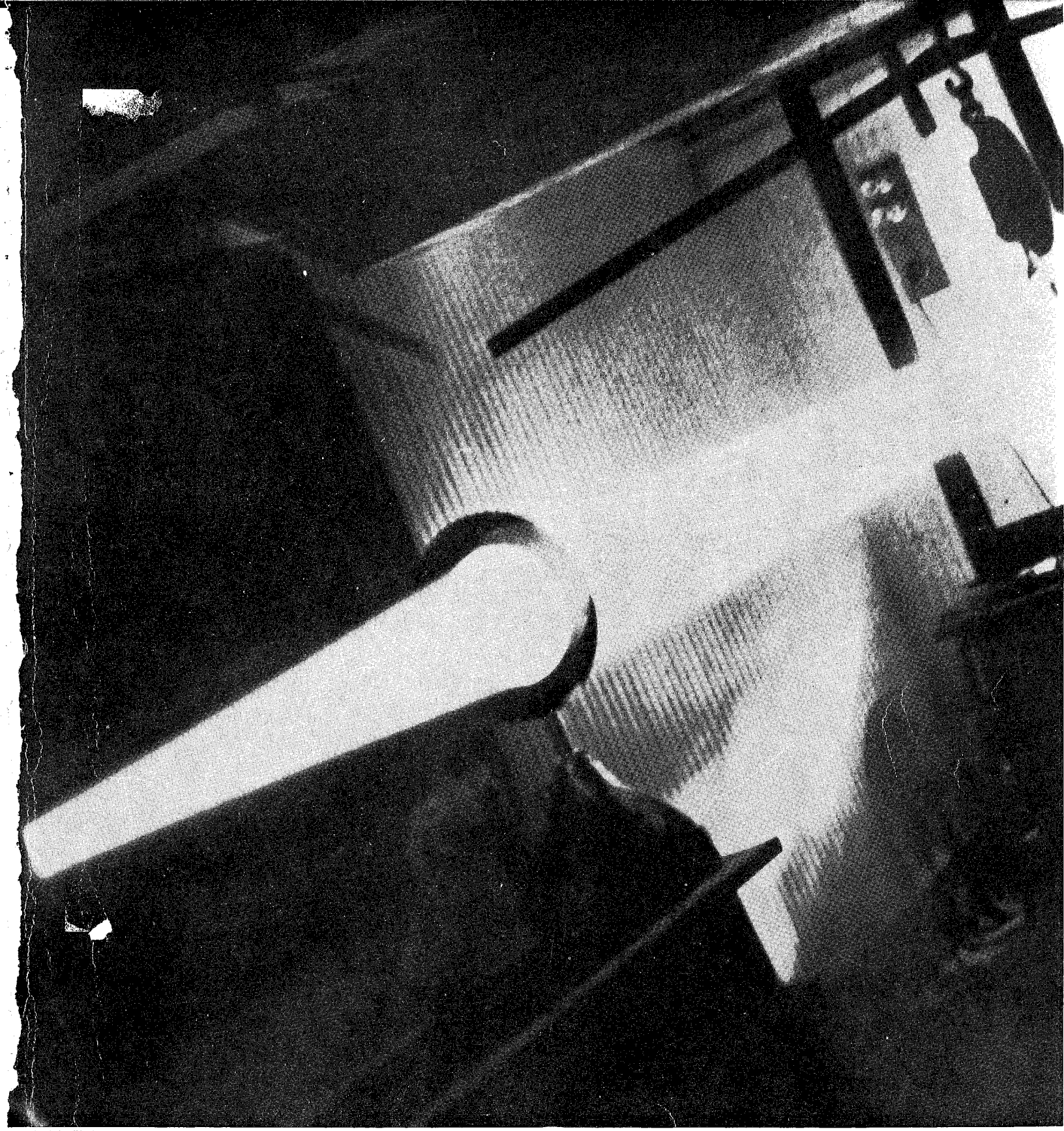

MINNESOTA TECHNO-LOG

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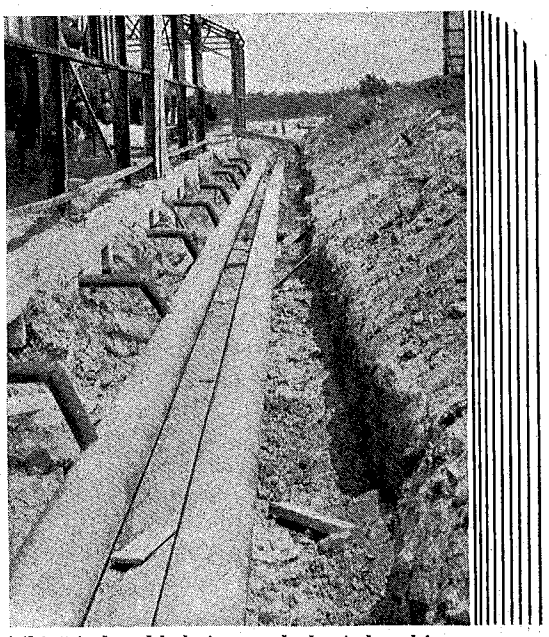
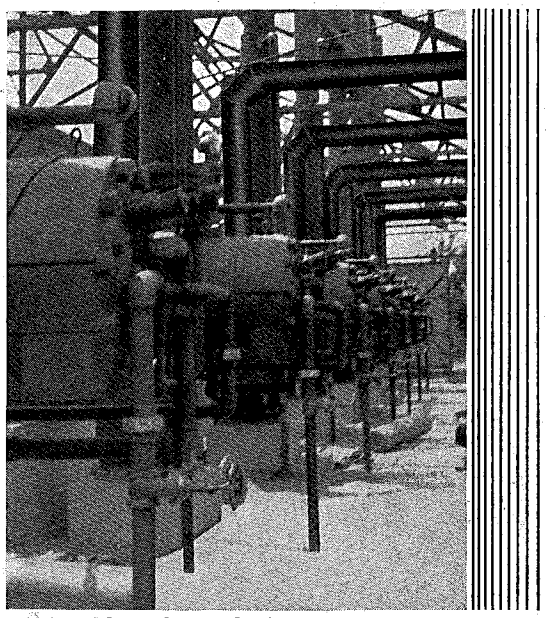
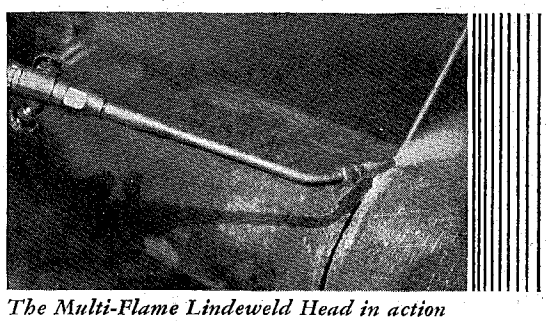


This Lindewelded pipe can be buried and forgotten



Lindewelding also can be done on vertical and overhead lines



The Multi-Flame Lindeweld Head in action

80-MILE PIPING SYSTEM FOR GASOLINE PLANT *Lindewelded**

● The construction of an East Texas gasoline plant required approximately 80 miles of welded pipe. The piping system included gathering lines from over 1000 wells. It involved straight line runs, headers, bull-plugs, bends, angles and other specials. Pipe size ranged from 3-in. to 26-in. diameter—5/32-in. to 7/16-in. wall.

The Lindeweld method of oxy-acetylene welding was selected for this project after competitive tests with other types of pipe joints. The company found Lindewelding produced dependably uniform results, cost less, and could be done in less time.

The entire system was tested under pressure. Many of the welding operators had not used Lindewelding previously. Yet the company's engineers reported they did not find a single defective weld.

Lindewelding was brought to this project as a part of Linde Process Service, which is regularly available to Linde Customers—without charge. Linde Offices will gladly give you complete details on Lindewelding. They are located in Atlanta—Baltimore, Birmingham, Boston, Buffalo, Butte—Chicago, Cleveland—Dallas, Denver, Detroit—El Paso—Houston—Indianapolis—Kansas City—Los Angeles—Memphis, Milwaukee, Minneapolis—New Orleans, New York—Philadelphia, Phoenix, Pittsburgh, Portland, Ore.—St. Louis, Salt Lake City, San Francisco, Seattle, Spokane and Tulsa. The Linde Air Products Company, Unit of Union Carbide and Carbon Corporation.

* Lindewelding is a new method of oxy-acetylene welding developed by the Linde engineering and research organizations. This method requires less oxygen, less acetylene and less welding rod. Welds can be completed in less time. Yet Lindewelding involves only a special flame adjustment and a "back-hand" technique, together with Oxweld No. 24 Lindeweld Process Welding Rod. When circumstances permit, the Multi-Flame Lindeweld Head can be used. This will further increase the speed of Lindewelding. It costs only $7.75. On pipe line construction Lindewelding is consistently saving 15 to 40 per cent in welding time, rods and gases.

Everything for Oxy-Acetylene Welding and Cutting

LINDE OXYGEN • PREST-O-LITE ACETYLENE • OXWELD APPARATUS AND SUPPLIES

FROM PRODUCTS OF UNITS OF UCC UNION CARBIDE AND CARBON CORPORATION LINDE UNION CARBIDE

MINNESOTA Techno-Log

37 ELECTRICAL BUILDING
UNIVERSITY OF MINNESOTA, MINNEAPOLIS

OCTOBER, 1935

WAYNE STONE
MANAGING EDITOR

ROBERT DIXON
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Page

PHOTOELASTIC POLARISCOPE..... .....*Cover*
STRATOCAMP..... *Frontispiece*
POLARISCOPE PICTURES STRESSES..... 3
UP, UP, AND UP..... 6
A BATH TO THE FINNISH..... 9
EDITORIAL 10
SLIPSTIX 12
HAGA-ZINES 13
ALUMNOTES 14
BLOWBY AND TEAR DROP CARS..... 16
UNIVERSITY FASHIONS 16
CAMPUS NEWS 20
MENTAL TILTS 23

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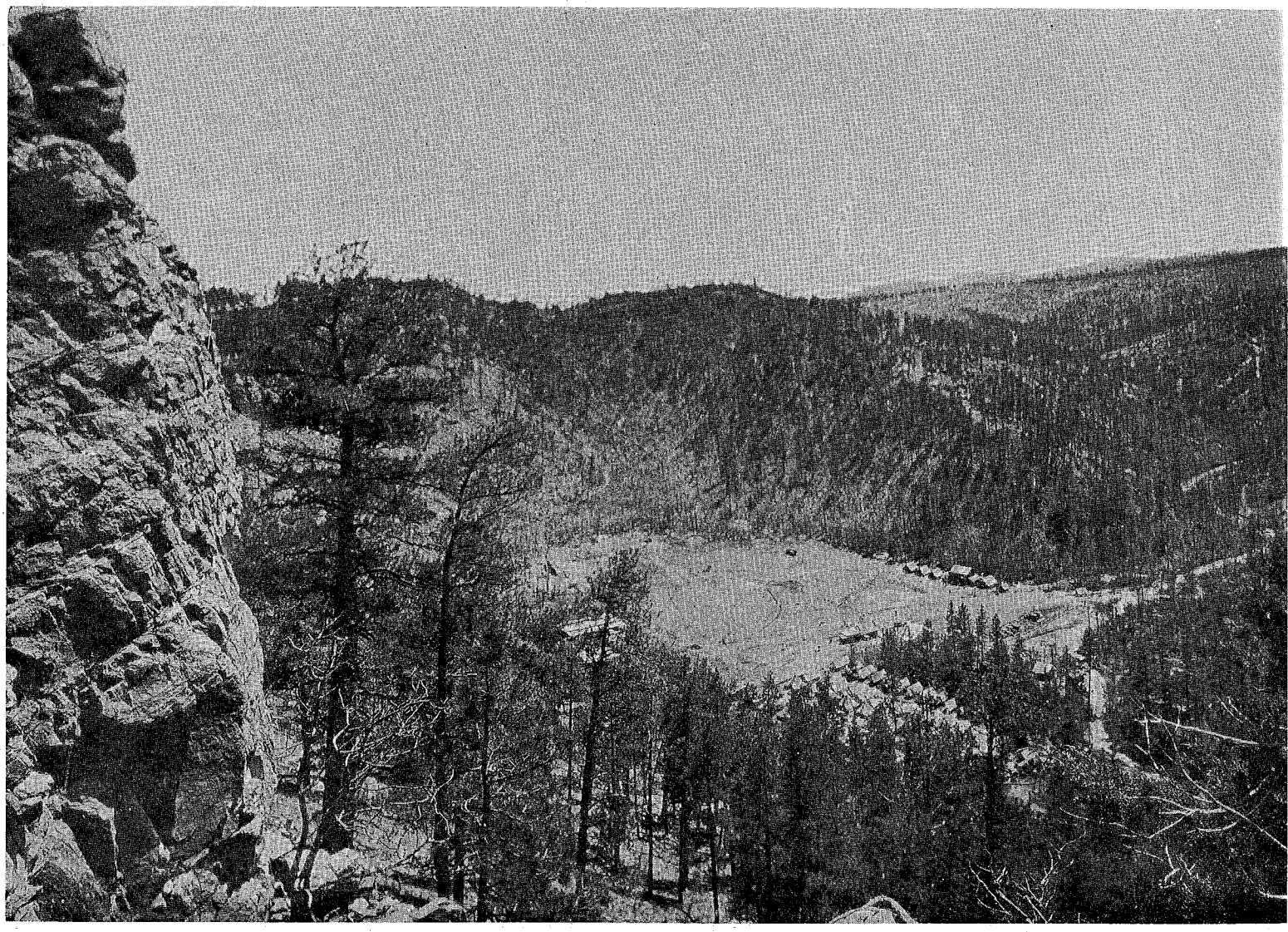


stratocamp

Polariscope Pictures Stresses

in new m. e. lab.

