,000 per mile. Concrete runs about $20,000 per mile of surfacing. Maintenance costs are somewhat lower for the concrete.

Surfacing alone does not make a highway. In almost every community in the state the residents can point to a stretch of road which they claim is an example of the poor type of surfacing used in the state. Highway 64 near Summerset has been either torn up, or has been in such a condition that it should have been torn up during every summer in the last twenty years. This road was laid by yesterday's methods. Equipment tore into the sides of the hills, ripped out the dirt, and deposited it in the fills. The dirt that was deposited was of a type which, if used at all, should have been mercifully hidden by tons of sandy material. Over this mass a good surfacing was applied, but the surfacing was not good enough to withstand the tremendous pressure caused by freezing. Frost boils appeared year after year, and new surfacing lasted as long as the original—one season. Last summer the county built up the road by placing a foot-thick mat over the spots which had been troublesome. This mat, together with the original surface, served to lift the top of the road out of the danger zone. Past experience in other sections have proven that the problem can be solved in this way.

In the construction of new highways the state is no



Before and After Terracing on Steep Slopes in Erosion Control

longer creating problem sections such as that described above. All cuts are tested in advance to determine their fitness for use in the fills. Some material is rejected for use in the road itself. In fills a sand and gravel lift of 18" may be applied over the regular grade. If the material in the cut is bad, the material is excavated below subgrade and better soil is substituted.

The walls of cuts have long been an eyesore to the motorist. From a plan view, they would appear to be lop-sided footballs. To the motorist, they are an obvious attempt to produce straight sides, and an equally obvious failure. Today, instead of a uniformly steep slope, the cut starts at a ten to one slope and grades into perhaps a four to one at the middle of the cut. The effect on the eye is a smooth curving, streamlined approach, which permits better drainage structures, and cuts down erosion common to steep slopes.

One of the more interesting and striking examples of soil erosion and control is shown in the two pictures taken on the State Trunk Highway 60 between Bridgeport and Wauzeka. The construction was complete in 1937 and by 1939 was in the condition shown in the first photograph. In 1939 the cuts were terraced, extra right of way purchased and the slopes lessened, the sides were seeded and the approaches and steeper slopes were sodded. Today this stretch of road appears as shown in the second picture.

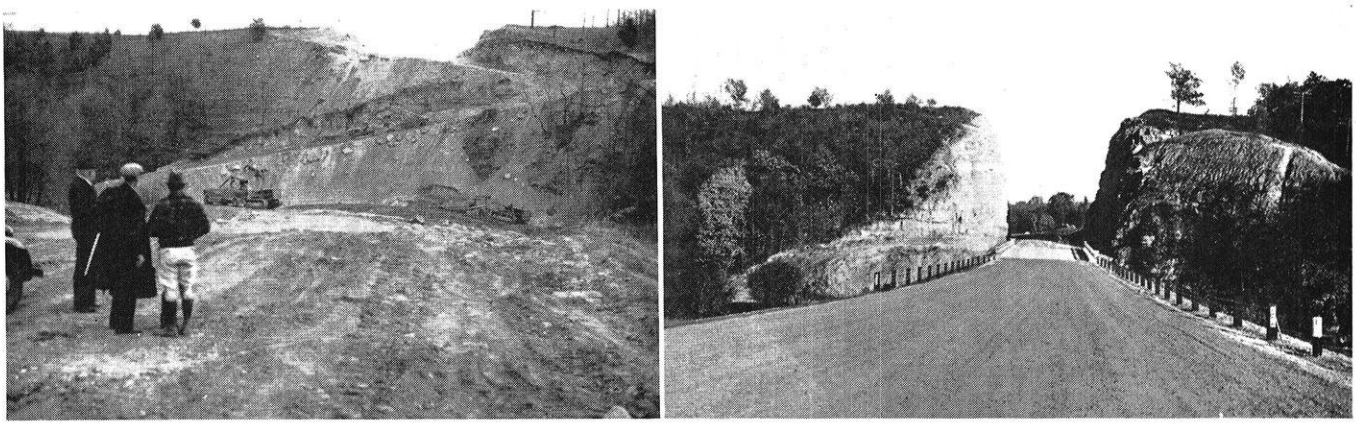
Drainage structures have become an increasingly important part of highway work. It has been found by experience that it is far more economical to put in larger culvert pipes and have them in usable condition even after the job has been accepted than it is to place a twelve-inch culvert which soon becomes clogged and useless. When these pipes are placed an inspector is at hand to see that the pipe is surrounded by a material which will not freeze and break into the side of the pipe. Culverts are built in such a way that they can serve as cattle passes, in which case the farmer using them will maintain them.

Excavation, probably the most important feature of road building, sometimes presents some interesting problems of its own. In a job completed by A. B. Lynch on State Trunk Highway 11 near East Dubuque in Grant county, a rock cut proved to be the most interesting project. The cut, shown in the pictures during and after construction, was cut through limestone. The cut at its deepest spot was 80 feet. In order to remove the material by scraper it was necessary to terrace the hillside and bring it down by a zig-zag route. At the base of the cliff a deep gorge had to be bridged before construction could be finished.

These jobs are the exception, but in highway work, the exception is often the rule. It is impossible to lay down a set of rules for the work, because the methods are always decided by the nature of the country through which the construction is to go.

On some jobs nature seems to have tried her worst to create all the hazards possible, and man has aided the

(continued on page 22)



Excavation for Cut Through Limestone Near East Dubuque . . . After Completion

Submarine Construction in Wisconsin

by Malcolm Feed, min '41

LAST June, about the end of exam week, at Manitowoc, Wisconsin, the keel was laid for the first submarine ever to be built on the Great Lakes. Specifically, the first section of the U.S.S. Peto was laid on the blocks June 18, 1941. It will be similar to a type already placed in commission having an over-all length of 310 feet, surface displacement of 1,450 tons, submerged displacement of about 2,200 tons, and a speed of 20 knots when running at the surface. The first of the "pigboats" built inland is to be launched at the yards of the Manitowoc Shipbuilding Company sometime late in the Spring of 1942, number one of ten called for in a $30,000,000 contract with the Navy.

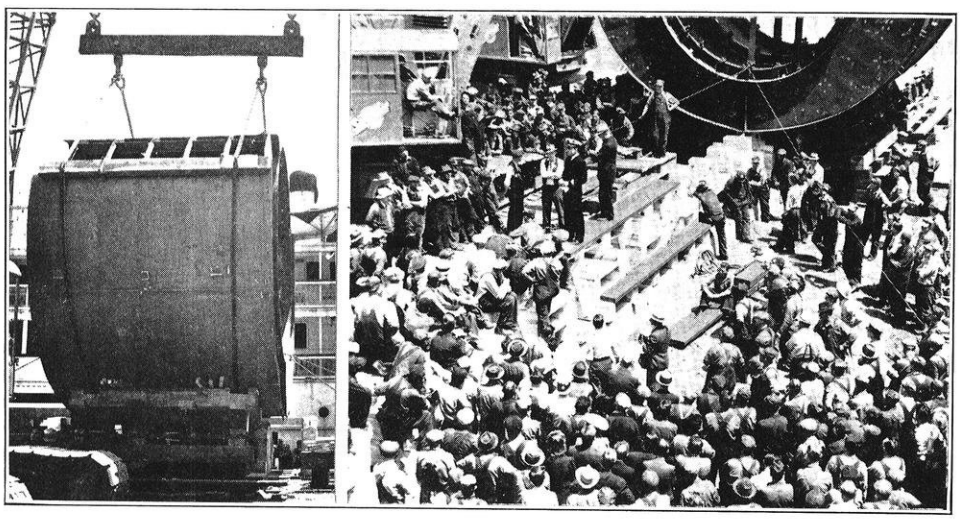
Here in Manitowoc, from 1917 to 1920, over 30 ocean-going freighters were built for links in that first "Bridge of Ships." Now more than 2,000 men are working three shifts, 24 hours a day because "Uncle Sam wants his Boats." The Navy has sent some extremely able constructors to supervise the job, and the Electric Boat Company, only other private company now building submarines, has sent its most experienced experts. To keep out all those not working on the boats, a high wire fence surrounds the yards, and uniformed guards patrol the gates, permitting entrance only to those who can show an official badge.

The latest Navy type is built with a double hull. The inner cylindrical "pressure hull" contains the engines, batteries, instruments, and the living quarters of the crew. The surrounding outer hull is shaped to contain an air layer. When the sub operates at the surface, the space between these hulls is filled with air enough to give it a buoyancy greater than its weight by 20 to 40%. To submerge, this reserve buoyancy is neutralized by letting sea water into the space until the difference between the weight of the boat and the weight of the water it displaces is only a few hundred pounds. This difference is always kept positive so that with engines stopped the boat would slowly rise to the surface. Smaller tanks at bow and stern, and on each side, can be filled or emptied separately in order to keep the craft on an even keel. When these conditions of near-equilibrium exist and the propellers are turning, the vertical maneuvering can be controlled with the diving rudders at the stern and the diving planes at the bow. The ballast tanks can be emptied for surface operation, or in case of emergency, by forcing compressed air into them.

Relative Sizes of Navy's Earliest and Latest Subs

The submarine is driven usually by two propellers each turned by one Diesel engine, or two in tandem, for surface travel. Underwater, electric motors powered by storage batteries can drive the propellers continuously for as long as 24 hours, but at a much lower speed. High speed submerging is not now considered important because under water the strategy of the waiting game is used.

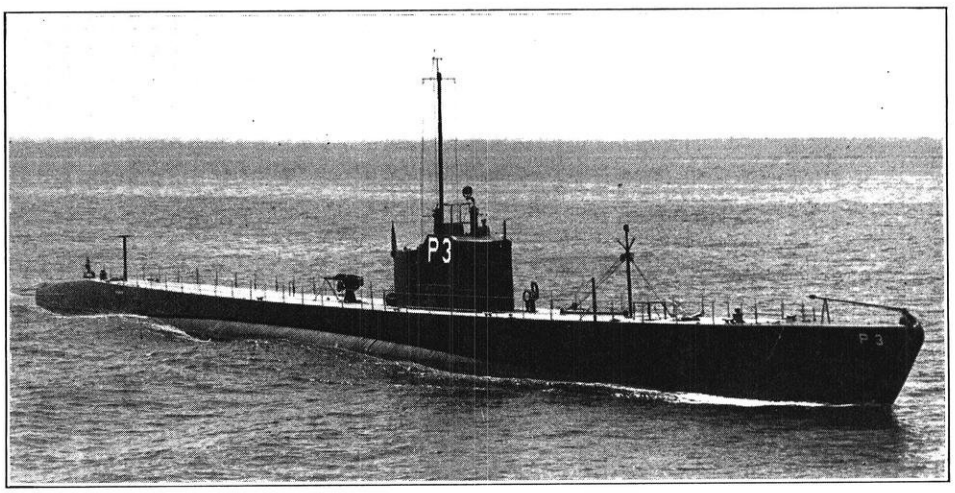
Detail design of subs focuses on weight-saving and the accompanying problems. The five chief design factors are: (1) sea-going ability, (2) speed, (3) radius of action, (4) armament, and (5) protection. Protection lies in the ability to dive as quickly and as deep as possible. The other factors resolve into a compromise between (a) speed, with radius of action, and (b) fire concentration. For speed means larger engines, and radius of action means greater fuel capacity, while the total weight to be carried is held to a minimum. On the other hand, greater fire power means more and larger torpedoes; more weight. Therefore, both factors benefit by decrease of dead weight. This is achieved by using better structural steel and more careful detail design, as well as by lightening engines with special metallic alloys. This close figuring on design, and the



Left: First Section of the PETO in Place. Right: Lt. Comdr. G. C. Weaver Addressing Group at Keel Laying

danger that salt water corrosion of porous castings might freeze the workings of a mechanism make rigid inspection of the building work essential.