By James J. Ryan
Professor of Mechanical Engineering

OVER in the Mechanical Engineering Department, in the basement directly under the main office, a new type of laboratory is rapidly assuming dimensions and importance for recognition as a full-fleged member of the University family of laboratories. It is a small scale industrial research laboratory, an outgrowth of attempts to design and build apparatus through the conversion of the elements of advanced theory into the practical applications of every-day usefulness. Few educational institutions have machine design laboratories in mechanical engineering for demonstrating and investigating the advanced problems which are commonly encountered in present-day design. It is hoped that, in the future, men and data will be available for the solution of some of the complex problems in industry ahead of this demand.

A recent survey made by the American Society of Mechanical Engineers points out that 40% of its membership are engaged in occupations classified generally as design and research. The advances made in every other branch of engineering during recent years indicate similar trends. Of immediate moment is the special demand in industry for young men having advanced training in the fundamentals of design and research. Educational work of this nature has been greatly curtailed during the past few years in the major industries, and the opportunity presents itself for colleges and universities to develop high grade men for immediate usefulness. This development in design and research, however, must remain fundamental, encompassing generalities that are broadening and comprehensive, no matter what the field of engineering or what subdivision of that field.

At the present time, mechanical engineers are particularly interested in three phases of the construction of machines that have received considerable attention in the past few years. These three may be summed up to be: the study of the stresses in machine structures; the application of the fundamentals of vibration in the design and operation of machines; and the application of the theory of lubrication.

Each of these phases contain many factors which may be subjected to substantial investigation. It requires very little ingenuity to discover elements of machine construction where stresses are now calculated with an accuracy of 50% or less. The general introduction of new instruments to measure complex stresses will enable a larger number of investigators to study these problems. More vibration difficulties are being encountered every day than the men, versed in such problems, can hope to solve. One of the oldest mathematical theories in engineering, that involving lubrication, is the least understood and applied. It is hoped that these conditions do not exist in other fields of engineering, but the importance of investigations in this particular field should not be under-estimated.

The machine design laboratory has been developed for the purpose of continuing research in the application of these fundamental problems, and for demonstrating the fundamental principles involved in complex theory by means of simple, practical models and apparatus.

The laboratory may be briefly described by discussing the apparatus that has been assembled for doing the work outlined above. In the study of the stresses in machine structures, the correlation of the theoretical stresses with those actually encountered in the structure is obtained by means of working models. A machine has been developed in which a transparent model of a stressed element may be analyzed to determine the stresses at critical points. This machine, a photoelastic polariscope, operates on the

principle that a polarized beam of light in passing through a transparent plate under stress is resolved into two components whose velocities are proportional to the principal stresses in the plate. These components are then recombined, but, because of their different velocities while traversing the plate, are more or less out of phase, and therefore establish interference. Thus interference bands will indicate lines where similar stress conditions exist. If a light source having a single wave length is used, such as a mercury vapor arc, the interference bands will be black and white. However, by using white light, a succession of colored fringes will appear in the order of yellow, red, and green, presenting a multicolored rainbow appearance. These bands or fringes may be observed on a screen or photographed on a camera film.

The pictures of stress distribution obtained by means of the photoelastic polariscope are particularly useful for studying the effects of stress concentration, as at fillets, and small holes in models. Under this condition, one principal stress is usually much greater than the other, and the analysis is relatively simple. However, at points where the two principal stresses are comparable in value, and shear stresses also exist, the photoelastic bands or fringes are then a function of the difference of the principal stresses. In order to determine their individual values, one method is to measure the change of thickness of the model at the stressed point, which is proportional to the sum of the principal stresses, and to solve algebraically for the values from the numerical sum, and the difference previously obtained. The directions or angles at which the principal stresses occur in the model are also of great importance, although they are readily found by adjusting the prisms and photographing the resultant fringes.

The field of polarized light in which the transparent model is placed is seven inches in diameter, making this machine as large as any in use in this country. It is about eighteen feet long, and the optical system is mounted on lathe beds placed on concrete piers. The white light source is a 500-watt incandescent lamp. A water cell prevents the intense heat of the projected light from injuring the optical system. The light is polarized by means of a Nicol prism, and the condition of interference is brought about by an identical prism. A permanent camera takes full-scale photographs of the stress patterns set up in the model.

The transparent material used in the models is either Bakelite or Marblette. The Bakelite for this purpose was developed several years ago in preference to celluloid, and in an annealed state is ideal for this purpose. Annealing, however, is required every time the model is machined or subjected to high stresses. The Marblette is a new phenol product, and was developed for photoelastic work in conjunction with the Columbia University laboratories. It does not require annealing, and is several times more optically sensitive to stress variation than Bakelite.

Portrait panchromatic films are preferred to orthochromatic to obtain equality of the color range with white light. Timing is extremely important, for the light intensity with white light requires an exposure of about 1/50 second, and the monochromatic mercury vapor light about two seconds. Color photographs may easily be obtained, and moving pictures of dynamic stress conditions will soon be available for analysis.

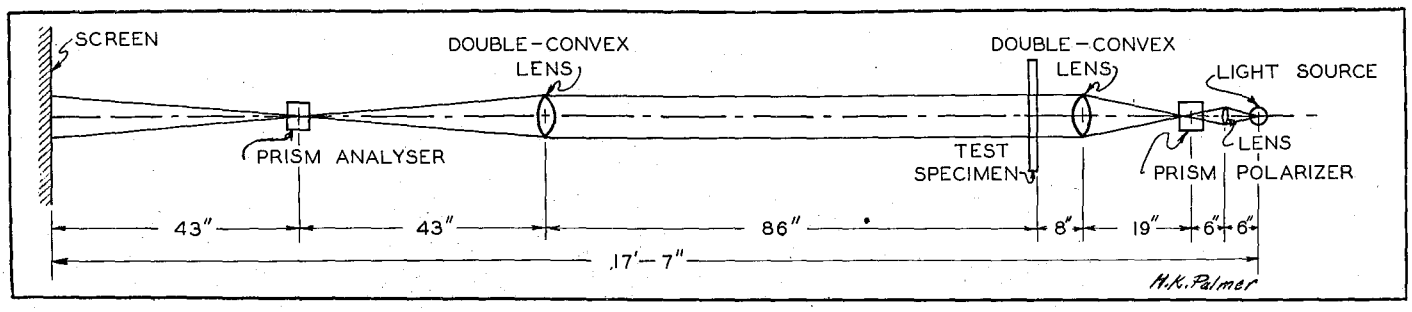
In the application of stress analysis to machines already constructed, a high-frequency magnetic strain gage may be mounted directly on the structure to record minute elongations proportional to the stress. This instrument may also be used to study dynamic stress conditions, as on the arm of a rotating flywheel, where the activating current is taken through collector rings and recorded on an electrical oscillograph.

The vibration apparatus in the laboratory, for the application of the fundamentals of vibration in the design and operation of machines, consists of a series of models for demonstrating various fundamental types of vibration, different kinds of balancing machines, and the instruments which are used in the analysis of vibration problems. One model of particular interest demonstrates the phenomenon commonly known as the "change in the phase angle" of a vibrating object as its frequency of vibration "goes through" the critical speed. A neon tube operated by a spark coil and a battery illuminates a rotating disc attached to a vibrating shaft at the instant of extreme movement, causing an arrow on the disc to appear to move through an angle of 180° as the system passes through the critical speed.

Other models include a set-up to simulate a machine on an elastic foundation, the vibration of shafting, vibration absorbers under machines, fundamental mass and spring systems, models showing the forces and movements of reciprocating engines, and models illustrating the conditions of torsional vibration.

Several types of balancing machines have been constructed. One is an automatic balancing machine, similar to those used in the production balancing of small electric motors. Another, a small-scale reproduction of a balancing machine for commercial rotors weighing 100,000 pounds, balances tractor engine crankshafts and flywheels

A schematic diagram of the photoelastic polariscope.



with considerable accuracy. Others represent various factors of fundamental importance in the design of balancing apparatus.

The instruments for measuring and analyzing vibrations include a Geiger Vibrograph and Torsiograph, which record on a moving strip of paper the picture of vibrations with considerable magnification. A new type of vibrograph, the Oscillo-Vibrograph, has been developed for use in the laboratory. It consists of a mechanical device which picks up the vibration, and an optical system which records the vibration on a ground-glass screen or a photographic film. It magnifies the vibrations many times more than other instruments, having a maximum magnification of 2,000 times.

A recent addition to the laboratory includes a powerful stroboscope having hot-plate gas filled lamps, and an oscillator unit to control the frequency of the lamp flash. This device is very useful in observing by slow motion the movement of vibrating objects. Instruments for measuring and analyzing mechanical noise, for recording earth movements, and the study of the vibrations of automotive motors have been developed. One problem, the effect of flexible pedestals (bearing supports) on machines having several shafts in line, has been completely analyzed by means of models.

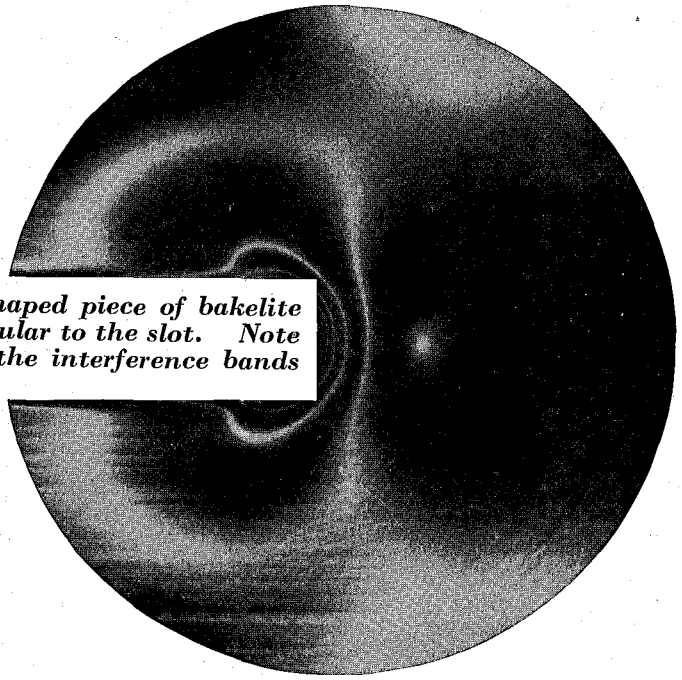
In the application of the theory of lubrication, of immediate importance is the construction of a large size journal bearing to check experimentally the mathematical data that are available. The problem involves the hydrodynamic flow of oil between a rotating cylinder and a curved surface, and various elements to be considered include pressure, velocity, temperature, viscosity, clearance between journal and bearing, coefficient of friction, positions of equilibrium, and length and diameter for optimum conditions.

At the present time, many investigators are working on this problem because of its vast importance, but the method of attack has usually been with small bearings and journals where measurements are extremely difficult. It is proposed here to use apparatus of a large size. Also, a very sensitive pressure measuring instrument operating on a high voltage has been obtained for this work. The apparatus is now under construction.

The journal is a section of an 8 inch diameter shaft, and the bearing length is 16 inches. To eliminate end reactions, bearings are mounted on opposite sides of the shaft journal with a hydraulic piston loading one bearing against the other. The assembly is free to swing between two external pedestals upon roller bearings on the shaft. Maximum bearing loads of 200 pounds per square inch will be obtained, and coefficients of friction, equilibrium positions of the bearings, and other fundamental data will be observed. A small electrically operated pressure gage will be mounted in the journal, giving instantaneous values of pressure in the oil film as the journal rotates. It is hoped that the hitherto elusive measurement of the velocity of the oil in the oil film may be experimentally determined with this apparatus.