The actual building of the submarines at the Manitowoc Shipbuilding Company involves prefabrication of the hull in sections. Within the welding shops, each section is welded up of plates and various angle and T sections, which have been cut to shape and bent according to pattern. Almost all the welding is electric arc welding, with V style joints. Then as it is needed, each section is moved to its respective berth on a special crawler-type section carrier. From this, the Navy uses two special Manitowoc cranes (35 ton capacity at a 30 foot radius) to swing the section into place, where it is blocked and welded to the preceding sections. One boat is made in a number of sections.

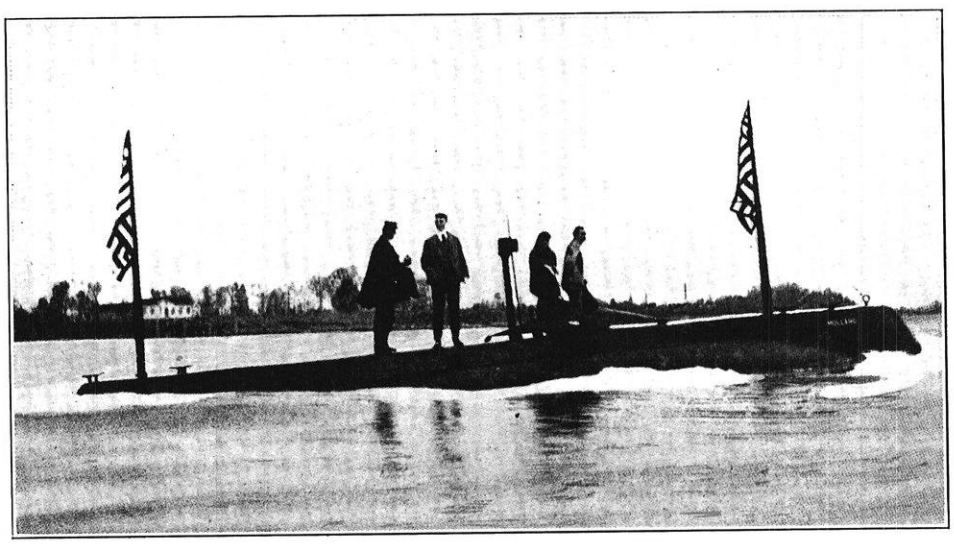


Modern Type Submarine Being Built by Manitowoc Shipbuilding Co., This Type Being Over 300 Feet Long, With Surface Speed of 21 Knots

But, although it is the most obvious, the hull fabrication is only about one-third of the work involved in sub building. The fine machining of the many valves and other working parts, often necessary with number four fits, keeps the machine shop busy, even with supplemental Navy-owned equipment. The installation of these parts then takes more workers, mechanics, electricians, and pipefitters. During this welding and installation great care must be taken not to disturb the weight-balance, and it is for this reason that two large signs order, "All materials taken aboard the Peto must be weighed."

Before they can become a part of the two-ocean navy, these boats must be delivered to the ocean. This delivery presents an additional problem, because the 300 foot length of the boats is too great for the locks of the Welland Canal on the St. Lawrence waterway, and their draft makes them too deep for the Chicago Canal-Mississippi route. When the submarine is ready, this problem will be handled by floating it on a special floating-drydock. The large amount of water displaced by the drydock will let it float with draft well under the maximum dictated by channel conditions. Thus the submarine can proceed under its own power down Lake Michigan, through the route of the Inland Waterway as far as the vicinity of Peoria. Here it will be mounted on the drydock for the rest of the journey to the Gulf of Mexico. In case some of the bridges spanning the water are too low for the submarine-drydock combination, even with masts and periscope removed, the drydock can be partially submerged to give the necessary clearance. From the Gulf of Mexico the submarine can proceed under its own power to Groton, Connecticut, where it will be completely outfitted before joining the fleet for active duty.

At the beginning of the First World War the submarine was a weapon of unknown capabilities. Today it is the chief reliance of the Axis navies. In the "Battle of the Atlantic," which may yet prove the decisive struggle of the present war, submarines are being used by Germany to stop the flow of all-important materials from the United States to England. What part the American submarines will play in this rapidly developing type of warfare remains to be seen. With the development of radio communication since the last war submarines no longer have to scout the high seas for enemy craft, but are guided by aircraft radio to the course of their intended victims. Traveling on the surface, at 20 miles per hour, a submarine may proceed unhindered under the cover of night to the course of the enemy and lie in wait. The potentialities of underseas craft are still many, and the present conflict will probably reveal them.



The HOLLAND, United States Navy's First Submarine, Purchased in 1900

A Symposium On

COOPERATIVE EDUCATION

by Steve Serdahely, c'44

COOPERATIVE engineering education has been defined as "a curriculum of predominantly engineering character, leading to a degree, which provides for the alternation at regularly scheduled intervals of periods of instruction in college and of supervised and correlated experience in industry."

With a vision of an education system such as this in mind, Dean Herman Schneider of the University of Cincinnati established the first cooperative engineering courses in that university. That was in 1909. Today thousands of engineering students the country over are registered in universities offering cooperative courses.

Actually, there exists no standard method of presenting cooperative education to engineering students. The educational program varies with the individual college. Usually, the size of the city in which the university is located and also the attitude toward educational matters in the given locality determine the manner in which the cooperative system will be presented. As would be expected, therefore, universities located in cities of 100,000 or greater population tend to adopt this method of engineering education more readily than do those schools which are located in smaller cities.

For example, the following is a list of some of the universities which feature cooperative education: University of Cincinnati, Cincinnati; University of Detroit, Detroit; University of Louisville, Louisville; Marquette University, Milwaukee; University of Pittsburgh, Pittsburgh; Southern Methodist University, Dallas. It is readily seen from this small list that the cities in which cooperative universities are located are large.

Of this list, Marquette University is perhaps the most familiar. For this reason, and also because this writer attended that university, the cooperative system at Marquette University will be used as an example for comparison with the all-academic system of engineering education.

Co-op System

As mentioned in the definition of cooperative education, the student registered in Marquette University's college of engineering will spend the greater part of his engineering education in alternating periods of academic and shop work. After the student has passed his sophomore year, he is placed in one of two sections into which the entire body of cooperative students is divided. It is evident that such a division is necessary if both industrial work and academic instruction are to be continuous. Thus, when the students in section A are attending classes at the university, the students in section B are working in the industrial plants.

It can be seen, therefore, that a coordinating force is needed to establish beneficial relations between the employer, the student, and the university. A Department of Industrial Relations solves this problem. The duties of such a department are many and varied. For example, positions for the students must be obtained and kept filled; records must be kept of the students' progress; difficulties between students and employers must be foreseen or adjusted; and advice or assistance must be given the students so that they will get the most out of their industrial experience.

Perhaps one of the most important duties of the Department of Industrial Relations is to determine the rate at which the cooperative students should be paid. Usually, forty to fifty cents per hour is considered as a base pay in the wage scale. Pay raises depend on the student's ability. The range of weekly wages has a bottom limit of approximately $15 per week and a top limit of approximately $30 per week.

Thus, in theory, the cooperative system of engineering education offers the student simultaneous practical and technical education as well as an opportunity to "earn while he learns."

Comparison of Advantages

The question follows: "Is the cooperative system, then, more desirable than the all-academic system?" or, "How do these two systems of engineering education compare with each other?"

The cooperative system offers practical experience as the standard for vocational guidance. All-academic systems, on the other hand, provide orientation courses, lectures, professional societies, and other effective means.

It is also often argued that the student in the cooperative system learns the most modern shop methods and engineering practices while the all-resident student does not. This would be true if the all-academic or all-resident systems did not include shop course in which up-to-date methods are used and discussed. In some cases, however, universities offering the cooperative system have eliminated some of the shop courses because of the fact that this knowledge could be obtained in the industrial plants. Occasionally, this elimination is done at the expense of a number of students who do not possess jobs which offer experience similar to that obtained in shop courses.

Then, too, the shop courses in all-academic engineering universities connect the modern methods with the fundamental principles. This practice prevents the development of a condition in which the student is "exposed" to an engineering method or practice which is beyond his fundamental knowledge.

Financial Considerations

Always presented as a favorable argument by proponents of the cooperative system is the financial advantage enjoyed by the cooperative student. This argument, however, is based on the assumption that the all-resident student has no opportunities to earn money during his university attendance. Full-time vacation work by all-resident students frequently results in the earning of an equal or even larger amount than that earned by the cooperative student in the entire year preceding the vacation period.

Also, the "extra year" which the all-academic student gains enables him to work an entire year before the cooperative student graduates.

The comparison between the salaries of all-resident graduates and cooperative graduates shows that, while the cooperative graduate's earnings immediately after graduation are somewhat higher than those of the all-academic graduates, when the respective students reach the same age their incomes are equal.

It is also said of the cooperative system that students who have been educated under this system have created a demand for their services. This is true usually in the industrial plant in which the cooperative student has worked. However, in normal times, the demand for all-academic students is greater than the supply. Therefore, both types of student have an equal opportunity to secure employment.