Other instruments to be used in the study of lubrication problems include the development of a machine for testing bearing materials, and adaptations of devices for oiliness investigations. Much work has been completed in these fields but classifications and standards have not yet been adopted.

This description of the apparatus that has been assembled in the laboratory, and the brief discussion of some of the elements of application that are involved leads to the final consideration of how its purpose is to be consummated. Consider, perhaps, that graduate research is foremost; but of utmost importance are the undergraduate laboratory courses, demonstrating principles involved in theory by observation and experiment.

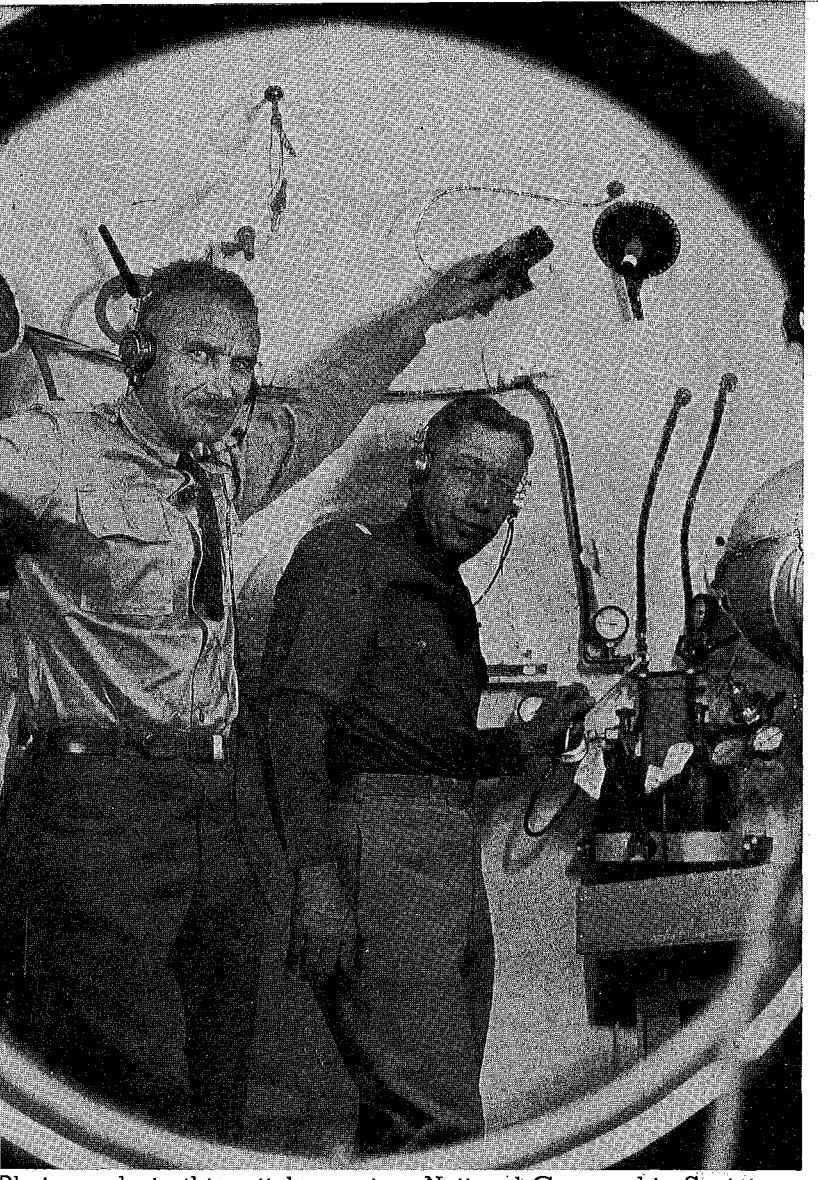


A polariscope picture of a U shaped piece of bakelite with tension applied perpendicular to the slot. Note around the inside of the slot the interference bands denoting stresses.

In the field of engineering graduate research, the application of photoelasticity to stress analysis is on a par with any other branch in its demands for a complete grounding in the fundamental sciences. Technique and apparatus are passing beyond the development stage, but much remains in the application of its possibilities to materials and design. Vibration engineering is another outlet for graduate research. The use of delicate instruments and the observation of dynamic models in action develop qualities in character as well as points of knowledge. The things that we with difficulty visualize in the field of lubrication will in short time be commonplace experiments, as graduate research is given tools and vision.

More prosaically, the boys who do the work, the undergraduates, need to get their glimpse of what it is all about. In humdrum design courses, it is a holiday to see a stress where you calculate there should be one, to check data against the result of balancing machine submits, and to take a photograph of the "pillow of oil" between the journal and bearing like the picture in the book. To handle more instruments than before, to dingle with a little more math to see how it is used, to increase the hates and joys of college. Thus laboratory courses will be added in the Machine Design Laboratory as required, to help round out those points which might otherwise remain obscure.

UP, UP,



Photographs in this article courtesy National Geographic Society

ıptains Stevens and Anderson inside spherical gondola in which ey will be sealed with a score or more instruments during their lloon trip from the Black Hills into the upper atmosphere.

AVIATION, weather, radio, health, plus plain old Yankee curiosity, are all contributing to this latest venture of the U. S. Army and the National Geographic Society.

Stratosphere! By scientists believed to be the magic word unlocking many secrets which, when revealed, will enlighten humanity about the world in which it lives. Those who have been following with interest the National Geographic-Army flights know all about that upper region of cold, rarefied air, which extends all the way from seven to thirty miles above sea level. But they perhaps don't know quite all that is being undertaken, and the long preparations necessary before attempted ascension. Weather, the main factor in holding up flights, and mechanical faults, all combine to hinder man's groping into the upper unknown in his search for ever-increasing knowledge.

To get 14 miles up, where approximately 22/23 of the atmosphere will be below them, is the aim of Captains Stevens and Anderson, U. S. Army air pilots whose former records and experiences have qualified them to the utmost for the work they are now undertaking. As they enter their gondola they see before them myriads of instruments—a scientist's paradise! Meters, radios, spectrographs, cosmic ray tubes, light meters, ionic apparatus, cameras, containers, thermometers, barometers, barographs, and many others, all contributing to the fullest cargo of instruments that has been taken into the stratosphere to this date.

Among the specific projects to be conducted are measurements of temperature and barometric pressure changes. The electric thermometer will have a resistance element made of extremely fine wire, shielded from the sun by two tubes of pressed fiber, one within the other. An electrically driven fan is mounted at the upper ends of the tubes and draws air through them. Thus the possibility of stagnant air, warmed by the outer tube, is avoided. The design of a mercury barometer for use in recording altitudes in the region more than ten miles above the earth presents difficult problems. If the instrument is to record from the ground level up to the "ceiling" of the balloon it must have tubes of glass a yard or more in length. Such an instrument is extremely fragile and may be easily broken. This year a short-tube barometer has been designed which will not begin to record altitudes until a height of approximately 7.5 miles has been reached (40,000 feet; 140 millimeters of mercury). It is from this level upward that the most accurate readings are desired. Altitudes between the earth and the level at which the mercury barometer will begin to function will be measured by a precise altimeter of the aneroid type built especially for the purpose. Collections of samples of stratosphere air, and spectrographic studies of sunlight and skylight, by means of light meters, will also be made.

samples of air to be gathered

and UP

By Donald H. Erickson, E. E. '38

The effort to add to the present knowledge of cosmic rays and their intensity and behavior in the stratosphere will constitute one of the central scientific problems of the expedition. Three electroscopes to be carried inside the gondola will be furnished by Dr. Robert A. Millikan of the California Institute of Technology, for the purpose of obtaining data on the intensity of the rays at various levels. One will be unshielded and will therefore be affected by rays of all strengths. A second will be shielded with two inches of lead and will therefore be affected by rays of intermediate and great strength. The third instrument will be shielded by four inches of lead so that only the rays of greatest intensity can penetrate to the instrument. This most heavily shielded instrument will weigh 600 pounds.

Cosmic ray counters (Goiger counters) constructed with electron tubes have also been supplied. These counters will record the amounts of cosmic radiation zones of the sky. A Stosse Chamber will record bursts of energy produced by the collision of cosmic rays with atoms of lead surrounding the chamber. Still another contribution will be a "cloud chamber" filled with argon gas and alcohol vapor, which will make possible the photographing of the actual paths through the chamber made by cosmic rays and flying particles released from atoms by the rays.

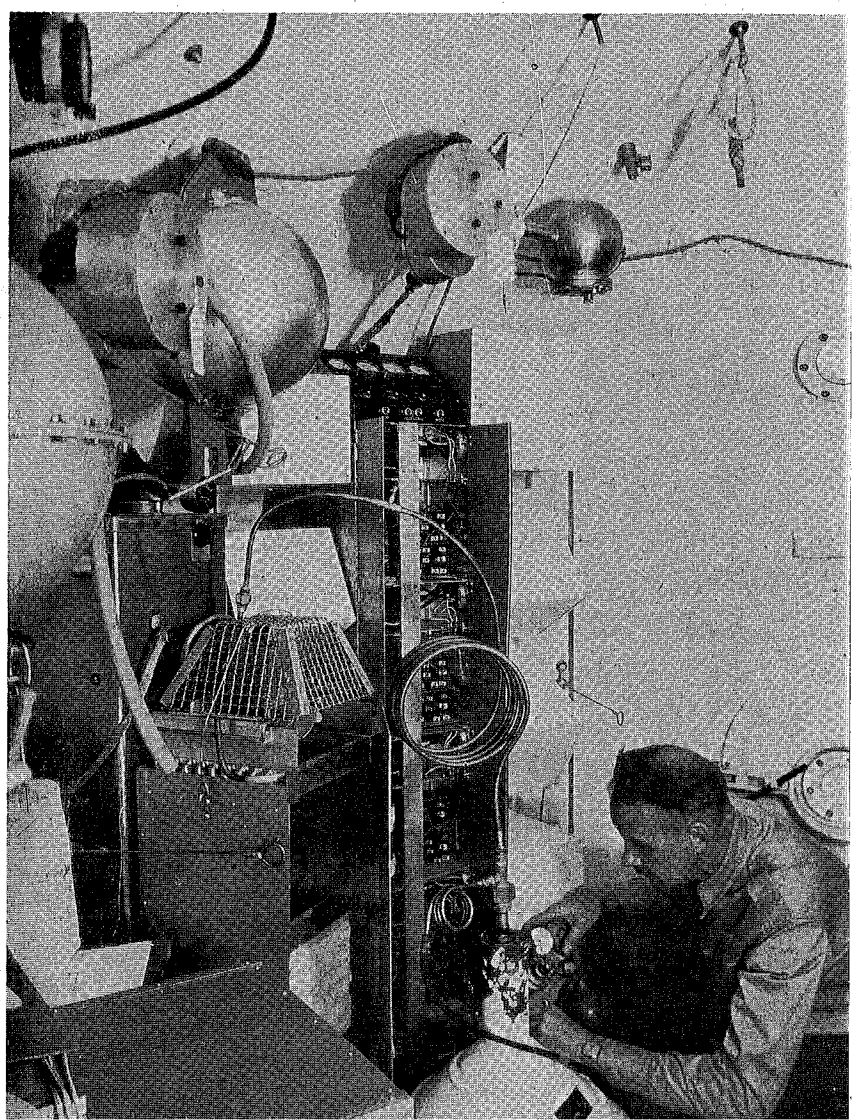
Two spectrographs will be taken along on the flight. The larger one will be suspended 500 feet below the gondola and be used to obtain additional data in regard to the absorption of ultra-short rays of light in the stratosphere. The second spectrograph will be located inside the gondola and will obtain its light through a special window of fused quartz glass.

Some surprising facts in regard to wind direction were brought out by the 1934 flight of *Explorer I.* Above an altitude of 60,000 feet the wind was found to be moving between six and ten miles an hour from east to west. All winds encountered at lower levels were moving in general toward the southeast and at much greater speeds. At an altitude of 42,000 feet the maximum wind velocity of 70 miles an hour was found. It is not known whether the slow wind to the westward encountered near the "ceiling" of the 1934 flight was in the nature of an eddy or whether it represented the lower portion of a major drift of air to the westward. All necessary data for studying wind direction and velocities at various levels are provided by the automatic vertical photographs of the earth, together with the automatic photographs of watches, compasses, and barometers.

During the 1935 flight, barometer and camera again will be used to determine altitude. In addition engineering parties on the ground, provided with transits, will make observations of the balloon at predetermined times.

For the first time in America, studies will be made of the electrical conductivity of air in the stratosphere. The instrument used consists of a metal tube nearly a foot in diameter and three feet long supported in a vertical position by a short arm extending outward from the equator of the gondola. In the top of the tube is mounted a small electric fan which draws air through the tube. Electrical conductivity of air depends upon the number of ions or electrified atoms present, the conductivity increasing with increased ionization. The operating part of the mechanism measures the number of gas ions encountered in a given time at various levels.