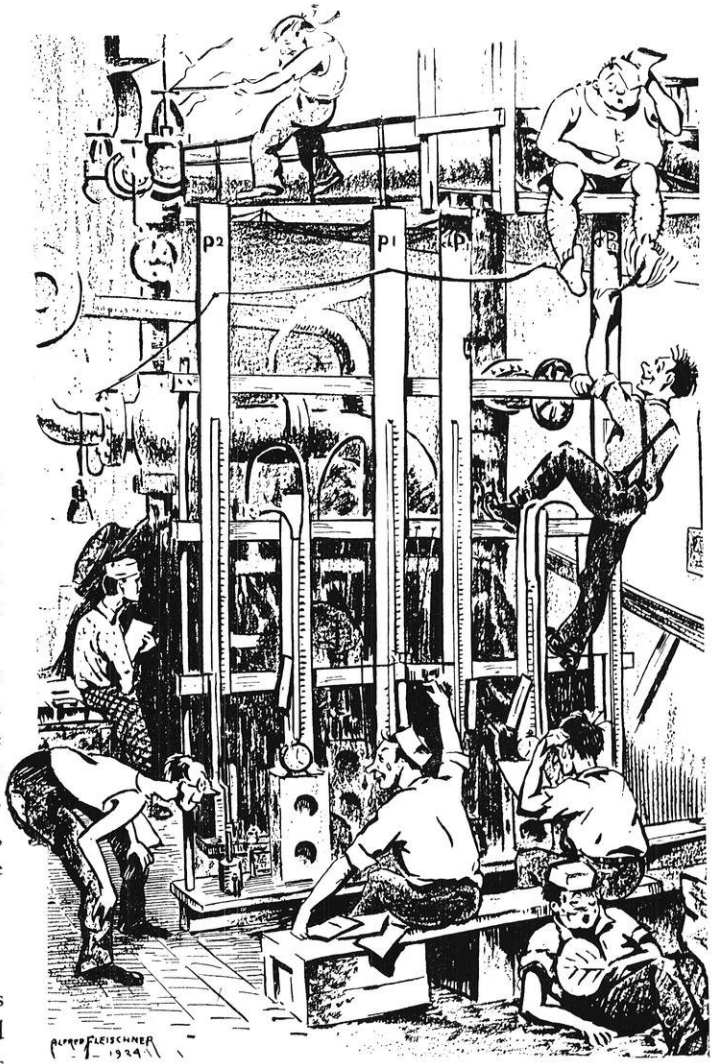
Industrial Relations

Under the cooperative system, it is said, good relations are developed between the various industrial plants and the cooperative university. This bond of relationship is established, of course, through the students working in the plants. Similarly, in the all-academic system, a like condition exists. In this case, however, members of the faculty create the friendly relations. This follows from the faculty members' positions in the industrial plants as consultants or advisors.

Finally, comparisons can be made between industry as a whole and its relation to each of these systems.

Supporters of the cooperative system contend that some of the industrial firms in which the students work are small and do not feel the need for engineer employees, but, after employing student engineers and benefiting from such additions to the personnel the small firms tend to make engineers permanent employees. But, in somewhat the same manner, all-academic universities also show how small firms enjoy the advantages of engineering aid. This is accomplished by faculty consultants, student reports concerning these small firms, and other means.

Not to be overlooked is the comparison between the types of job held by both the all-academic and the cooperative students. In a survey conducted between two universities which were much alike (except for the fact that one was cooperative and the other all-resident) the positions held by graduates of both schools were divided into four groups: (1) Primarily administrative; (2) Primarily technical; (3) Research and teaching; and (4) Miscellaneous. In each case the percentages were remarkably similar, differing but a few per cent from each other. Also, graduates from each type of institution occupied primarily technical positions in the early years after graduation and primarily administrative positions after many years in the field. Then, the type of institution attended had little effect upon the positions obtained by the graduates after leaving the university.



Thus, considering all of the comparisons made above, the final decision of which type of institution is superior is an individual choice.

Recognition must be made, however, of the manner in which the cooperative system of engineering education is developing. Since its inception in 1909, it has become an important factor in engineering education, deserving the numerous endorsements which have been made by industrial plants throughout the nation.

What Every Young Student Should Know

by Don Niles, m'44

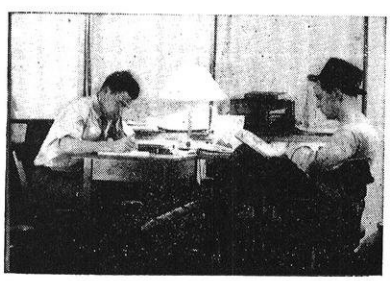
WHY KID YOURSELF? *You can't possibly do a semester's work during Christmas vacation—even if you tried to. The following article contains nothing new. You should have read this material long ago. But that's no reason you shouldn't read it again. Or perhaps the repetition means that the information below is not only worth the rereading, but is also worth the doing. The engineering course you are taking is designed to weed out about twenty per cent of the enrollment. Why belong to that lower crust? Only three short weeks after Christmas remain before final examinations. Don't depend upon the STATIC page's Santa Claus to get you through. We hope you are good and scared already.*

LISTEN my children and you shall hear some words of wisdom as to how you can get the most out of that forty-eight dollars you shelled out at the start of the year. There will also be some words of my own, perhaps not so much of wisdom but maybe of interest.

First and foremost, most students are here for the purpose of learning something, which opinion is especially prevalent in the "bread and butter" courses, engineering, medicine, etc. Of course, we must take into account the students who want a good time (for one semester), and also those who heard that engineers get draft exemption.

Therefore, the **first** thing to be done in any case, is school work. Not dates, jobs, or bull sessions. When you get home from classes dig in and sweat, get your work done, and then meet the girl friend. Not before. That also goes for week ends. Friday may be a 12:30 night, but if you have work to do, remember that Saturday is a 12:30 night too. And if you still have work to do, there will be more 12:30 nights to come. It takes less time to keep up than to catch up. If you **never** seem to have any time, then that isn't normal either and you had better begin checking up somewhere along the line.

To keep the article from being "one man's opinion," here are a few facultative opinions, first of which is that of Dean of Men Scott Goodnight. He says that studying is a habit. You can't expect to go out every night six days in a row and expect to get much work accomplished on the seventh. You just can't concentrate because concentration must be learned—it isn't a natural instinct. It can be done. Put your whole mind to the task and you can get it done with the least expenditure of time and effort—which, after all, is what is desired.



The dean said it was absolutely possible to get good grades and still engage in outside activities providing you really **work** when you work. And when a dean of men says "Good grades," he doesn't mean a 1.001.

"Acquisition of study habits and concentration is not easy. It requires grit, diligence, and will power." Also won't power. One doesn't acquire good study habits by watching that blonde walking by the house, and **not** watching her requires grit. Concentration is neither aided nor abetted by listening in on any jokes being mumbled by your roommate to that gink from down the hall. And **not** listening takes will power. So there you are.

Dean Goodnight also believed that freshmen especially should plan a schedule and hold to it. But upper classmen are not out of range of that scheme. No one else has quite such a high regard of his ability as a sophomore—and also no one else has quite such a jolt coming when the semester grades are released and he finds he spent too much time impressing the freshies.

Someone the freshman engineers know well is Dapper Doc Holt, who pummels an outline of chemistry into the heads of the non-chemical engineers.

He believes subjects should be taken one at a time. For example, rather than going to drawing for two hours, then to math, and then to chemistry, he believes we could get more out of it by going to drawing for two hours, then to drawing, and then to drawing. With nothing else to be learning at the same time, we could put all we had into that one.

You all have experienced the dreadful feeling coming over you when you realize you are starting a new subject in two or three classes at one time, and you don't quite savvy any one of them quite completely. Now you see his idea.

He also thought it is a good idea to jot down your

Study · Study · Study · Study

notes on cards and bring them out at unusual times and places. Another of his suggestions was to explain something to somebody. Those two ideas can be correlated. It is surprising how useful a date can be when she is willing to listen to an explanation of a derivation—might keep you out of mischief too. Engineers are noted the world over for their ability to devote a moonlight night to explaining the operation of electric motors and such.

Dr. Holt did not condone "bull sessions" or outlining the textbook. "Bull sessions" are likely to get off the subject of thermodynamics and onto other warm subjects, while if one outlines the text he too often figures that he must know it then when all it did was to go in the eyes and out the fingers without even disturbing a brain cell. Remember, the mind is an apparatus for thinking and remembering, not just to be used for following directions.

You see, fellas, there's no other way about it. You can't learn without working, and you can't work without taking time. There are lots of short cuts and time savers, but none of them can take the brainwork out of it. What they do do is to cut down the excess of non-brainwork so you can have more of a chance to use your noggins.

Some students say that they do their best studying after midnight. Maybe so—if you can still arrange to get at least eight hours sleep every night. It doesn't seem to work so well to get four hours sleep Friday night and expect to catch up Saturday night. Ask any Pershing Rifles initiate how he felt Sunday after being initiated all night.

Of course, many people will argue about the sleep subject saying that they find five or six hours enough, but in most cases you'll find that such people are either bull-shooting somewhat and are getting more sleep, or they aren't getting the grades to back up their statements. A fellow with plenty of sleep is much easier to get along with, too.

Any distraction, no matter how small, will cut a little off of your efficiency. Have you ever noticed your eyes aching a little and perhaps see the page waltzing around after you've read at night? A possible cure for that is to get an eye shade to cut out the excess glare. If the sore eyes develop into headaches you had better see an optician. Maybe a pair of cheaters are in order.

The best light is given by a fluorescent lamp. They give out mostly blue light and very little of the uselss red and yellow. Almost the same effect can be achieved more cheaply with a twenty-five cent 100 watt blue daylight bulb in your present lamp. Your landlady would surely appreciate it if you would get your own rather than putting the bee on her. If you can't see why a daylight bulb is so named, turn it on in daylight and compare the light to that of a regular bulb.

If your clock is noisy, shove it in a drawer or under a pillow. If your roommate is noisy, shove him under the water in the bathtub and hold him there a while. If you yourself are noisy, you might as well shove off for home.

So far we have dealt only with school conditions. It is a heck of a lot harder to learn by making yourself study without instructors or classes. When you have an assignment to be done the next day, you get it done or else. And when you get stuck, just trot up to your instructor's office and give him the old "show me" technique. When you don't have an assignment, but think you should study something anyway, you always have the realization before you that the day after tomorrow would be just as good as tomorrow, and if something important comes up (like a good movie) why you might just as well put the whole thing off. If it won't sink in, you have to dig it out yourself and it's plenty easy to get discouraged about the whole thing, especially when you have a job all day besides.

Most of us have not done that to any great extent, so the opinion of someone who did do it—and ended up on top of the heap—is in order. One name immediately comes to mind among those who left school early, worked, and came out on top in the engineering world. Governor Julius P. Heil. The Heil Company is definitely a high class engineering establishment.

Gov. J. P. Heil

Consequently, this department hauled out his pup tent from Boy Scout days, and camped in the outer office of the outer office of the governor's office. After a wait of seven days, three hours, and fourteen minutes, with neither food nor drink with the exception of a few political plums which aren't very filling, a clear space developed on the horizon and I was ushered into The Presence.

Darned if he wasn't human.

He shook my hand (I haven't washed it since) and said, "Well, what can I do for you, young man?"

The question was, "How can a young person make himself study when he doesn't have teachers making him do it?"

"Well, it all depends on brain power and ambition. If one wants to advance, and if he has the brain power to think in channels of inventions or what can be improved—he has something which no professor can give. Are you in engineering?"

"Yes."

"Then you know what I mean by improvement."

He paused to think. Nope, no Coca Cola.

"Conditions of finance makes them work, too. When a young fellow is hungry and has no money, he'll try and figure out some way to make some. Maybe he will think of some new idea and go to work on it. If it's good, sooner or later the public will accept it and he has helped not only himself but other people as well.

"Always work. Be like the little bee and keep going. Never sit down and you're sure to learn something."

"That's what I did!"

Now you know how to study under all conditions. Quiet, noisy, or on your own. It all boils down to this: if anything distracts your attention while studying, either **get rid of the distraction,** or **learn to work in spite of it.**

Let's see you do it.