Captain Stevens, commander of expedition, examining air-conditioning equipment. Note the two electroscopes near top of gondola. The tall cabinet and tilted rectangles are more cosmic ray apparatus.



Immediately after the first flight of the National Geographic-U. S. Army Stratosphere expedition failed some time ago, preparation was begun for a new flight to go up this fall. At the time of this writing, the balloon and equipment are ready for flight at a moment's notice from the weatherman. The flight might very possibly have taken place before you read this.

In addition to the principal radio instruments which will transmit and receive voice signals, the gondola will carry two ultra-high frequency transmitting sets which will be kept in continual operation sending out modulated waves. One will send out signals on a frequency of 56,000 kilocycles (5½ meter waves) and the other will send on a frequency of 112,000 kilocycles (2 7/10 meter waves). If they behave exactly like light waves they can be received only with the horizon theoretically visible from the gondola. It is possible, however, that owing to refraction they will reach some distance beyond the horizon.

In one project a sterile tube will be dropped from the highest altitude attained by the balloon through six or seven miles of stratosphere air, in an effort to determine whether living spores float in the stratosphere. Some spores that float at lower levels of the atmosphere are known to carry diseases of crops and plants, while others are harmless. In a second project, spores of various kinds will be exposed in quartz tubes to see if they will survive the streams of rays which pour upon them in the highest region reached. The apparatus with which efforts will be made to collect spores from the stratosphere air consists of a cylindrical container made of light metal, about six inches in diameter and 2½ feet long, within which is a sterile collection tube whose inner surface is coated with a sticky substance. The ends of the outer tube are closed by sterile plugs when the instrument is taken aloft. It will be dropped from the highest altitude attained by the balloon, and lowered toward the earth by a parachute. Plugs will be extracted automatically and the stratosphere air will sweep through the collecting tube until the device reaches a level just above the lower reaches of the stratosphere. By means of an aneroid barometer sterile pads will then be clamped over the ends of the collecting tube and the apparatus will continue on to the earth. The outer cylinder will bear a plate offering a reward for its return intact to the headquarters of the National Geographic Society.

Cultures of fruit flies *(Drosophila)* will be taken aloft to determine whether their bombardment by the radiations encountered at extremely high altitudes will affect the characteristics of their descendants.

Two recording barographs, calibrated under the supervision of the National Aeronautical Association and the Federation Aeronautique Internationale, will be taken aloft to record the official altitude obtained during the flight. Photographs of it will be taken by one of a battery of factograph cameras installed in the gondola to make automatic readings of 21 instrument dials, including those of thermometers, barometers, spirit levels, compasses, watch faces, and meters for sun, sky, and earth brightness. These factograph cameras will be operated automatically by the same master mechanism which makes exposures through the vertical camera, and will thus make their records every minute and a half throughout the flight. Other cameras will be carried to photograph the earth's curve and other phenomena.

gages read with automatic cameras

The *Explorer II* is larger than the *Explorer I,* which, at the time of its manufacture, was the largest balloon ever constructed. When fully inflated it will be a sphere 192 feet in diameter, and 13 feet greater in diameter than *Explorer I.* The capacity is 3,700,000 cubic feet, as against 3,000,000 for the other—an increase of approximately 23 per cent. The total area of the completed balloon is 115,845 square feet—approximately 2 2/3 acres. When the balloon assumes its spherical shape the distance from the top of the bag to the bottom of the gondola will be 267 feet. The distance between the top of the gondola and the bottom of the fully inflated balloon will be 67 feet. Inflated for its take-off with only a bubble of gas in its top, the balloon will extend 316 feet above the ground.

The balloon will have two girdles or bands around it. These will consist of heavy fabric, the tops of which are cemented to the balloon bag. The lower portions of the belts will be cut into scallops following mathematical curves known as catenaries. In this way the strains from the points of the scallops, which will be the attachment points for ropes, will be spread evenly to the balloon fabric.

When the balloon leaves the ground it will contain only about 300,000 cubic feet of helium, approximately eight per cent of its capacity. Since the gas expands as it rises above the earth, it is necessary to start with this small amount, allowing room in the bag for expansion. The bag will become full and take on its spherical shape approximately 12 miles above the earth. The exact height to which the balloon will rise will depend upon a number of factors: the temperature and barometric pressure at time of take-off; the degree of extra expansion due to super heat caused by the shining of the sun on the bag; the total load of the balloon; the relationship between the weight of the ballast that can be discarded and that which must be retained for the down trip; and the amount of gas valved away in order to keep the balloon on the same level for certain periods. It can be estimated very roughly that the balloon should rise to an altitude above 70,000 feet, or 13¼ miles. At this height the atmosphere will be only about 1/23 of the density of the atmosphere at sea level.

craft should rise to thirteen miles

The balloon and its ropes weigh 6,350 pounds. The gondola, instruments, equipment, and men weigh 3,750 pounds. More than 8,000 pounds of lead-shot ballast will be carried. The entire weight of balloon, gondola, and load when it leaves the ground will be approximately 9 tons.

(Please turn to page 18)

A Bath to the Finnish

By B. H. T. L.

WE HAVE in our midst an authority, and, unlike most authorities, he has neither read, investigated, spoken, studied, or taught concerning the subject of which he claims to be an expert. He has had, which is still more astounding in the case of a self-professed authority, actual, first-hand, intimate experience with his subject. His subject or "Magnum Opus" is The Finnish Bath, and the man—would you believe it?—is our good friend, Mr. Clifford I. Haga, the terror and joy of those freshman engineers who happen to be fortunate enough to be getting their fundamentals of English at his brawny hands.

When touring the northern part of our fair state—some of our visitors might feel induced to call it unfair as they shiver inside of their scanties—and see as you pass the farms a sort of outhouse that is not an outhouse because it is too big, it might be a granary but for the fact that there is no grain about, or a chicken coop—except that there are none of the usual signs of chickencoopishness about the place—then you know that you are in a Finnish community and you are beholding the only farm building of its kind—the "Sauna" or Finnish bath-house. Carlton County and the country around Cloquet and Aitkin abounds with these bath-houses and they may be found in any place where a Finn meets a Finn more than once. To a Finn a bath is not only a cleansing process but an orgy of pain and pleasure that becomes at once the most damnable thing that you have ever experienced and again the most delightful. The Finns often built their bath-house before they built any of the rest of their buildings, living in the dressing room during the time the dwelling was being constructed. The bath-house, which is situated on the side of a convenient hill to provide natural drainage, is a clean, neat structure about 20 ft. long and 12 ft. wide with a window in each of three sides.

In one end is the dressing room, about 12x8 ft., in which are a table, mirror, benches, and usually a couch. The other end is about 12 ft. square, and in here the bathing takes place. A stove is constructed of a 30 gallon oil drum, a door is hung on crude hinges and enclosed in another oil drum of the 55 gallon capacity. The smaller drum is placed in the bottom of the larger drum, both lying horizontally, and the top third of the larger drum is cut off.

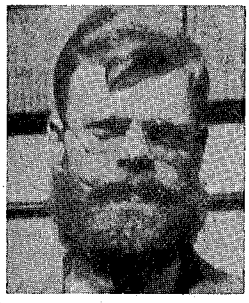
With the little drum nestling snugly in the bottom of the big drum, rocks the size of your fist (your two fists if you're a little fellow) are dumped in around the smaller one to soak up the b.t.u.'s when a fire is built in it. The fire is built of pine knots, and, as the Finns put it, "The Bine must be full of Bitch." When the fire has been roaring and figuratively champing at the bit long enough to turn the stones red hot, a few dippers full of previously provided water are thrown on the stolen diamonds ("hot rocks" to you) and they, in that Winchellized slanguage, immediately go Phfffft! The water turns to steam so quickly that it doesn't even splash. The steam smites the nude body of the bather and turns it a gentle cherry red, while said bather writhes in exquisite agony.

Hearing Professor Richardson of the English department intimate that he had experienced a Finnish bath in Helsingfors on his journey this last summer, we sent our most inquiring reporter to interview the foremost non-Finnish authority in the Northwest on the technique of the Finnish bath. Some of the statements in this dissertation might be laid to the fact that (as B.H.T.L. claims) this was written, partly in a deep dark "Jernt" and the remainder while riding on a motorcycle, and it is true, the editor swears, that B.H.T.L. turned this particular piece of copy in, by slipping it under his door at midnight one Sunday, and in doing so awakened slumberers for blocks around, plus the next door neighbor's cat.

In the other side of the steam room are three tiers of wooden benches, one knee high, one waist high, and one shoulder high. [Editor's note: Baby bear, Mamma bear, an' Papa bear.] The first is for women and children, the second for just ordinary tough guys! The highest is for "those that can take it" as the native Finns so quaintly put it, this being an old proverbial phrase uttered by the Finns since way back.

After the body is well cooked, the bathers prolong and increase the fun by vigorously belaboring each other with cedar twigs made into a switch about three feet long. This, they say, brings the blood to the surface and increases the muscular tone—personally we believe the tone would be getting pretty sour by this time.

After he is beaten to pulp he completes his own annihilation by pouring a bucket of cold water over his body and dashing out of the room before he begins to sweat again.



Did I say Mr. Haga was an authority on Finnish baths? Nay, he's a connoisseur.

By the way, "Haga" means "garden" and he certainly knows how to live up to his cognomen, if you know what I mean. (Take a look at him, boys—take a look at him.)

The MINNESOTA Techno-Log

OCTOBER, 1935

WAYNE STONE
Managing Editor

ROBERT DIXON
Business Manager

Your Techno-Log

HOW MANY of you readers realize the place that your TECHNO-LOG holds among the similar technical magazines of this country? The TECHNO-LOG in competition with twenty-four other engineering college publications won first place for best all-around magazine for the year of 1933-34. These twenty-four other publications are members of Engineering College Magazines Associated and include publications from such well known schools as Massachusetts Institute of Technology, Purdue University, and University of Michigan. The entire list is printed on the contents page of this issue. In addition the TECHNO-LOG won first place award for the best cover, and third place for best illustrated magazine during this year. The awards for last year have not yet been announced.

But what about the awards to be won for this year? Awards cannot be won by a one-man magazine. Your editor cannot write the articles, plan the makeup, read the proofs, dig up news and alumni articles, do the copy-reading, maintain a pleasant disposition and publish a magazine that will win awards. It is necessary to have a staff that likes the work and can be depended upon to do it. TECHNO-LOG work contains a lot of grief, takes valuable time, and is no occupation for a loafer, but it's invaluable experience and a lot of fun. It gets in your blood and once the boys get into it, they stick. Drop into the office, if it sounds interesting, and have a try at it.

—W. A. S.

At the Desk

NEW cover, new type faces, new TECHNO-LOG—what do you think of it? Some good, some bad, mostly indifferent. But look at that cover again. Good photography isn't it. Charles Sweatt took it down in Jimmy Ryan's new Machine Design Lab. By the way, that lab is interesting. Charlie and your editor spent a whole evening down there watching stresses perform on a screen. They come out in full color, blue, green, red, purple, it's amazing. The black and white picture reproduced on page five doesn't do it justice. And then there's a bunch of other things down there, balancing machines, stroboscopes, and vibrographs. It gives you the opportunity to see some of the things you calculate. Drop down in the lab some time and have a look around.

"Up, Up, and Up." Sounds interesting. It is. Read it. Don Erickson wrote it. He wrote to Captain Albert W. Stevens last summer, who sent him about eight thousand words on the flight. It was such interesting reading that we would have liked to print all of it, but we couldn't. The frontispiece is a picture of the Stratocamp from where the balloon will or probably has already, before you read this, risen.

That beard of Mr. Haga's! Did you see it? If you didn't, look on page nine. There he is, King-Kong, in person.

Hi, Frosh . . .

Advice, advice, and more advice! That's just about all any freshman ever gets, and yet nobody tells him anything. So we're going to refrain from advising him, and just give him an idea of what to expect.

First of all, it's kinda tough. They hand you a little of everything the first year, and for a while you won't know what you're taking. Now take this English course, for example. We all know that you don't like to write themes, yet you've been doing a lot of it, and you should be able to follow the routine given in the book, as far as form goes. And you'll find that that is just about the most important part. Three quarters of it, and you'll be able to look on it just as we did: not too hard, if you know how.

As for your math courses, well, the first quarter you may sink kind of low, yet the second quarter, trig, should bring you up quite a few notches. Your last quarter will start you in the real stuff, and then you have to do a little more of what is called studying. Of course, there are always those who crack A's. But that shouldn't discourage, but spur you on. It's a cinch that they didn't get it without studying.

Drawing will be something you've probably had very little of before, and will provide you with a slight surcease from the never-ending study, until the third quarter, that is. Your eyes and hands are used mostly, and the sooner the fundamentals, and order of inking are learned, the faster it will go. Printing might be mentioned here as a mighty nice thing to specialize in. An engineer is expected to print, and print well, but how many of them do?