Know Your Campus

HONORARY SOCIETIES

MEMBERSHIP in honorary societies is offered to the students maintaining an outstanding record in the College of Engineering. Tau Beta Pi draws its membership from all of the five departments and in addition the mechanicals, civils, and electricals each have honorary fraternities to represent their individual schools.

What is an honorary fraternity? This question is in the minds of lower classmen and even frequently in the minds of upper classmen. Most people realize that scholastic achievement is one criterion, but many of these same people believe the only meaning is a license to wear a shiny key signifying self-adoration. To show that this is not the true picture of these organizations, this article presents each of the four Wisconsin chapters of honorary engineering fraternities as portrayed by their leaders and also a brief statement about the presidents.

Tau Beta Pi is the national honorary engineering society on the campus of the University of Wisconsin. The Wisconsin Alpha Chapter is the sixth oldest chapter in the society of a total of seventy-six chapters. The society was founded at Lehigh University in Bethlehem, Pennsylvania, on June 15, 1885. The local chapter was chartered in May, 1899. Of the 33,000 members initiated since its beginning, over 1,100 were initiated at the Wisconsin Alpha Chapter.

The purpose of the society is best expressed in the Preamble to the Constitution of Tau Beta Pi which reads in part as follows: "The Tau Beta Pi Association was founded at Lehigh University in 1885 by Edward Higginson Williams, Jr., to mark in a fitting manner those who have conferred honor upon their Alma Mater by distinguished scholarship and exemplary character as undergraduates in engineering, or by their attainments as alumni in the field of engineering, and to foster a spirit of liberal culture in the engineering colleges of America."

Men are selected from the schools of Chemical, Civil, Mechanical, Electrical, and Mining and Metallurgical Engineering.

Scholarship is not the sole criterion for the admission of a man. After scholastic requirements have been fulfilled, the selection is based on integrity, adaptability to all circumstances and conditions, breadth of interest and character.

Scholastically a man must be in the upper fifth of his senior class, or if a junior in the upper eighth of the class. The chapter generally invited about twenty men each semester. In the first semester the two or three highest ranking juniors and around seventeen seniors are invited; in the second semester better than half of the men invited are juniors.

The key, which is known as the "Bent," is a mark of distinction and honor to men in the industrial engineering world as well as in college and is an indication of the quality of a man.

President Harold Peterson, a resident of Madison, will complete his course in Chemical Engineering in February of '42. Graduating from high school in 1933, Harold worked for six years for the Kimberly Clark Paper Company, during which time he managed to obtain two years of college work at Oshkosh State Teachers College.

In addition to carrying the responsibility of the presidency of Tau Beta Pi, Harold is a member of AIChE and is doing undergraduate research work for the Wisconsin Alumni Research Foundation. Last year he was the recipient of the Ida V. Sivyer scholarship. For the exposition of '41, Harold was in charge of industrial exhibits.

Chi Epsilon is the honorary civil engineering fraternity, but by no means a "stiff-shirt" organization. To provide incentive for greater engineering achievement it recognizes as its principles scholarship, character, practicality, and sociability. Particular stress is placed upon the principle of "sociability," for members of Chi Epsilon arrange a yearly program which makes it "fun" to be a member—as well as an honor. Bowling parties, dinner dates, and picnics bring the members (along with their dates) together with the faculty outside the classroom.

Chi Epsilon is proud of the 250 members which have been initiated into the Wisconsin Chapter during its history of sixteen years. By glancing through the newsletter published last year by the Wisconsin Chi Epsilon Chapter, the names of many prominent engineers will be found. To mention just a few: W. S. Kinne, F. E. Turneaure, L. F. Van Hagan, W. S. Cottingham, D. W. Mead, M. O. Withey, L. A. Smith, K. F. Wendt, A. T. Lentz, R. S. Owen, L. H. Kessler, G. W. Washa, and J. G. Woodburn.

Chi Epsilon is a national fraternity open to civil engineers in the upper third of their class. There are Chi Epsilon chapters in seventeen major engineering schools in the United States. The first chapter was organized in 1923 at the University of Illinois. The Wisconsin Chapter received its charter in 1925 to become the sixth engineering school to boast a Chi Epsilon chapter. The total number of men initiated in all chapters since its inception is in the vicinity of 2,500. The Wisconsin Chapter is particularly proud of the fact that one of its members, Prof. R. S. Owen, is the National Secretary-Treasurer.

In the driver's seat for Chi Epsilon is Melvin Ree, a senior civil engineer from South Milwaukee. Organizations in which he is a member include AICE and Tau Beta Pi, and he has a WARF research assistantship in hydraulics. In the concert band he plays clarinet, and he

eats in the Congo Co-op. Last summer Mel worked for the highway commission. When he finishes school next spring, Mel is not sure what he wants to go into. He says, "I'm not pinning myself down."

Eta Kappa Nu, the honorary electrical engineering fraternity, being on a national scale, has active chapters in most of the engineering schools throughout the country. Alumni chapters are active in larger cities. All of these organizations are banded together by a national executive council and a national advisory board. Each alumni and college chapter is visited at least once each year by one of the national officers. The purpose of this visit is to inspect the chapter and to help the officers and members with any difficulties that may arise. The official publication of the organization, the **Bridge,** is a bi-monthly magazine edited by the executive secretary.

The purpose of Eta Kappa Nu is to promote and reward scholarship, to give aid in employment, to foster and promote closer cooperation between students and faculty, to cooperate fully with other professional and honorary organizations, and to give as much aid as possible to all engineering activities.

To be eligible for membership, the men must meet certain requirements. A junior must be in the upper quarter of his class and a senior must be in the upper third. Qualities such as general ability and leadership are also considered.

The local chapter has participated in activities of an engineering nature, such as the exposition. An award is usually presented to the EE student with the highest average at the end of his freshman year. In both the fall and spring a banquet is held in conjunction with initiation. For these occasions excellent speakers are obtained. Each spring a picnic is planned in which all electrical engineering seniors are invited.

Directing the activities of the Wisconsin chapter of Eta Kappa Nu is senior electrical, Lester Elmergreen. Les lives in Madison and graduated from Madison East in 1938. He is a member of AIEE, Tau Beta Pi, and Kappa Eta Kappa. As a senior member on the Polygon board, Les has taken over the publicity work for that organization. Last summer Les worked for the Dayton Power and Light Company, and this fall he supplements his school work with a Wisconsin Alumni Research Foundation undergraduate assistantship.

Pi Tau Sigma is the national honorary mechanical engineering fraternity. It was organized simultaneously in 1915 by groups of mechanical engineers at the Universities of Wisconsin and Illinois with the result that each is now known as the Alpha chapter.

The purpose of Pi Tau Sigma is to foster the high ideals of the engineering professions, to stimulate interest and coordinate departmental activities, and to promote the welfare of its members. Selection of members is based upon scholastic standing, leadership, personality, industry, social adaptability, and probable future success in mechanical engineering. Mechanical engineering students having junior standing are eligible for membership; elections are held each semester.

Honorary members recently elected are: J. B. Fisher, of Waukesha Motors Co., and F. M. Young, of Young Radiator Company.

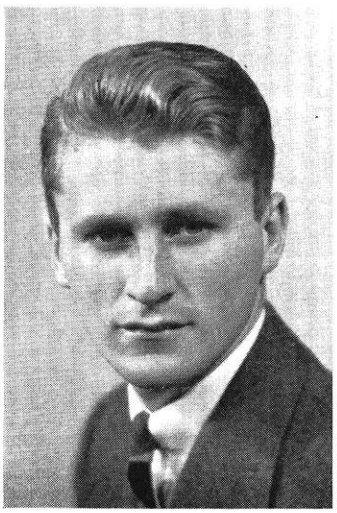
The Wisconsin Alpha Chapter sponsors a "Freshman Drawing Contest" each spring with prizes of a slide rule, handbook, and engineer's scale going to the three freshmen submitting the best contest drawings. An additional award of a Mechanical Engineering Handbook is to be given annually to the mechanical engineering sophomore who attained the best scholastic average during his freshman year. The first of the latter awards will be presented during the fall of 1943.

Activities of Pi Tau Sigma consist of assisting with various functions of the Mechanical Engineering Department; holding dances, bowling parties, sleigh-rides, and picnics. Exhibits are presented at the exposition.

Bob Zoellner, whom many of you know as the man behind the desk in the engineering library, is a native of Scotia, New York. For three and a half years preceding his university career Bob was employed by the General

(continued on page 22)

Peterson



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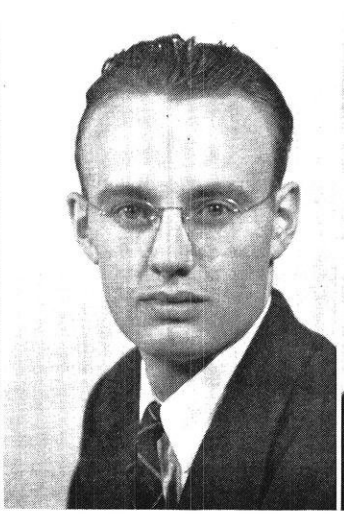


Elmergreen

Zoellner

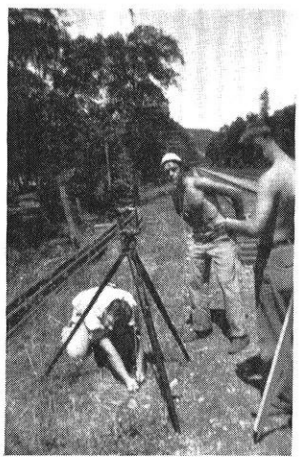
Memories of Last Summer

CIVIL LIBERTIES

THE rain poured down from the skies, the students poured into the camp, and the mud and water poured into our shoes. The first day in camp was enough to dampen the ardor of anyone except a party of work-loving civils at the civils' summer camp at Devil's Lake last summer.

By the evening of the first day all the faculty tents, and enough student tents had been salvaged from the general mess and erected as protection against the storm. During the next two days construction hours by the students put the camp in running order. Plumbing (?) was installed, the dining room was cleaned up, the hospital was erected, and Frank Sandner learned the fine art of cracking the black snake whip.

Among the more important improvements was the transformation of the law school from a vacant out-building to a fully equipped twelve cylinder establishment.

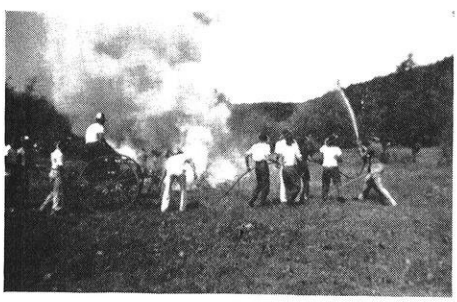


Come Saturday night, and the boys all repair over the lake for a little relaxation after the week's toil. The Chateau is an establishment where, for one thin dime, Jess Saeman was permitted to stand for three Saturday nights and imagine the bliss of dancing with the Baraboo queens.