You're going to take a lot of notes in your chem courses. And, boy oh boy, how handy the complete set comes in for exams. A book you have, of course, but the more notes, and the faster you push the pencil, the better off you'll be. Third quarter is going to get in your hair if you aren't careful. Get your equations straightened out, and everything will be hunky-dory.

For you electricals, drill is a mighty nice thing to take. For second year reasons especially. All the extra things you take like drill, athletics, band, and most important for the engineer, *Techno-Log,* will be beneficial for you, if you can handle them. And you yourself will decide that after several experiments. Reasons for them are self-sufficient. And the more people you meet, the more contacts you have with the business world when you need them.

Our traditions are many. Engineers' day, the brawl, and others all form an interesting year, and bring back the old adage, that "all work....."

—D. H. E.

Our Buildings

We all want to be able to take pride in our college, yet we all know that this can only be done by having up-to-date buildings, something that we can more-or-less "brag" about, and yet not exaggerate.

In this age when modern air-conditioning and sound-proofing are commonplace, it is with some little astonishment that we view the present mechanical engineering plant. A nice place, if viewed with sentimental recollections by grads of 20 or 30 years ago, but to oncoming freshmen, especially after a look inside, it is not an exactly inviting place to sign up for, for four years of studying. A better air conditioning system should be installed in the new building, and, by the way, the chemistry building might be mentioned in the same breath, with regard to the same fault. In the M. E. building a good system of sound proofing should be observed, or the building should not be built on the main campus.

A much larger building is absolutely necessary, as the aeronauticals also have their classes there. The need for it is no doubt seen by many, and with the Government helping, one should be built in the very near future. An engineering college is judged not only on a basis of its faculty, but also on its modern equipment and buildings. For those who know, the former is most important; for the majority who know only what they see, the latter is significant.

—D. H. E.

Clamor

You clamored for it. We heard your clamor. So now we clamor. You want something funny in your magazine. As publishers of your magazine, we want something funny. We aren't funny. That is, in the humor line. So it's up to you. Stop being funny just for your class. Expand and be funny for the whole college. You get the idea. We get the humor. You get the humor. You stop clamoring. We hear no more clamoring. So we stop clamoring. Everybody's satisfied.

Your Societies

Profiting by our college opportunities 100% is something that very few engineers ever do, or have done. And of the many percentages that contribute to the complete amount, one stands out very obviously, yet is very seldom taken advantage of. We refer to our various student societies.

Of the many benefits, perhaps that of association with projects closely connected with your career is most useful. Meetings are always interesting and many of your pet theories and plans can be broached for instant discussion and experimentation. The close connection with alumni oftentimes provides interesting and highly valuable contacts. Speakers are always available and give may excellent pointers.

Trips to various industrial plants are extremely interesting, and special guides, for these tours only, to provide information beyond the availability of the casual observer. These are the same types of plants and projects each one of you will be connected with later on, and familiarizing yourself early with these will enable you to talk and act with more confidence about them when necessary.

Motion pictures, and innumerable others pursuits carried on by the respective societies, are interesting and recreational, and correspondence with other branches forms a major part of the activities. More could be said along the same strain, but we believe you get the idea, and we only hope you get the spirit. It's for your own advantage, and, well, you're "master of your fate."

SLIPSTIX

A Word to the Wise

The world is old, yet it likes to laugh.
New jokes are hard to find;
A whole new editorial staff
Can't tickle every mind.
So if you find an ancient joke
Dubbed in some modern guise,
Don't frown and give the thing a poke,
Just laugh—don't be too wise.

—*Tech Flash*

You Tell Her

Before the radio there were only three methods of communication: Telegraph, Telephone, and Tella-woman.

Puzzle

Last year I asked her to be my wife and she gave me a decidedly negative reply, so to get even, I married her mother. Then my father married the girl. When I married the girl's mother, the girl became my daughter and my father married my daughter, so he became my son. When my father married my daughter she became my mother. If my father is my son and my daughter is my mother, Who am I? My mother's mother is my wife and must be my grandmother and being my grandmother's husband I must be my own grandfather, and there you are.

—*Tech Flash.*

Theorem No. .00001

To prove: A ton of coal is a chicken thief. Proof:

1. A ton of coal is 2,000 pounds.
2. 2,000 pounds is a weight.
3. A wait is a short stop.
4. A shortstop is a baseball player.
5. A baseball player is a foul catcher.
6. A foul catcher is a chicken thief.

Therefore a ton of coal is a chicken thief.

—*Rose Technic.*

Pomes?

First it rained and then it blew;
Then it friz and then it snew;
And very shortly after then
It blew and snew and thew again.

—*Bremerton.*

The poor benighted Hindoo.
He does the best he kindoo.
He sticks to his caste
From first to last.
For pants, he makes his Skindoo.

—*Ill. Technograph*

Yassah yassah

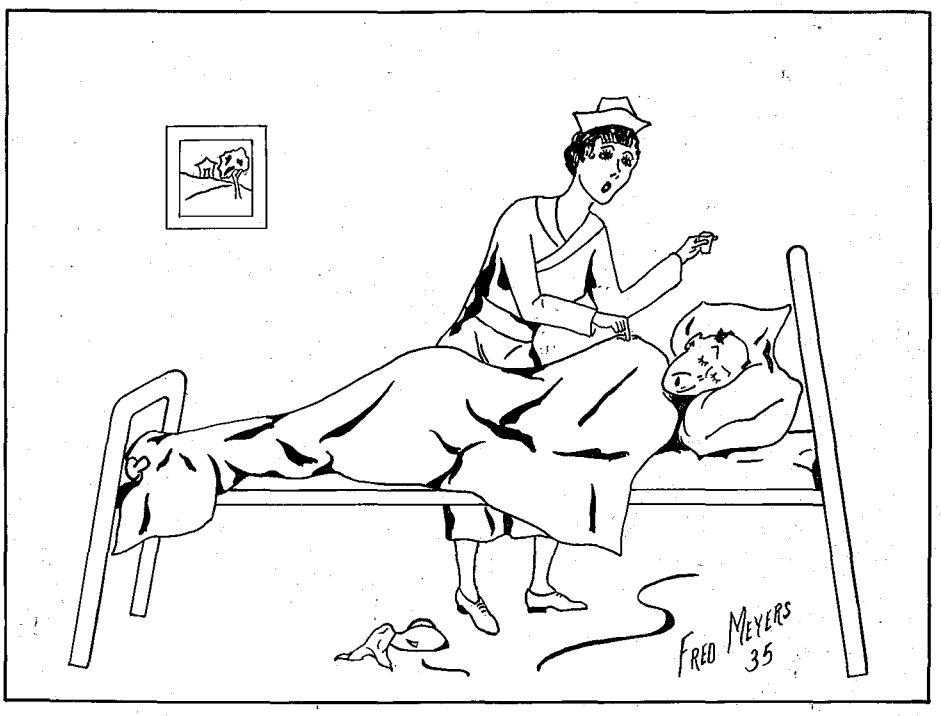
"Yassah," said old Link, "business very good. Done bought a pig fo' $10, traded pig fo' a barrer, barrer fo' a calf, calf fo' a bicycle, and sol' de bicycle for $10.!"

"But yo' don' make nothin' Link."

"Sho' 'nough, but look at de business Ah been doin'."

Rumor

What's the rumor going around about the Civil's campaign for erecting eyepieces on their transits?



"Oh, Mr. Puffensnore—your sleeping pill!"

Tick-Tock

Three obnoxious ticks of the insect world—Lunatics, bed ticks, and University of Minnesota Aeronauticks.

Life-Goes-On Dept.

"If the person who took my topcoat from my party last night will leave his address, I will send him the hat and stick that goes with it."

—*St. Louis Telegram.*

Scraps

Speaking of unemployment—The average student has about 12,000,000 brain cells.

As broke as a Freshman who has just finished buying his first set of textbooks.

Think it over—People who throw kisses are inexcusably lazy.

HAGA-ZINES

By C. I. Haga
INSTRUCTOR IN ENGLISH

VACATION is over—alas, thank God!—and now there is no book for me to talk about. Yet Generalissimo Stone tells me to have something ready on such-and-such a day! Was ever well-intentioned book-reviewer worse off: Full of eagerness, but without a book on which to load that enthusiasm and speed it on its way. All the fault of my vacation, which I enjoyed so well. What did I do? Nothing; that is, I saw only a half-dozen books. What have I done in the short while I have been back? Practically nothing in the way of reading.

The trouble is that while I was away Il Duce and the Lion of Judah got to sassing each other and there has begun to be a great deal of talk about these two. War, say many persons. War, did you say? I'll have to look into that. And that's what I have been doing: trying to catch up on my international situations so that I can begin to guess which way the cat will jump. Consequently I have been reading nothing but newspapers and magazines with only a half-dozen novels thrown in merely for relaxation, and I am in no position to talk about books. All I can tell you is that I have read many things—some good, many poor, and a brilliant few downright foolish.

Forgetting for the moment our immediate concern about Minnesota's football chances—after all, victory or defeat for the Gophers will not affect wheat prices or taxes (or your grandchildren, if you have any) as directly as will this far off lynching bee Il Duce wants—and, remembering that our world is a small one, we might look into the reliability of such sources of current information as are available to us through our library.

To begin with, we can cross off the list all newspapers except two. To be sure, the papers are full of news, but news seldom makes us wise. Read newspapers, of course, but don't depend upon them for any real illumination. As I said, there are two exceptions: *The New York Times* and an English newspaper, *The Manchester Guardian,* in its weekly edition. Lately *The Manchester Guardian* has been slightly less useful because of the British censorship of ship and troop movements, but for illuminating comment on the purely political and diplomatic maneuvering at Geneva and in the various foreign offices it is still unsurpassed. In a way, that handicap of censorship is of value to us as foreigners, for it shows us what must be the state of mind of the English; when we know what they don't know, we can understand better why they feel and act as they do and what may be the consequences to us. As for the *New York Times,* no other newspaper can match it in this country. Get the *Times* habit and never break it.

I can also suggest some magazines. *Current History,* a monthly published by the *Times,* usually guesses right. *The Living Age,* containing reprints of articles from a hundred-odd European journals and magazines, is indispensable. It may, at first, strike you as a bit sour with a touch of anti-this-that-and-the-otherism, but you can quickly learn to discount that tendency. Reading *The Living Age* regularly will put you anywhere from six months to two years ahead of your friends in guessing at the outcome of world affairs. *The Yale Review* and *Foreign Affairs* must be added to this list also; both are heavier going than the average student is accustomed to, but they repay all the effort put into reading them.

But what about the newsstand faithfuls, *The Saturday Evening Post, Collier's, Liberty, The Literary Digest, Time,* and *The Reader's Digest?* No, absolutely no! to the first three. They have other purposes in this world than to inform us intelligently on international affairs as important as the Italo-Ethiopian squabble. *The Literary Digest* has its uses and so has *Time;* the latter is the most dependable and intelligent popular magazine available. *The Reader's Digest* is for the cud-chewers, those too busy to go out and forage for themselves. For my part, and this is a purely personal view, the three or four members of the group best represented by *The Reader's Digest* are quite worthless.

Then in addition are such magazines as *The New Republic* and *The Nation,* both weekly journals that swing far over to the left for a vantage point from which to view and interpret this best of all possible worlds. Because of their viewpoint, even more anti-this-that-and-the-other than that of *The Living Age,* these two are likely to shock you at first. My advice to you, purely in the interests of family peace, is not to take them into your homes if your family circle is at all conservative. (I speak from experience.) Moreover, for your own good again, don't be too deeply impressed by their omniscience just because they tell you things you cannot find in the conservative journals. Left-wingers can be just as wrong, just as often as right-wingers. But it is my sincere opinion that every intelligent person should have some acquaintance with journals of dissent, and *The New Republic* is a brilliant example of that class.

Now you can settle down in your ring-side seat and watch the world go merrily to—oops! I mean the bow-wows. The price of admission is the time necessary to read more or less regularly one daily newspaper, three or four weeklies and as many monthlies. Will that knowledge better your grades? Not directly. Will it give you a better job after graduation? Hardly. Will it give you a better "line" with which to vanquish the fair sex? Not unless you are pursuing a she-professor. (Even then I cannot promise perfect results.) Then why bother? Right—if you feel that way about what deeply concerns you, willy-nilly, don't bother. But I know many of my undergraduate friends do "bother"—thank heaven!

Next month I am going to tell you about a great novel.

ALUMNOTES

IN another month we'll all be wishing we were down in New Orleans with **Edwin Hartsman** and **Bill Johnson,** M. E. '35. They are with the Fairbanks-Morse and Company. **Arthur Dohm** and **Gordon Maas,** M. E. '25, are with the American Can Company of St. Paul.

John Gill and **John Johnson,** M. E. '35, are making tractors for John Deere at Waterloo, Iowa. Wonder if Deere gives the "Johns" a preference?

Bob Armstrong, M. E. '35, is now with Donaldsons of Minneapolis and **Fletcher Whallon,** M. E. '35, is with Daytons.

Lee Whitson and **Ed Howard,** M. E. '35, are working for the Minnesota Mining and Manufacturing Company of St. Paul. Lee says that he will be back in school this winter for graduate work.

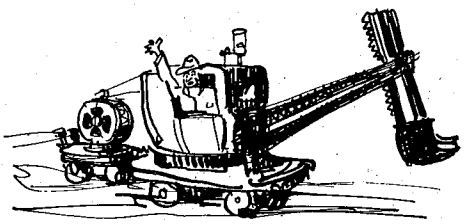
Bill Gordon, M. E. '35, is now doing his stuff at the Franklin Power Station at Rochester, Minnesota.

Harold Miller, M. E. '35, now catches the street car every morning to the Roberts Hamilton Company of Minneapolis.

Amos Sutton, C.E. '35, is working for the State Highway Department.

A new hand at the International Harvester Co. of Minneapolis is **Gerald Lupient,** M. E. '35. **Charles Sweatt,** M. E. '35, narrowly avoided being a banker, having worked for the First National Bank of St. Paul, but he's back in school now for graduate work.

Bill Burgum, C. E. '35, is now digging tunnels for the Minneapolis, St. Paul Sanitary Department. **Harry F. Baker,** another C. E. '35, is up in Superior, Wisconsin, working for contractor James Leck.



Wonder what this job of Soil Engineer is? Seems to hold quite an attraction for **Jake Essen,** C. E. '35, who is Junior Soil Engineer for the Minnesota Highway Department at Mankato, **Leon Hamlet,** C. E. '35, is holding down the same job at Morris, and **Everett Enns,** C. E. '35, is doing the same at Bemidji.

Howard Schlieter, C. E. '35, will be seen around the campus again this fall. He's to be a teaching fellow in the Civil Engineering Department.

Leonard Willis, M. E. '35, is with the Lipman Refrigerator Company of Minneapolis. **Harold Shaw,** M. E. '35, is just about as far away from his former stamping grounds as he can get while working for the Union Carbide and Carbon Corporation of Charleston, West Virginia.

John Borrowman, C.E. '27, who is a Jr. Engineer for the U. S. Engineering office, was working on a breakwater at Algoma, Wisc., last summer.

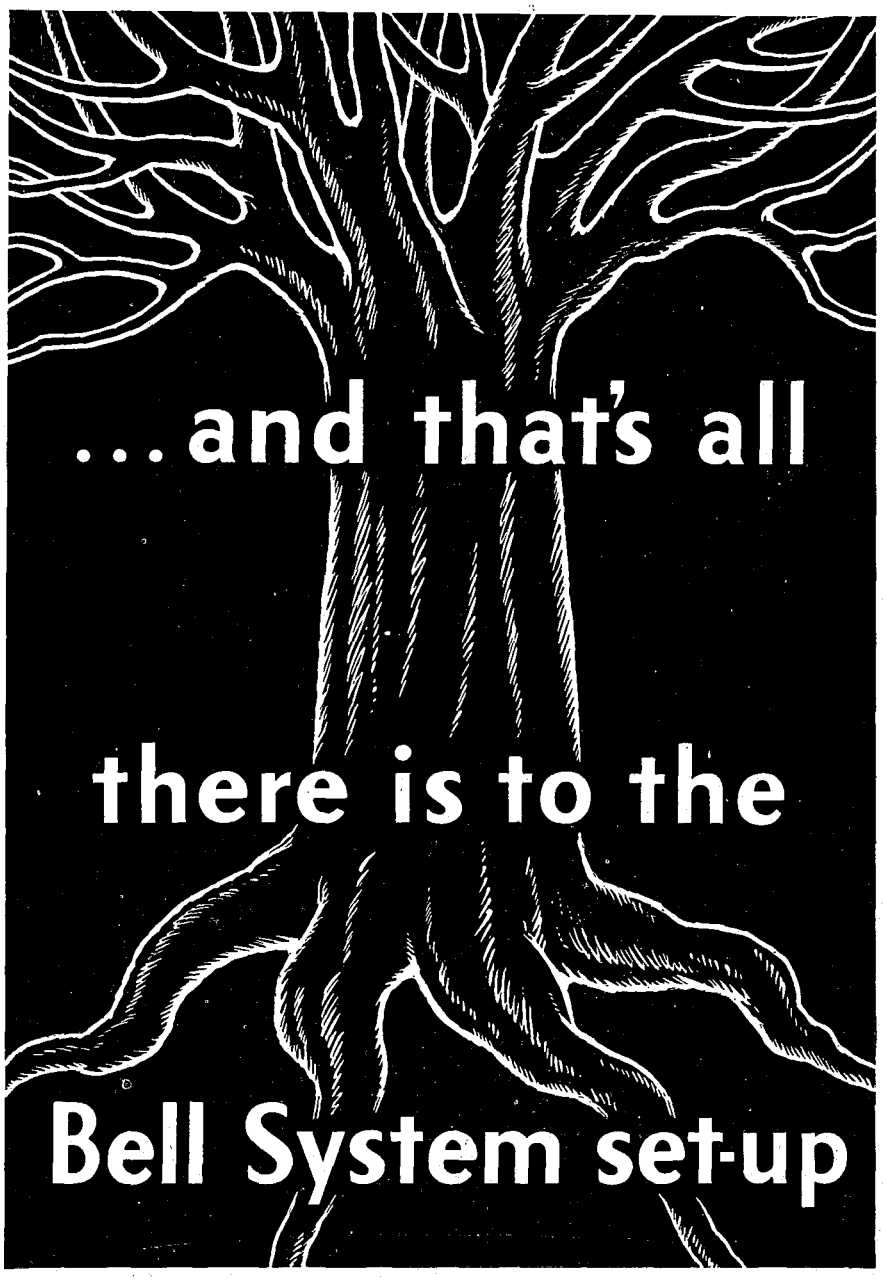
T. F. (Pete) Shilling, E. E. '24, of the Cleveland Gas Company, Cleveland, honored our fair city by his presence this summer. About six weeks ago the home of **K. J. Bohrer,** E. E. '33, expanded and now K. J. has a promising young football player in the form of a baby boy.

The stork is getting set for a busy season because—**Max Risby,** E. E. '31, was married in the Little Brown Church in the Vale this June; **Helgi Punkari,** E. E. '30, was also married in June, and now **Carl Zeigler,** E. E. '34, is married.

And now here's just a word of warning to you electricals—ol' Dan Cupid is looking for you. **J. F. Johnson,** E. E. '34, will be around to school again this fall.

Wonder what several of the boys would be doing if Minnesota had no Highway Department? Some of the '35 Civils now with the Highway Department are **Delbert Diessner, Oscar Englund, Goodwin Kolstad, Kenneth Larson,** and **Lowell Korstad.** Why not get in touch with them? They can be reached by addressing the St. Paul Office of the Minnesota Highway Department.

Frank Whaley, M.E. '31, is working at the Waldorf Paper Co. in St. Paul, as is **Lawrence Erskine,** M.E. '25.



THOUGH large, the Bell System is simple in structure. You can think of it as a tree.

Branches: 24 associated operating companies, each of them attuned to the area it serves.

Trunk: The American Telephone and Telegraph Company, which coordinates all system activities.

Roots: Bell Telephone Laboratories and Western Electric, whose functions are scientific research and manufacture; Long Lines Department of A. T. and T., which through its country-wide network of wires links together the 24 operating companies, handles overseas service; Advisory Staff of A. T. and T., which advises the operating companies on all phases of telephone operation and searches constantly for better methods.

Working as one, these many Bell System units enable you to talk to almost anyone, anywhere, any time.

Why not call your folks tonight? For lowest rates, call by number after 7 P. M.

BELL TELEPHONE SYSTEM

Blowby---And Tear Drop Cars

EVERY year or so a very radical design in houses or buildings, or cars, comes to the fore. But very few of these are of lasting value because of poor engineering and engineering principles behind it.

A car has now been developed by the McQuay-Norris Mfg. Co. that combines both of these, and toward which the modern car is undoubtedly tending. A drop of water, when falling, naturally forms itself into a shape of least resistance, and so to it, just as naturally, does this Tear Drop test car conform. But that isn't all. The inside is engineered just as well, and tests are even now being made on the road for both motor and streamline performance.

The Tear Drop design of these cars offers many advantages over the conventional type of car for testing. It reduces load on the engine at high speeds. It places the driver in intimate sound relation with the engine at all times, because the engine is really riding right inside with the driver. A larger compartment for instruments is made available, and the specially designed bodies, built on popular priced automobile chasses, give the cars an increased speed of 10 to 15 miles per hour.

Mechanics will be interested in a description of the various instruments and their functions. The Blowby Meter is one of the most important instruments on the car. It measures accurately any gases that leak past the pistons into the crankcase. It shows the rate of blowby as well as the accumulated cubic feet of blowby. This is important because too much blowby overheats the piston assembly and produces a sludge in the oil. It accounts for poor fuel economy and increases the temperature of the water in the cooling system. Blowby also produces an unhealthy atmosphere in a closed car, frequently resulting in headaches and nausea, sometimes with fatal results.

An accurate clock is used to check the speedometer against time and distance. The speedometer has a 150-mile range, assuring more accurate readings at lower speeds. A larger and more sensitive ammeter is used, and an improved gas gage checks miles per gallon.

Another important instrument is the Exhaust Gas Analyzer. It checks the fuel mixture going into the combustion chamber, making it possible to maintain a definite carburetor mixture throughout each test run for comparative results. It also determines the back pressure in the exhaust at any time during the run and indicates immediately any stoppage or change in the exhaust line.

An Oil Pressure Gage records the exact pressure of oil delivered to the working parts of the engine. This pressure must remain constant for comparative results. The Oil Temperature Gage records crankcase oil temperature. Water temperature is recorded on the Water Temperature Indicator.

The Visco Meter is a delicate, finely calibrated instrument which shows in Saybolt seconds the viscosity of the crankcase oil. The Oil Level Gage shows the depth of the oil in the crankcase. The Exhaust Gas Temperature Gage registers the temperature of the gases in the exhaust line. Frequently this registers 500 degrees and any operating condition large enough to indicate an unfair test comparison.

The Compression Gage shows the compression in each cylinder for comparison with previous runs. It is indispensable in trouble-shooting because with it it is possible to determine trouble due to faulty valves or faulty piston rings.

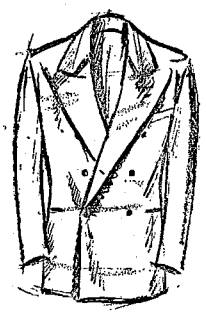
The amount of loading in a car at any speed is determined by the Vacuum Gage, a most necessary factor for comparative tests.

University

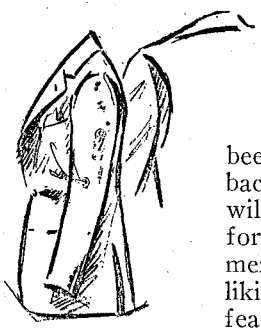
FALL brings with it the opening of college and, at the same time, the appearance of the college man on the campus, dressed in the latest styles. Stylists have "gone the limit" this year in creating clothes for the man who wishes to be smartly attired. This season the university man will find that the trend in suit fabrics will be toward smoother, small-patterned materials. However, the rougher fabrics are still the most popular with collegians, and these will be prominent, especially at football games and other occasions where smart appearance, and at the same time a nonchalant air, is demanded.

English Lounge D. B.

As has been the case in the past, the double-breasted jacket holds the spotlight, and this season it will be seen in ever increasing numbers. The British influence is felt in one of the popular, new styles this year, the Duke of Kent long-roll double-breasted jacket. In this model the bottom button only is buttoned. To obtain its smartness it is necessary that the line from the peak of the lapel to the buttoned button be one which is smooth and unbroken. The chalk stripe in this model is finding great favor with college men. Another model, the conventional double-breasted suit, is more than holding its own. Stripes, checks, herringbones, and oversquares will be the patterns chosen. Note that in this model only the top button is buttoned to obtain the smartness which the jacket possesses.



Single Breasted Suit



Simplicity in style is the keynote of the newer single-breasted suits. The tendency of recent months has been a swing to the plain back. However, sport backs will continue to be popular for some time since college men have taken a distinct liking to them. One model featured this season is the new two-button gusset sleeve suit with two side vents. It is a suit which combines smartness and comfort. The single-breasted drape is in great demand. It is cut wide in the shoulders, and is drawn closely at the waist. In this model the English influence again comes to the fore since the drape has long been a favorite in the British Isles.