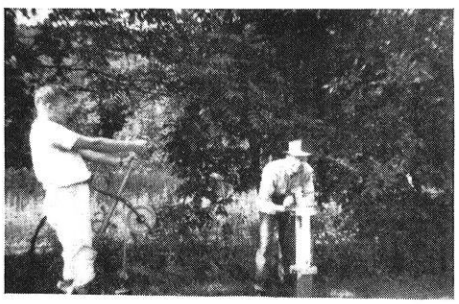
It was not always necessary to trek the hard tracks to enjoy the sensuous pleasures of the Chateau, for on some nights Gribble would consent to load his late model Buick with ten or eleven fellows and transport them, for the sake of charity and a small fee. This fee also included transportation to church the following morning.

Sunday morning was housecleaning, Sandner as chief task-master, and afterward, for such members as didn't go to church, a concert by Professor Owen, built around the ballad, "There Was an Old Sow."

In regard to work, there was some of that too. The first day was spent in the hills, with the hot sun beating down on the rocks, and the cool lake far, oh so far, away.



Water was forgotten only in the morning hour. From nine o'clock on, parched throats called surveying jargon and prayed for water. Eventually, after dehydrating some eight hours, we tripped merrily back to camp.



The work included topog maps, plane table work, land line surveying, triangulation, hydrography, two weeks of rails, a special course in highway surveying, base line measurements, and water power survey. In addition to this regular work, there were tours through plants in the vicinity.

Plane table work under Sandner was perhaps the most vivid, due partly to the work itself, but mostly to the instructor. None of the camp members will forget Frank standing in the center of a field and shouting, "We have 160 acres to map in the next three days, and we are going to finish it, every bit of it, and if you are a sixteenth of an inch off when you get done, by gad, you'll do the whole thing over. Wake up, Spiekerman!"

Professor Wesley deserves more space than the length of this article permits. He was probably the most active of all the lecturers we had at camp. His hydrog surveys were a high spot on the program; Uncle Herb will match whistles with any engineer, past or present, if the proper blonde is present for inspiration.

The two social highlights of camp, not counting Uncle Gaffney's nightly escapades, were prom and the banquet. The prom was complete with imported dates, except one cousin, and a real live band. The union collected the dues during the dance, so we know our boys were not scabs. Twelve-thirty nights were not enforced, and rumor has it that Strehlow considered himself cheated because there was no sunrise.

The banquet was even a finer deal than the prom. In addition to chicken, fried like mother ought to learn to cook them, there was corn, beer, ice cream, and, best of all, big black cigars.

Eleven o'clock-lights-out was postponed indefinitely when fire chief Micholas discovered the main switch. During the last three days in camp neither of your two authors, nor ten or eleven other guys saw a bed. On the whole, camp was a great experience, but let's not do it again.

Plowing in a 1600 mile telephone furrow *for defense*

To assure coast-to-coast telephone facilities adequate to meet future defense needs of the nation, the Bell System is constructing a 1600 mile, $20,000,000 cable line between Omaha and Sacramento.

Several newly developed "plow trains," working from opposite ends of the line, are burying the cable for maximum protection. They dig deep furrows, lay two cables in them and cover them with earth — all in one continuous operation. Their meeting will mark completion of the first *all cable* line across the continent. Carrier systems will be operated in the cables —one direction of transmission in each.

This vast project is just one of thousands in which the Bell System is now engaged to provide additional communication facilities so vital to Army, Navy and defense industries.

AMERICAN TELEPHONE & TELEGRAPH CO. AND ASSOCIATED COMPANIES — BELL SYSTEM

ALUMNI NOTES

by Roy McIntosh, met'42

Civils

CONRAD, CUTHBERT P., '15, who has been chief hydraulic engineer for the Brazilian Traction, Light & Power Co. at Sao Paulo, Brazil, for many years, is now on active duty as Lieut. Commander in the civil engineering corps of the U. S. Naval Reserves at the Bureau of Yards and Docks, Navy Dept., Washington, D. C.

MATTHIAS, FRANK T., '31, one-time editor of the Wisconsin Engineer and formerly instructor in topographic engineering at the University of Wisconsin, is now on active duty as captain, contract authorization, constructing quartermaster, Q. M. General Office, at Washington, D. C.

SOWLS, HOMER T., '31, is assistant civil engineer with the Q. M. corps, U. S. War Dept., at the New River Ordnance Plant at Dublin, Va.

ERICKSEN, FRANK P., '32, has been called to duty as 1st lieutenant on airport construction at Dothan, Ala.

McGUIRE, F. D. '32, is engineer in masonry design on the Panama Canal.

PADDOCK, ROBERT H., '32, has been called to duty as captain in the infantry. He is instructor in the ground school at Kelly Field, Texas.

THRAPP, HARRISON F., '32, is lieutenant in the U. S. Naval Reserve and assistant public works officer at Guantanamo Bay, Cuba.

WHEELER, EARL W., '32, is regional safety engineer for the Soil Conservation Service, with headquarters at Milwaukee.

BORKENHAGEN, EDWARD H., '33, is an assistant civil engineer at the Forest Products Laboratory at Madison, Wis.

KOCH, FRED O., '34, is with Chas. P. Smith of Fond du Lac, as engineer on a flood control project at Portsmouth, Ohio.

HART, WILLARD H., '35, is engineer with the Portland Cement Association at Milwaukee.

HENRY, J. EVERETT, '36, city engineer for Wheeling, W. Va., was called to active duty with the zone construction quartermaster at Columbus, Ohio.

ROHLICH, GERARD A., '36, associate professor of hydraulic engineering at Penn State College, was married on Sept. 8 to Mary Elizabeth Murphy of Janesville, Wis.

SIMANDL, CHARLES J., '36, is on active duty as lieutenant in the 3rd Naval District at New York, N. Y.

VOGEL, RALPH H., '36, is a 1st lieutenant with the constructing quartermaster, Q. M. General Office, Washington, D. C.

DAVY, PHILIP S., '37, is an associate civil engineer with the U. S. Army at Washington, D. C.

DENO, LESLIE J., '37, was caught in the draft and is now at Camp Roberts, Calif., teaching mathematics.

KUTCHERA, DON H., '37, is in the engineering department of the Electric Bond and Share Co., at New York City.

WAGNER, ELDON C., '37, instructor in topographic engineering at the University of Wisconsin, has been called to active duty at 1st lieutenant with Company D, 30th Engineering Battalion. His company is on detached service at Camden, S. C., where Roselyn and Sally have joined him.

EDELSTEIN, ALVIN, '38, is junior engineer with the U. S. Engineers Office at Auburn, Calif.

FAULKES, WILLIAM F., Jr., '41, is now with the U. S. Engineers engaged in laying out airport runways at Oscoda, Mich.

•

Mechanicals

BOARDMAN, CLARK C., '10, manager of the Thermatomic Carbon Co., Sterlington, La., is at present resident manager of the Dixie Ordnance Works.

McLENEGAN, D. W., '21, has recently been advanced to the position of Engineer in Charge of Air Conditioning and Commercial Refrigeration Department, General Electric Co., Bloomfield, N. J.

SHIMANSKI, VICTOR E., '25, is doing sales engineering for the Trane Company, La Crosse, Wis.

•

Miners and Metallurgists

Several of our metallurgical graduates are doing double duty in national defense by teaching the fundamentals of metallurgy to men in industry while at the same time continuing their profession. These men are giving instruction through the facilities of several universities:

HIGGINS. ARTHUR K., MS '32, with Marquette University; **LIBERT, WILLIAM B.,** '35. at East Chicago, Indiana; **GRANGE, HOWARD L.,** '38, at Wayne University; **HARVEY, TOM G.,** MS '39, with Purdue University Extension in Indiana; **HILLE, GUENTHER H.,** '40, U. of Wisconsin Extension at Sheboygan, Wis.

SEVERSON, LLOYD J., '36, formerly at Pulacayo, Bolivia, S. A., is now with the Oliver Mining Co., Hibbing, Minn.

BLACK, ERROLL V., '40, formerly doing metallurgical work at the Belle City Malleable Iron Co., Racine, Wis., is now doing time study and job analysis with the same company.

SWENSON, WILLIAM T., '40, has a new position as mining engineer with the Mountain City Copper Co., Rio Tinto, Nev.

GIESE, WALTER R., '41, and his bride, the former Vera Lippman, SC '41, recently visited the campus.

•

Electricals

KATES, WILLARD A., '21, one time editor of the Wisconsin Engineer, is general sales manager for the Corning Glass Works at Corning, N. Y. He is the author of an article on "Fair Trade Practices" in the July 15 issue of Sales Management.

MARTIN, CLARENCE F., '25, is in the army and at the present is at Fort Jackson, S. C., but expects to be at Camp Forest, Tenn., by the middle of December.

McCOY, ROBERT C., '27, Vice-Pres. of the Bldg. Corp., is temporarily promoting sales of miniature railroad trains in Detroit and Toledo.

HALAMKA, GEORGE L., '34, is now associated with a power plant engineer, redesigning the power facilities of the J. I. Case Co., Racine, Wis.

RUCKS, HAROLD E., '38, formerly with the Carbide and Carbon Chemicals Corp., is now 2nd lieut., 6th Signal company, 6th infantry division U. S. Army, Fort Leonard Wood, Mo.

THORKELSON, LT. WILLIAM L., '39, and Miss Helen Rankin were married in Columbus, Ohio, on June 14, 1941. He is a past editor of the Wisconsin Engineer.

BOON, KENNEL, '40, who is with the Russell Electric Co. of Chicago, married Miss Irene Pesz of Wauconda, Ill., Nov. 15, 1941. They are living at 4322 Kenmore Avenue, Chicago.

HAUVER, G. NELSON, '41, has left the Wisconsin Electric Power Co., to take a position as Inspector of Naval Materials, but will remain in Milwaukee.

KISSINGER, MILAN P., '41, who is with the Westinghouse Electric & Manufacturing Co. has been transferred from Sharon, Pa. to Philadelphia, Pa.

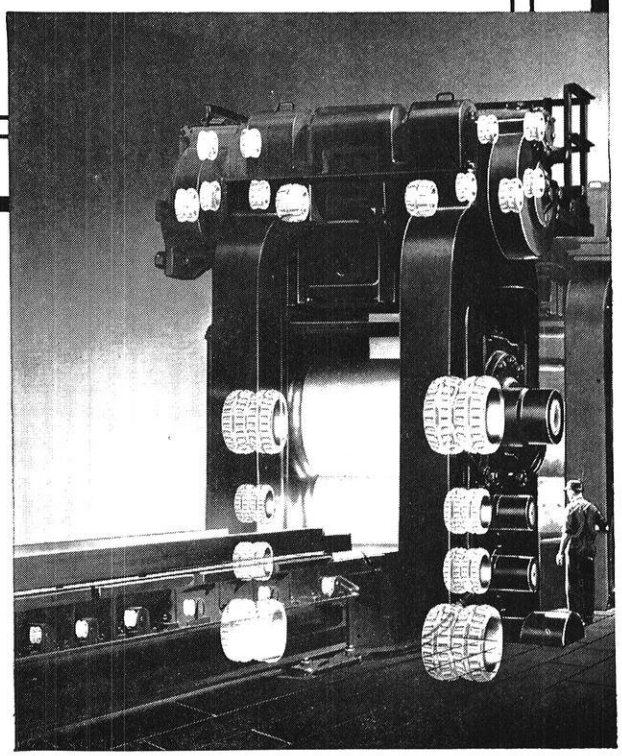
•

Chemicals

CLARK, MANLEY H., '22, of the Southern Countries Gas Co., Los Angeles, presented a report on "Gas Engine Power" for his committee at the

(continued on page 21)

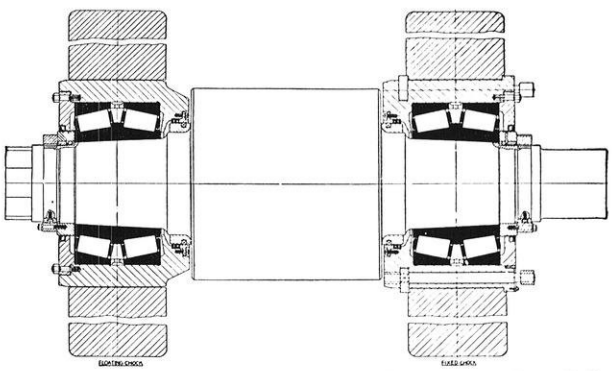
What Bearings would you specify for a Steel Rolling Mill?



Let's assume that you were asked to design a 4-high continuous strip steel rolling mill to operate at a rolling speed of 2,000 feet per minute. What bearings would you select for the necks of the back-up and work rolls?

If you knew your bearings you would specify Timken Roll Neck Bearings. Then you would be sure of smooth mill performance at all speeds; steel rolled true to gauge at all times; simplified lubrication; long bearing life (Timken Roll Neck Bearings hold all records for tonnage rolled); easy roll changing (no delicate parts to handle); fewer involuntary production interruptions.

This is but one of thousands of bearing applications in industrial machinery where Timken Bearings have proved their supremacy. When you have gained a thorough knowledge of Timken Bearings you will be in position to solve any bearing problem you may ever encounter. Write for a copy of the Timken Reference Manual—a valuable text book.



THE TIMKEN ROLLER BEARING COMPANY, CANTON, OHIO

TIMKEN

TRADE-MARK REG. U. S. PAT. OFF.

TAPERED ROLLER BEARINGS

Manufacturers of Timken Tapered Roller Bearings for automobiles, motor trucks, railroad cars and locomotives and all kinds of industrial machinery; Timken Alloy Steels and Carbon and Alloy Seamless Tubing; and Timken Rock Bits.

CAMPUS NOTES

STATE SOCIETY MEETS

The Engineering Society of Wisconsin, composed of practicing engineers throughout the state, held its Fall meeting here at the University the weekend of November 14 and 15. Friday morning E. L. Roettiger, Chief Engineer, Wisconsin Highway Commission, told about present and future highway developments in Wisconsin, and George Martin, Superintendent of the Green Bay Metropolitan Sewerage District, talked on the operation of engines using sewage gases. That afternoon G. C. Wilson, of our faculty and vice president of the ESW, presided as speeches were given on construction for power and water control on the Wisconsin River, the electric power situation in Wisconsin, and engineering in the paper industry. Friday evening Geoffrey Willoughby, Executive Secretary, Wisconsin Council of Defense, enlarged upon the objectives of the Council.

Saturday, with Dean Johnson presiding, a round table discussion of the platting law was led by Ray S. Owen, Wisconsin Professor of Topographical Engineering. Later, the research work of the University was described by various members of the faculty, with emphasis upon the importance of the projects now under way.

•

KHK HOLDS NAT'L CONVENTION

Kappa Eta Kappa, professional electrical engineering fraternity, was host to a national convention Friday and Saturday, November 28 and 29. Fraternity members from Kansas and Minnesota met at the KHK house, 1124 West Johnson street.

Before the convention convened, KHK held their informal initiation, bringing eight neophytes into the organization. Arthur C. Lytle, Dan Ault, Jack Hamilton, James Maloney, Warren Apker, Mike Larson, Nels Larson, and Bob Crawford showed definite ability in completing quests and capturing cats. The formal initiation banquet was held November 28 at the Loraine Hotel with new members, actives, and a good number of alumni present.

STAFF MEMBERS INVADE URBANA

Bright and early Friday morning, six sleepy staff members of the Wisconsin Engineer left Madison for the annual convention of the Engineering College Magazines Associated at Urbana, Illinois, on the campus of the University of Illinois. The ECMA has twenty-eight member publications from Washington State to Georgia Tech, most of whom were represented at the two-day convention.

Wisconsin delegates were Homer Schneider, editor; Harvey Schlintz, business manager; Jack Erwin, associate editor; Jerome Baird, editorial assistant; Herbert Blocki, feature editor; and Carl Wulff, circulation manager. Eating up the miles and the nation's petroleum resources in a seven passenger Packard of doubtful vintage, Wisconsin's determined little group ploughed through fowl feathers and the La Salle police force (cuss him seven bucks' worth for us) to arrive at the new Illinois Union building Friday noon. The Illinois Technograph was host to the convention there.

The object of the ECMA is to develop better engineering college magazines, an object which the present staff is working overtime to realize. The sessions of the meeting were spent in discussing magazine problems. It was of interest to note that the Wisconsin Engineer was one of the few magazines not supported on the fee basis.

This magazine won first place for its alumni section and honorable mentions for its cover and best individual student article. These awards were made by the ECMA critic and new president, Robert Taylor, for the eight issues of last year. The Michigan Technic won the coveted award as the best all-around magazine for the last year's issues. But just watch us at the next convention at Purdue in 1942!

ENGINEER'S HOP

Putting away their slide rules and monkey wrenches for a day, the engine school swung out in traditional style at Polygon's annual Engineer's Hop, 207 couples strong. Confetti, serpentines, hats, horns and balloons made complete the unique "Preview of New Year" theme as conceived and executed by Fred Thoke, M & ME 4. Society exhibited machines of the Rube Goldberg variety intrigued the crowd in periods of comparative inactivity while the appropriate music and novelties of Ralph Miller and Orchestra inspired jitterbugs and common folk alike.

Professors M. O. Withey and R. R. Benedict, acting as chaperones and judges of the society exhibits, awarded first place to the A.I.Ch.E. gadget which lighted cigarettes and cigars with apparent ease. The exhibit of A.I.C.E. received an honorable mention. Acting on the basis that a good Rube Goldberg machine must accomplish relatively nothing by the expedient of many complicated motions and apparatus, the judges selected the chemical engineers' entry because it was the best example of wasted motion and energy. The cigar lighter was started by applying a flame to a thermocouple which activated a few relays, a P-H meter, a solinoid, a dozen switches, a fan and a sail boat before finally closing a circuit containing an electric cigar lighter.

•

AIEE

Scheduled Events

Monday, December 15 — General Electric "House of Magic."

Wednesday, January 7 — "Engineers Against Time, or The Job Ahead" by Col. James L. Walsh. Joint meeting with Madison Section.

Thursday, January 15—Presentation of student technical papers.

Polygon Board

Polygon Board wishes to announce to the societies, that elections of representatives to the Board are to be held at the end of this semester. Each board member is elected at the end of the first semester of the junior year and serves for the remaining three semesters. In this way, the board is composed of six members the first semester and of twelve members the second semester of each year.

The junior members on the board serve for one semester on committees headed by the senior members. The election of officers and the selection of committees for the coming year are then made in the last meeting in the spring. The offices and committees are President, Secetary, Treasurer, Program Chairman, Publicity Chairman and Tickets Chairman.

•

Suggestions Needed

In following up on the ideas presented in the last issue of the Wisconsin Engineer and a few others which have come to our attention, the Polygon Board intends to form some program of action for next spring. The suggestions offered to date have given the board a wide variety of activities from which to make a decision. We feel, however, that a decision as to what the Engineering College should do this year should not rest entirely upon the six men that comprise the board but also upon those men in the societies who are also vitally interested in the problem. In view of this opinion, Polygon Board intends to draw up some feasible plan of action and present it before the officers of all engineering organizations sometime before Christmas vacation. All others interested are, of course, invited to this meeting and we hope that some definite program can be decided upon at this time.

Henry Schmalz,
President, Polygon Board

Alumni Notes...

(continued from page 18)

American Gas Association's convention held at Atlantic City in November.

DREW, EVERETT G., '22 and his partner Mr. Hoffman, sales representatives for two companies, the Foster-Wheeler corporation and the J. O. Ross Engineering Co., have relocated their office and are now at 809 N. E. Lombard Street, Portland, Oregon.

PESCH, A. W., '22, has been with the Southern Kraft Division of the International Paper Company for several years. At present, he is mill manager of the Georgetown, S. C. plant.

BERRY, GRAFTON, '34, has charge of the ink department in the printing plant of the Daniels Mfg. Co., Rhinelander, Wis.

EASTWOOD, EUGENE L., '35, passed away May 2, 1941. At the time of his death he was employed as an engineer at the Ingersoll Milling Machine Co. of Rockford, Ill.

TOCK, WILFRED, '35, has recently joined the engineering force of the Allis-Chalmers Mfg. Co. in the crushing and cement machinery department.

LANFORD, HERBERT, '38, and Mary M. Ramage, B.S. '38, were married July 14, 1941. Herbert is now with the du Pont de Niemours in the powder division. Although his work requires considerable traveling, they are making their home in Kankakee, Ill.

HONOR SOCIETIES . . .

(continued from page 15)

Electric Company and returns to work there each summer. He is entirely self-supporting and maintains membership in ASME, Pi Mu Epsilon, Phi Eta Sigma, Evans Professional Group, and Tau Beta Pi. He is vice president of Triangle and president of Pi Tau Sigma. Bob also has WARF undergraduate assistantship. Bob believes "that it is a great advantage to have had practical experience before coming to school and that Wisconsin is a good school." And Bob has seen enough men and schools to know.

THIS FALL'S INITIATES

TAU BETA PI
- Robert Bosser
- John Elliott
- Lester Elmergreen
- Willard Gehrke
- Paul Hoffman
- Harry Hummel
- Reuben Imm
- Anthony Koehne
- Roger Lescohier
- Carl Lufter
- Lawrence Millonig
- Frank Morley
- Leonard Nussbaum
- Roger Peters
- Charles Phillips
- Melvin Ree
- Joseph Ranftl
- Homer Schneider
- Robert Thomasgard
- Clifford Tice, Jr.
- Donald Uecker
- William Wright

CHI EPSILON
- John Elliott
- Robert Munson
- Roger Peters
- Sol Resnick
- Jesse Saemann

ETA KAPPA NU
- Elwood Carter
- Neil Davis
- Paul Fischer
- Bernard Hansen
- Joe House
- Jack Lower
- Robert Miller
- Victor Richard
- Norbert Schmitz
- Ju-gee Sheng
- Leon Smith
- Theodore Tveit
- Blake Wheeler

PI TAU SIGMA
- Lyle Brehm
- Robert Daane
- Hugh Faville
- William Feireisen
- Henry Geisler
- Wallace Huebner
- Earl Kleinmann
- Donald Livermore
- Aldon Lokken

HIGHWAY CONSTRUCTION . . .