Fashions--

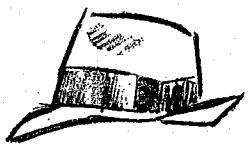
Striped Shirts

Men are becoming more and more interested in their shirts as evidenced by the extremely smart shirts which have appeared recently. Stripes and more stripes seem to be the call when the matter of shirtwear arises. Narrow, medium, and wide stripes are to be seen everywhere. One of the newest creations is the "candy stripe" shirt, available in any number of smart colors. The new, medium wide-spread collar, either starched or of the button-down type, is very popular. The button-down collar has invaded the college campus and with good reason. It meets the two requirements of a university man—style and comfort. Another shirt which will be seen a great deal this year is one with the tab collar. It is at its best in the popular English stripe, and when worn with the single-breasted drape model or the Duke of Kent jacket furnishes a very pleasing combination. Just a note on ties—stripes and more stripes.

Buck Shoes

Brown, as its popularity increases in clothing, will be widely used in shoes this fall. The brown buck shoe, which attained such great popularity on campuses last spring, has maintained its standing and will be seen in the classrooms and at the sporting events this fall. Either a leather or crepe sole is shown. The wing-tip shoe, always a favorite, is in demand this fall. It is shown in both a smooth leather and the rough Scotch grain.

The Tyrolian



Hats are to play an important part in the man's ensemble this fall. The newest innovation, and one which has caught on with the college student, is the Tyrolian hat. Its rough finish, bright feather, and conical crown make it a smart headgear. The other model ranking with the Tyrolian is the snap brim with the bound edge. It is featured in a dark brown and can be worn in a number of ways.

Up, Up, and Up

(Continued from page 8)

The balloonists will make their ascent into the stratosphere in an air-tight, metal ball which will be suspended beneath the balloon. This gondola or cabin is made of Dowmetal, a magnesium alloy lighter than aluminum. The metal shell is 3/16 of an inch thick. The globe is 9 feet in diameter and is thus larger than any of the eight spherical gondolas that have preceded it into the stratosphere. The total volume of the globe is 382 cubic feet, and when empty weighs 638 pounds.

The interior will not be fitted with a system of shelves as was the 1934 gondola. Instead, anchorage lugs or knobs will be provided on the inner surface, and from these, the instruments will be hung. This procedure will make available additional working space. A floor of metal 6 feet 8 inches in diameter extends across the bottom of the gondola 16 inches above its lowest point. Six observation portholes, covered with double thicknesses of glass, have been provided in the shell of the gondola.

The gondola is painted white inside. On the outside, the upper half of the gondola is white and the lower half black. This method of painting aids in the maintenance of a comfortable temperature inside the gondola. If the ball were entirely white it would reflect away too much of the sun's heat; if it were entirely black, it would absorb too much heat.

Extending from a point a short distance below the equator-line on one side of the gondola, midway between the manholes, is a hinged arm of Dowmetal tubing 14 feet long. This arm is kept in a horizontal position by guy cables attached to the lead ring near the top of the gondola. At the end of the arm is mounted a fan with blades 18 inches from tip to tip, with an electric motor attached. This fan, controlled from within the gondola and driven by a storage battery, will cause gondola and balloon to turn slowly, thus pointing the instruments in all directions around a vertical axis.

A newly built gigantic parachute of the round-point, triangular type, 80 feet in diameter, will be carried folded in a bag near the top of the gondola, its ropes attached to the gondola's load-ring. It is capable of slowing down the fall of the gondola, in case of accident, thus making it possible for the flyers to leap with their individual parachutes. The parachute would bring the lightened gondola and its instruments to earth without major damage.

The several hundred pounds of storage batteries which will be taken on the flight to operate instruments and apparatus can also be discarded as ballast during the down trip. To make the disposal of these batteries easy, they will be carried suspended from brackets on the outside of the gondola in such a way that they can be released from the inside. Each battery will be heavily insulated with fiber-board and probably a jacket of chemical solution to prevent the battery liquid from freezing. Cables from the batteries will lead through the shell of the gondola through specially designed plugs which will be pulled easily from their sockets by the falling batteries. Parachutes carry them slowly to earth.

In order to control the ascent and descent of the 3,700,000 cubic-foot balloon and the speeds of motion upward and downward, it will be necessary to carry on the flight approximately 8,000 pounds, or four tons, of lead ballast. This ballast will be in the form of tiny shot about the size of mustard seed. Because of air resistance, these tiny bits of lead can never reach a very high velocity in falling, and can not cause injury or damage on the surface of the earth even though they fall 13 or 14 miles. Forty bags beneath the gondola will carry from 100 to 200 pounds of shot apiece. In the middle of each bag near the bottom will be imbedded a dynamite cap which, when fired, will open the bottom of the bag and release its entire contents. These caps will be connected by copper wire with a compact firing device which can be operated both from within the gondola and from the deck on top of it. Any one of the bags can be emptied selectively, or, in case of emergency, the entire 6,500 pounds of ballast can be released in a few seconds.

Most interesting of all, however, will be the results from a successful flight, and it is hoped that these will soon be made possible. Weather conditions permitting, and old lady luck riding with them, this month should bring some important discoveries in that last frontier, the stratosphere.

Engineering Professors Stage Annual Golf Tournament

Profs. R. E. Gibbs and W. H. Richards battled it out to a tie for first place in the Annual Engineering Faculty *Blind Bogey* Golf Tournament held at the University Golf Course on Monday, Sept. 23. R. W. French shot a par 3 on the second hole and it is possible that his handicap may be reduced to a mere 50 before the next meet. Both J. V. Martenis and J. M. Bryant kept their caddies busy fishing in mud-puddles for their golf balls, and Dean O. M. Leland, intent on keeping his ball in sight, wandered off for a bath in one of the water hazards.

When the *Blind Bogey* was drawn, it was found that both Gibbs and Richards held the exact number, winning a prize of nice new shiny golf-balls.

A few of the students feel that they were "left out" when the profs failed to announce the tournament. Such a tournament would provoke a bit of interest in the student body, being one game in which the students might show the profs how to integrate properly, and, too, it might be rather interesting for the non-golfers to watch.

Following is a summary of the scores:

Name of player	Gross	Handicap	Net
J. H. Kuhlman....	105	26	79
A. B. Algren.....	114	28	86
J. V. Martenis....	104	28	76
R. E. Gibbs.....	96	21	75
H. C. T. Eggers..	132	40	92
L. C. Caverly.....	106	27	79
J. M. Bryant.....	135	43	95
R. W. French....	138	65	73
C. A. Mann.....	97	23	74
S. Lind	106	25	81
W. H. Richards...	95	20	75
W. T. Ryan.....	109	28	81
O. M. Leland.....	112	33	79

Book Store Offers Increased Facilities

In accordance with the expanding volume of business and the trend of modern business establishments to satisfy their customers to the fullest extent, the Engineers' Book Store has been enlarged and improved. The continued handling of medical supplies in addition to engineers' supplies is one of the chief reasons for this improvement in the store.

The customers' floor space is half again as large as it formerly was. The book business and supply room have been made one unit. As a result of this, the handling of books has been speeded up considerably. It is the hope of the management that the result of this entire change will be a much more efficient counter service as well as a more satisfied patronage.

At the present time the bookstore has approximately twelve hundred members and expects to have more as its business and stock increase. The dividends paid to these members this year for their last year's purchases total $5,644.95. This is equivalent to 16⅔ per cent of the price of the merchandise purchased. All profit not used for the upkeep and maintenance of the business is paid to the member in the form of dividends. The Engineers' Book Store never paid a dividend less than 15 per cent.

Prof Richardson Returns from Trip

Professor Richardson, inveterate traveler of the English staff, spent his entire summer vacation in Europe. He left the University of Minnesota on June 17 and returned Sept. 17.

The salient feature of Mr. Richardson's trip was a three weeks' cruise from Oslo, Norway, to Spitzbergen on the Norse ship *Stavangerfjord*. One of the stops was at King's Bay, which is the starting point for all Arctic expeditions. The cruise extended as far north as the ice barrier, 500 miles from the North Pole.

Aboard the *Stavangerfjord* were the Prime Minister of Norway and other diplomats with whom Professor Richardson made personal acquaintance.

Professor Richardson next visited Sweden and Finland. From the Scandinavian countries he crossed to Leningrad in Russia. He arrived at Moscow while the International Congress of Physiologists was in session. He was the guest of Dean Lyon of Minnesota, who was attending the congress.

Last year Professor Richardson spent the summer in Japan and other countries of the Orient.

A. I. Ch. E. Plans "Chemical Mixer"

The American Society of Chemical Engineers is planning an extensive program and many interesting meetings this year. Each quarter will be marked by a feature event, the first of which is a "Chemical Mixer" dance with Ralph Oace, senior Chemical Engineer, as chairman. The winter quarter event will be the second annual student-faculty dinner. In the spring quarter the society will sponsor a large picnic.

In keeping with the society's former activities there will be bi-weekly motion pictures and frequent lectures. A smoker will be held in the near future. The following are plants to which inspection trips will be made during the coming year: a linseed oil plant, a sewage disposal plant, a water purification plant, the Minnesota Mining & Mfg. Co., a packing plant, and the Waldorf Paper plant.

U Students Travel By Water in East

Sailing across half of the United States, through canals, rivers, and lakes, is the recent experience of Dick Springer, C. E. '36, Bob Springer, Eng. Pre.-Bus. '37, and Frank Haskell, from the St. Cloud Teachers College. They started from Cape Cod, Massachusetts, on July 30th of this summer, sailed down to New York harbor, thence up the historic Hudson, through the Erie canal, to Chicago via the Great Lakes.

From Chicago they passed through the Chicago Drainage Canal to the Illinois River, and then over the Hennepin Canal to St. Paul, arriving September 20th. The boat is now harbored at the St. Paul Motor Boat Club.

The 26 foot schooner, with 30 foot mast and 350 square feet of sail, was won by Dick last winter when he wrote the best essay on "Marine Finishes" in a contest conducted by the Valspar Company.

A.S.M.E. Holds Open Meeting Announces Essay Contest

Those who are interested in the student branch of the American Society of Mechanical Engineers will be glad to know that the new officers met the first week of school and discussed the society's activities for the coming year. It was decided to continue the practice of presenting interesting and well known speakers at intervals throughout the year, showing a number of instructive and entertaining moving pictures, and conducting inspection trips through several of the large industrial plants in the Twin Cities.

At the officers' meeting it was decided that a smoker and open meeting be held for all M.E. students. The smoker was given in the Minnesota Union at 8:00 p. m., October 9.

The society will be piloted this year by the chairman, Wayne Stone, who will be ably assisted by the vice-chairman, Malven Olson; secretary, Lester Miller; and treasurer, Wallace Andeen. James J. Ryan, well known mechanical engineering instructor, is the honorary chairman and faculty representative.

The national organization of the A. S. M. E. has announced the subject for the Charles T. Main award for 1936. This award will be granted to the best paper turned in on the subject "Development in the Generation and Distribution of Power and its Effect upon the Consumer."

Freshman Class Grows by 57 Men

The College of Engineering, Architecture, and Chemistry is still growing. This year there were 373 freshmen registered the first two days in contrast with 316 registered in the fall quarter last year. The aëronautical, electrical, civil, chemical, and agricultural departments boast only a slight increase over last year. The mechanicals, on the other hand, have succeeded in more than doubling their frosh enrollment. Only architecture and engineering business departments suffered a drop in freshman enrollment.

The total enrollment in the College of Engineering, Architecture, and Chemistry was not as great as it was last year. Either the upper classmen are not all coming back or else they believe in late registration. The following table gives the number of freshmen in each of the engineering colleges the first day of the fall quarter and the total enrollment:

	Freshmen (1935)	Freshmen (1934)	All other classmen (1935)
Aëro.	61	55	134
Agr.	6	3	3
Chem.	37	31	87
Chem. Eng.	80	66	182
Civil	37	33	111
Elec.	65	62	183
Mech.	70	30	157
Eng. Bus.	12	16	20
Arch.	3	18	81
Arch. Eng.	1	0	5
Int. Arch.	0	0	5
Lands.	1	2	0
Total	373	316	968

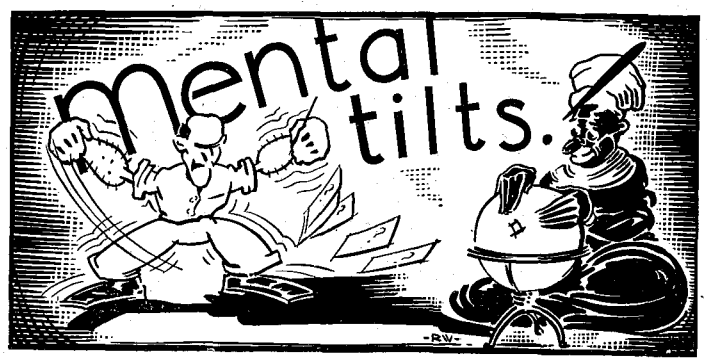
Total in the college this year... 1,341
Total last year... 1,374

New Instructors Begin Duties Here

Several new instructors made their debut before University of Minnesota engineering classes last week. Fulton Holtby is taking the position left vacant by John H. Moffett in the foundry. Mr. Holtby received his M.E. degree from Cornell in 1934. Mr. Moffett left last year because of illness.