(continued from page 7)

situation. In the city of Menominee a bridge had approaches which included, in addition to a generally snaky road, three sharp right angle turns and one horseshoe turn. The bridge as it stood was built over a power development, which had already caused some complications. In order to straighten the approaches it was necessary to relocate the bridge, but because of mills serviced by the old bridge, it was necessary to maintain the old bridge. The picture shows the old bridge and the abutments for the new one. A new truss was designed and the new span cut right over the old bridge. The total cost was $292,000, and the job was handled by L. G. Arnold.

On these jobs and many others throughout the state were students from the Civil Engineering School of Wisconsin, working as surveyors and inspectors, and gaining, in addition to funds for the following year, valuable experience under job conditions. About forty juniors and seniors were employed last year, with several represented in each of the eleven districts.

(We wish to acknowledge the help and cooperation of William P. Ward, an engineer in the State Construction Department.)

•

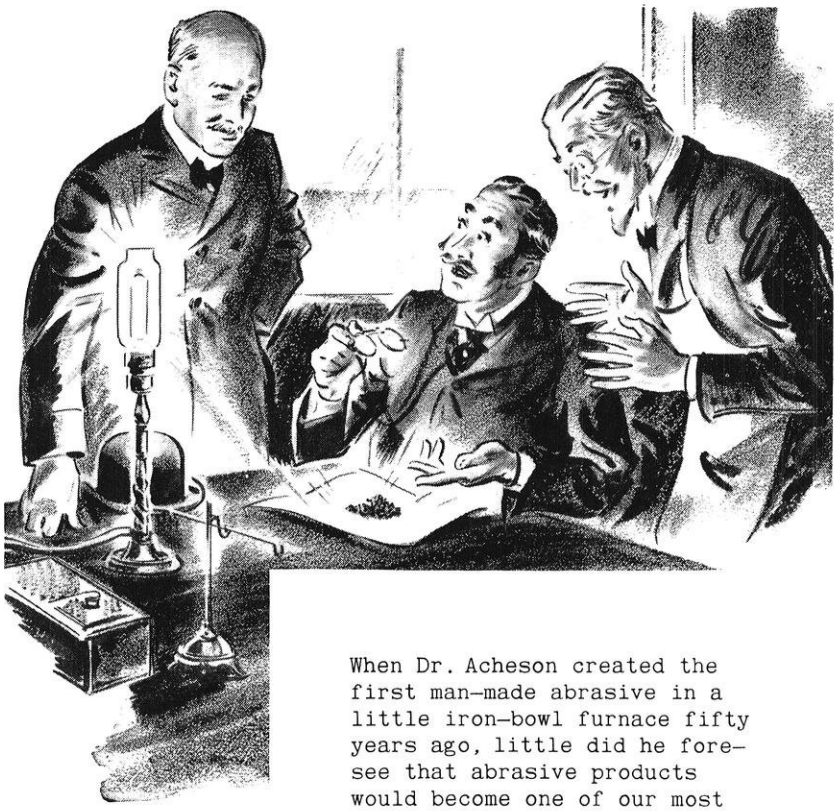
Once upon a time, so the story goes, the fence broke down between Heaven and Hell. St. Peter appeared at the broken section of the fence and called out to the devil: "Hey, Satan," he said, "since all the engineers are over in your place, how about getting them to fix this broken fence?"

"Sorry," replied Satan, "my men are all too busy to go about fixing measly fences."

"Well, then," replied St. Peter, "I'll have to sue you if you don't."

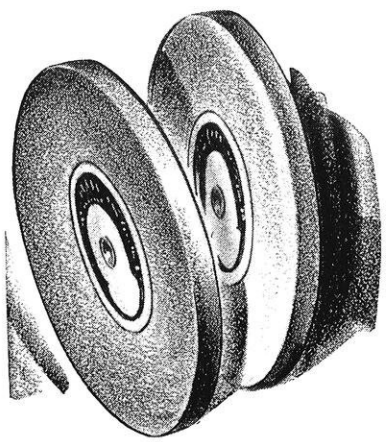
"Oh, yeah," chortled the devil, "where you goin' to get a lawyer?"

Was $880.00 a pound...NOW 16¢!



"You really made these crystals in an electric furnace?" the gem expert asked. "They look as if they'd been in the earth a million years!" "Certainly I made them", said Dr. Acheson. "And all I ask is that you crush them and try them instead of diamond dust for gem polishing." The expert did...and placed an order at $880 a pound! Today this same Carborundum Brand Silicon Carbide serves all industry, sells in grain form for as little as 16¢ a pound.

When Dr. Acheson created the first man-made abrasive in a little iron-bowl furnace fifty years ago, little did he foresee that abrasive products would become one of our most important production tools... that one day they would be used in the grinding, finishing, shaping and polishing of practically all the products of all industry.



Today, our outstanding research, manufacturing and engineering facilities are ready to serve you no matter what industry you may decide to go into. The Carborundum Company, Niagara Falls, New York.

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ABRASIVE PRODUCTS
50 YEARS OF SERVICE
TO ALL INDUSTRY

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WHAT'S YOUR I.Q.?

1. Assume that you are at a hunting lodge. You walk three miles due south, and shoot a bear. Leaving him there, you walk five miles due west. On reaching this location you find that you are only three miles from your lodge. What color is the bear?

2. Assume the diameter of the earth to be 8,000 miles. You have a cord stretched around the earth at the equator. You wish to increase the length of the string enough to have the cord one foot away from the earth at all places. How much should the length of the string be increased?

3. A man gives you a dollar and asks for fifty coins. What would you give him? (No cheating.)

4. A canal runs over a bridge, and at a certain time the weight of water on the bridge is two thousand pounds. If at the same time a boat weighing one thousand pounds is put on the bridge, what is the total weight on the bridge?

5. You have a boat with sides one foot above the water. A ladder is hanging over the sides and protrudes 8 inches into the water. If the tide rises six inches, how far is the ladder in the water?

(Answers on Page 28)

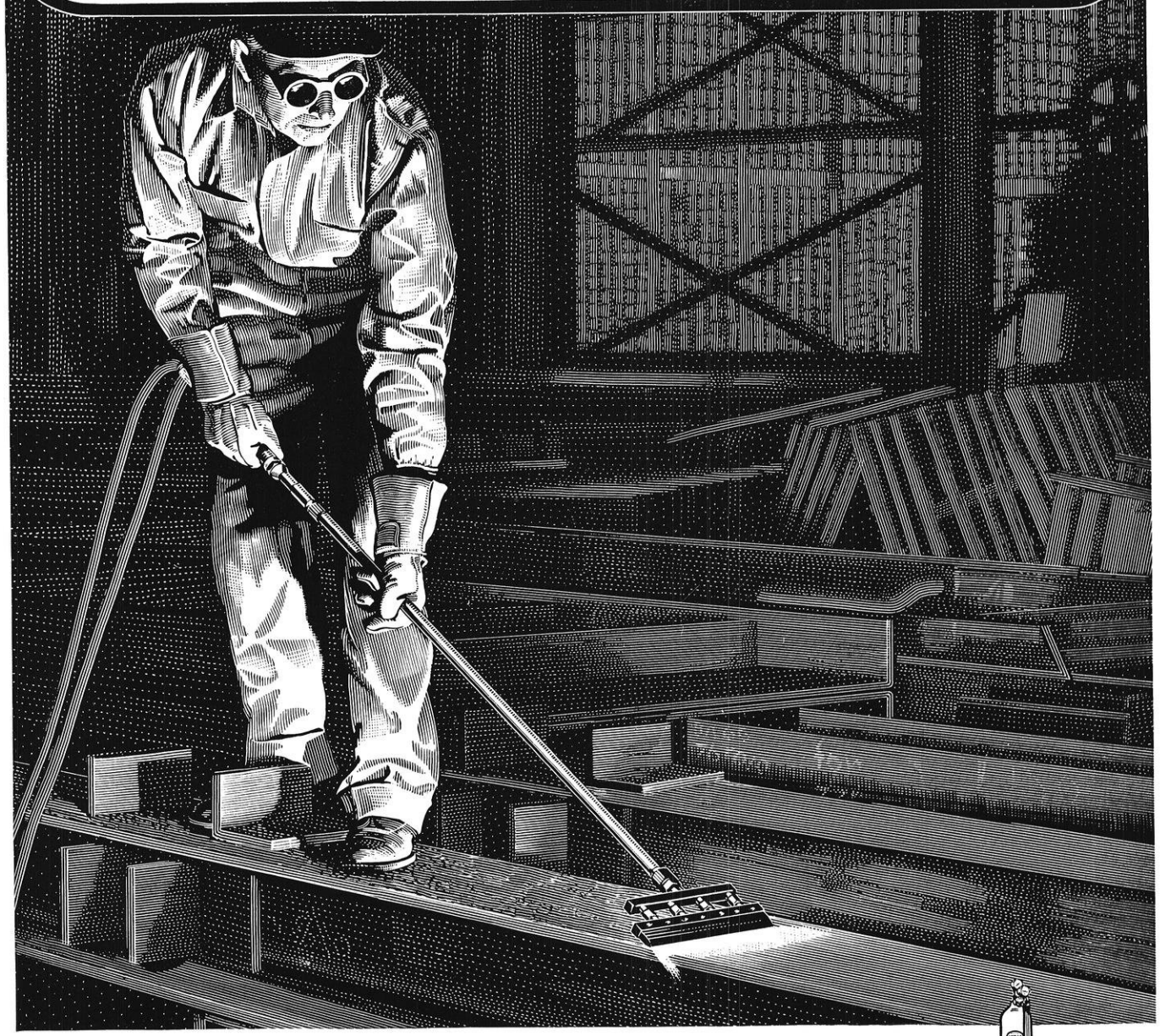
• • •

Dentist: Open wide, please, wider, just a little more, please, there, that's fine.

Patient: Ah-h-h, ur-r-r, glug.

Dentist (inserting rubber gag, sponge, towel, drill and four fingers): How's your family?

SWEEPING STEEL WITH A BROOM OF FLAME



SWEEPING over metal structures and structural parts this modern broom of fire prepares metal surfaces for a long-lasting, protective coat of paint. It is the Airco Flame Cleaning Process and removes rust and scale and dehydrates metal surfaces as it cleans. It provides a warm, dry surface conducive to a lasting paint job and assuring a faster one. Flame cleaning is the most effective method yet devised to prepare metal surfaces, new and old, for painting and repainting. Ultimate maintenance costs are lower.

Versatile is the oxyacetylene flame. It provides better and faster ways of making machines, engines, ships and tanks by shaping thin steel plates or heavy slab forgings and structures with economical ease and with a high degree of accuracy. The oxyacetylene flame hardens steel to any desired degree and depth. It softens steel, or bends it, or straightens it. It removes scale from billets, castings and forgings.

Possibly you are interested in learning more about the machines and apparatus which harness the Airco oxyacetylene flame and put it to work in so many different ways. If so, write for a copy of the pictorial review "Airco in the News" to the Airco Public Relations Department, Room 1656, 60 East 42nd Street, New York, N. Y.

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ANYTHING AND EVERYTHING FOR GAS WELDING OR CUTTING AND ARC WELDING

Our Present . . .

STATIC

. . . To You

(This is the third in a series of articles introducing prominent personalities in the College of Engineering.)

New faculty member? (We wish.) A student? Impossible! He's just a visitor from the far north—the man we've been waiting for all semester. He has come with a little message for us—the message which appears on his Christmas cards this year.

"The holiday is almost here,
And now to every engineer
A Merry Christmas is my call,
And Happy New Year to you all.
Reports and grades you need not fear,
'Cause Sandy Claws is an engineer."

• • •

It was a tense moment, then suddenly Lindy saw one wing disappear, and his face went white. Immediately the other wing disappeared and he grew frantic. He returned to normal, however, as someone passed him a drumstick.

•

Judge: Have you come to a decision?

Jury Foreman: The jury is all of the same mind—temporarily insane.

HERE'S MORE STATIC . . .

"Good morning, madam. I'm the census-taker and desire a little information."

"Well, young man, what will it be?"

"How many in your family?"

"Five," she snapped, "me, the old man, the kid, the cow, and the cat."

"Any politics in your family?"

"Mixed. I'm a Republican, the old man's a Democrat, the kid's wet, the cow's dry, and the cat's a Mormon."

•

"I hear your son's at college."

"Yep."

"How's he doing?"

"Pretty good, I guess; he's taking three courses. I've just paid out ten dollars for Latin, ten dollars for Greek, and a hundred dollars for Scotch."

•

MORE STATISTICS

Population of the United States	131,000,000
Eligible for Old Age Pensions	33,000,000
Left to do the work	98,000,000
Federal clerks and employees	24,000,000
Left to do the work	74,000,000
Ineligible because of child labor laws	60,000,000
Left to do the work	14,000,000
Unemployed, per Federal Census	13,999,998
Left to do the work	2

That must be Santa Claus and me; he's still at the North Pole and I'm getting tired—very tired.

•

A recession is a period in which you tighten up your belt.

A depression is a time in which you have no belt to tighten.

When you have no pants to hold up it's a panic.

•

Little Johnnie had torn his trousers twice in the course of one morning, and when he came in with his pants torn again his mother said: "You go right upstairs, remove your pants, and mend them yourself."

Some time later, she thought of him and went upstairs to see how he was getting on. The torn pants were lying on a chair, but there was no sign of Johnnie. Returning downstairs, she heard a noise in the cellar and decided that he was down there playing. "Are you down there running around without your trousers on?" she called loudly.

"No, madam, I'm just reading the gas meter," a deep voice answered.

•

"William, get your father's hat out of the mud-puddle."

"I can't, Maw, he's got it strapped under his chin."

(continued on page 28)

A LITTLE MORE STATIC . . .

A young man dashed into a telegraph office, scribbled a message, handed it to the clerk, and dashed madly out and down the street. The clerk read the message, "May had twins today, more tomorrow."

•

"It's nice to kiss in a shady parking place, but the boy friend doesn't stop there."

"You mean . . . "

"Yes, he keeps right on driving."

•

A cute little trick from St. Paul
Wore a "newspaper dress" to a ball.
The dress caught fire
And burned her entire
Front page, sporting section, and all.

•

Numyet, the Eskimo, was sitting on a cake of ice telling a story. He finished and got up.

"My tale is told," he said.

•

WHAT'S YOUR I.Q.?

Answers:

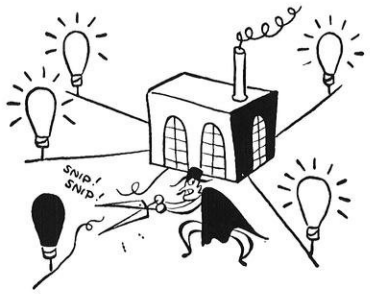
1. White, since the lodge would be at the North Pole.
2. 2 Pi feet.
3. 40 pennies, 2 dimes, and 8 nickels.
4. 2,000 pounds.
5. 8 inches.

When power must not fail!

How a Westinghouse Distribution System Foils Lightning, Accidents, and Saboteurs

BEHIND America's urgent defense production, stands electric power. It runs the machines that turn out the weapons for the defense of America. It must not fail, must not even falter.

In the first World War, this vital power could be cut off, and cut off easily . . . by saboteurs, by accidents, or by lightning.



▶ For, in those days, the *only* means of distributing electricity was through *radial* systems, in which the power lines radiated like the spokes of a wheel with the power station as the hub. So, if *any part* of a power line were damaged, no electricity could be delivered to users *all along the line.*

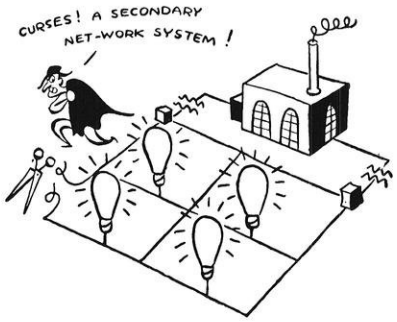
No way was known to reduce the vulnerability of power distribution until the early '20's, when engineers of a large power company conceived the idea of the *secondary network system.*

▶ The idea was to connect low voltage secondary lines in a *network*, with the main power (primary) lines joined to the network at several places. Thus, with power being sent along several different routes, a line could be damaged and electricity would continue to flow to its users along the other routes.

It was a great idea . . . if it could be made to work on large and complicated city systems. That was the problem, a problem which the power company brought to Westinghouse engineers.

▶ The secondary network system wouldn't work at all until some pump-proof method was found to keep power from flowing backwards into a damaged section of the line. Westinghouse engineer John S. Parsons (a member of Georgia Tech's class of '21, a graduate of the Westinghouse Training Course, and the holder of 30 of the 150 patents on secondary networks) found the way . . . a pump-proof relay which, when power is flowing in the wrong direction, closes its contacts and causes a network protector (automatic air circuit breaker) to trip and cut the feeder off the line.

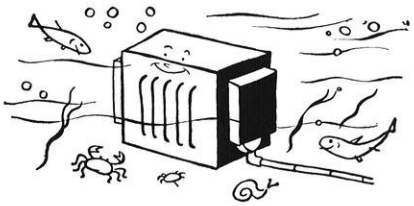
Then, there was the question of where to put the transformers, relays, and protectors that secondary networks needed. The amount of space this equipment would take up would be tremendously expensive in crowded cities.



▶ The obvious way to overcome this obstacle was to put this secondary network equipment underground. But transformers, relays, and protectors wouldn't perform properly in damp underground atmosphere. Westinghouse engineers went to work and developed a transformer-relay-protector unit that could fight off dampness and perform as well underground as above ground! Now, there are network units that do their job even though submerged under salt water, twice a day!

To make doubly sure that they had the space problem licked, Westinghouse engineers cut down the size and stepped up the power capacity of these network units. They made it possible for a unit that was one-third smaller to do the same electrical jobs!

▶ Secondary networks raised all sorts of new problems. And Westinghouse engineers had to find a lot of new answers before they were able to bring secondary networks from an idea to a working distribution system.



Today, Westinghouse engineers have brought secondary network systems to 164 cities. They've adapted these systems to the specialized needs of defense plants, army camps, airports, and power houses. Their work has contributed tremendously to today's ability to distribute unfailing electric power . . . despite lightning, accidents, and sabotage.

★ ★ ★

▶ This story illustrates how Westinghouse engineers work. More than that, it shows how the Westinghouse Company works. For there are 1,500 engineers in Westinghouse . . . in service, in management, in design, in sales, in every single branch of the business. These engineers give the company its point of view.

Westinghouse takes pride in the engineering behind its products. Its engineers are always analyzing its products, working over them, making them better. It has the engineer's impatience with the old and his eagerness to create the new.

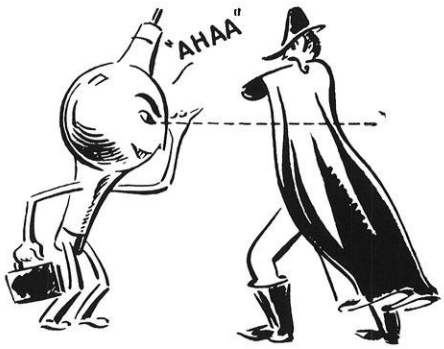
▶ Engineers founded and built Westinghouse. Engineers will carry it on.

WESTINGHOUSE

Westinghouse

Westinghouse Electric and Manufacturing Co., Pittsburgh, Pa.

G-E Campus News



SUPER-PEEKSTER

EVEN when our defense "Sherlocks" can't, x-rays *can* "see right through" potential saboteurs and their hidden bits of destruction.

Without unwrapping or any dangerous tampering, suspicious packages may be inspected quickly and safely. Portable x-ray equipment is also used for fluoroscopic examination of overstuffed furniture, mattresses, or other articles in which questionable items might be hidden.

The x-ray has been instrumental in unearthing such things as a hypodermic needle and some narcotics cleverly hidden in a woman's handbag, a revolver baked in a loaf of bread, or hacksaw blades concealed in a cake of soap.

CURVES OF COLOR

THE most expert human eye can distinguish about 100,000 different colors, but that's practically color-blindness compared to the 2,000,000 that the G-E color analyzer can detect. The color analyzer can even measure your lady friend's blush, provided she holds it for two and a half minutes, and then, it will record it on paper for future reference!

The recording photoelectric spectrophotometer (that's the color analyzer's name) is only one of the things you can see in action in one of G.E's newest movies, "Curves of Color." This film, in full color, gives a 10-minute story of the world of color, telling why accurate color recognition is of such great importance to man and industry.

"Curves of Color" (16mm, sound) is purely educational and will gladly be lent to organized groups without any charge but the transportation costs. If you would like to show it at one of your dinners or club gatherings, just drop a line to Campus News, Dept. 318-6, General Electric Company, Schenectady, N. Y.

HOT DOGS AND COLD DIPS

THE strip mine of the Truax-Traer Coal Company in Fiatt, Illinois, hasn't actually been invaded by picnickers (yet) who want to cook hot dogs in the dipper of the big, 30-yard stripping shovel there, but it's an idea! Hot plates have been installed in the dipper, and Calrod heating elements have been put in the dipper handle.

The purpose of these heaters is not, however, to provide an extra service for possible picnickers, but to keep mud from freezing to the sides and bottom of the dipper. This used to reduce payload 50 per cent or more, and bonfires and a shutdown of 30 minutes to an hour were necessary to thaw out the frozen mass.

GENERAL ELECTRIC

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