R. C. Jones, professor of Architecture, has left to take the place of Lawrence B. Anderson at the Massachusetts Institute of Technology for the first semester. Professor Anderson will replace Professor Jones here. Professor Anderson is a graduate of the University of Minnesota where he received his B.S. degree from the S. L. A. College in 1926 and his B.S. in Architecture in 1927. He received his master's degree in Architecture from M. I. T. in 1930.

Arnold Cobb, a new instructor in steam engineering, received his B.S. (M.E.) degree from Pennsylvania State University in 1924 and his M.S. degree in 1933. From 1924 until 1931 he practised railway engineering with the New York Central Railway. From 1931 until now he has been an appraisal engineer for the American Steel and Wire Company.



After putting our brains on the rack (wracking our brains) all summer, we finally evolved, through a long and laborious process, too long to mention at present, several more or less slightly interesting technical problems. Also having saved our money on week-end nights, by listening to her radio, we again feel able to offer to the super-geniuses who come in here with 90% bull, and 10% solution, a munificent grand prix of ten dimes. We would like to offer enough to put you through college, or rather out of college, but such base, mercenary designs on your part are little worthy of a scholar and an engineer.

But getting down to brass tacks, or hard facts, we have a little problem, so simple that a freshman can work it, and if you have two or three days to spare, try it.

A Scotchman owns a horse that eats according to piece work rates. The horse demands that he be fed 7¾ kernels of grain for each foot-pound of work done. This Scotchman also has a cable, besides the horse, 80 feet long, weighing 2 pounds per foot, hanging from the edge of a cliff. If the horse winds the cable up onto a drum at the top of the cliff, how many kernels must the Scotchman feed the horse? (Sinister horse-laugh follows.)

Now another ducky little problem presents itself. We discovered a fellow last summer lying on the ground, shaking with a severe case of delirium tremens, all wrapped up in about 300 feet of cord and with a stick shattered to bits laying nearby. Approaching cautiously, we unwound him from the cord, gave him a strong bracer of red-eye, and let him talk. His rambling tale covered the good earth and the seven seas, and he finally wound up on a deserted isle, on a bottomless lake, on a forgotten continent. Here, he claims, he was digging for turtle eggs one day, and unearthed a parchment, dating back to man's first attempt at delving into the deeper mysteries of the original mathematicians. The problem follows.

If 100 yards of cord be wound in a single coil upon an upright post an inch in diameter, how much time will it take a man to unwind it, by holding one end in his hand and walking around the post (keeping the cord tight). He walks 4 miles an hour. What is the length of his path?

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The Gopher Mascot

whom you see on the seal, welcomes the freshmen and upper classmen. Our mascot asks that you look for the Seal of Acceptance displayed at the following concerns which are advertising in the **TECHNO-LOG**. Patronize these advertisers, for they have something worthwhile to offer.

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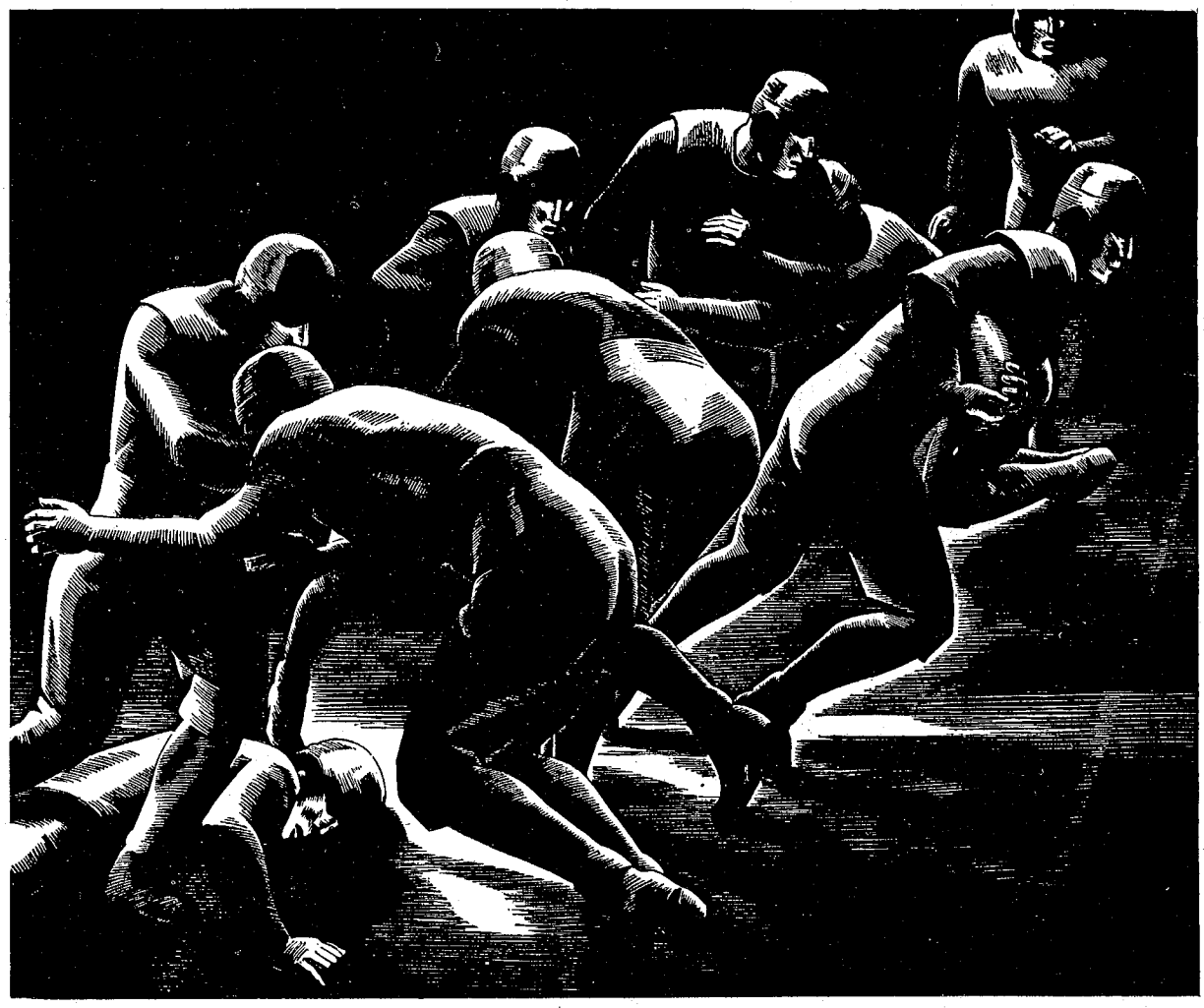

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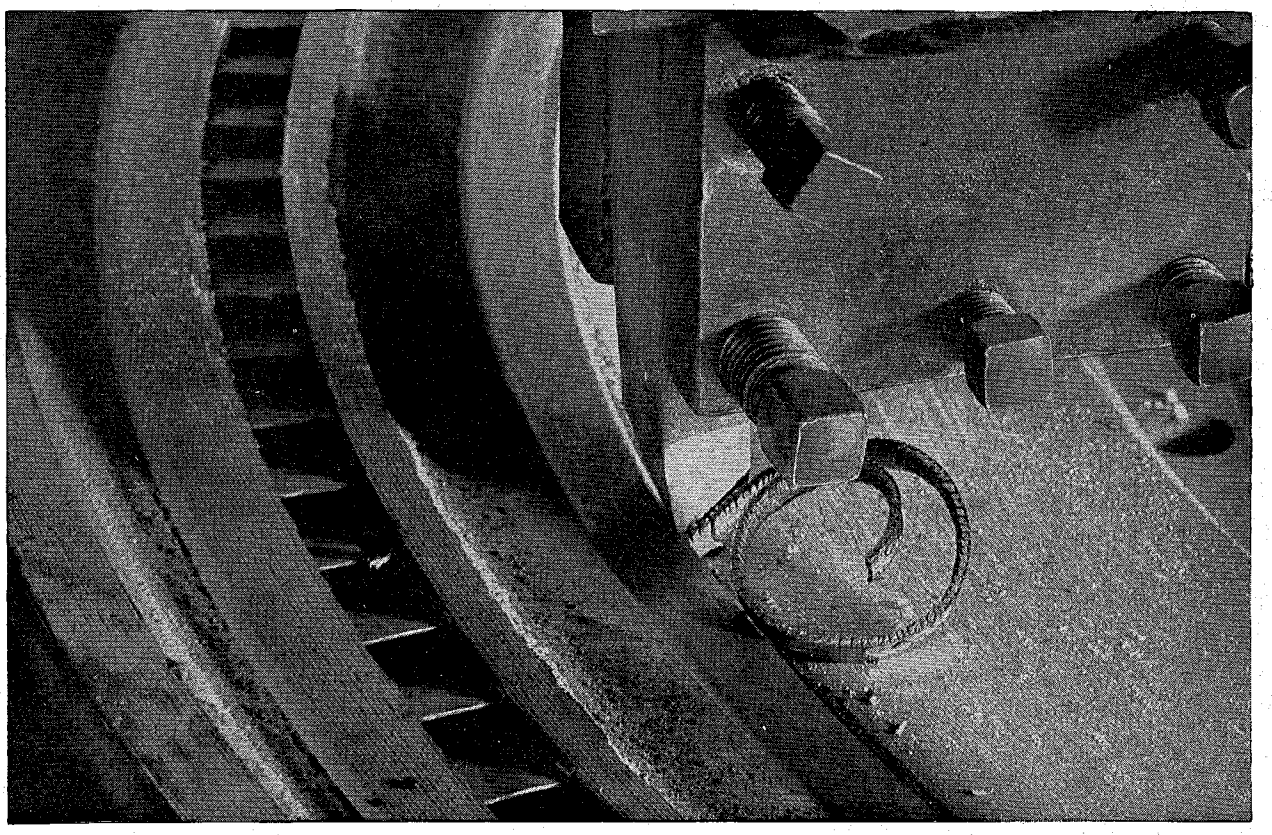

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THOUSANDS of years ago, a skin-clad workman pounded away with a cobblestone on a slab of hard rock. In a few years, that slab might be passably square and smooth.

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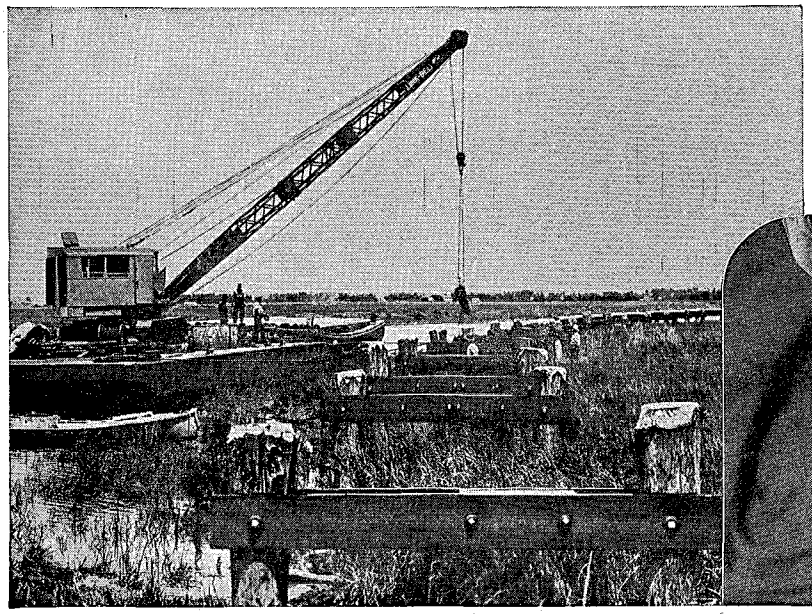

Two 10-in., one 14-in., and one 6-in. lines were laid on this trestle. Insert shows close-up of Multi-Flame Lindeweld Head in action.

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Lindewelding was used to install two 12 in. water lines, one 6 in. oil line, and one 14 in. gas line over miles of trestle. In addition, eight miles of 6 in., 8 in. and 10 in. lines were installed in the sulphur field running from the plant to the wells and other points. After installation, these lines were tested under 200 lb. water pressure . . . *without a leak!*

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MINNESOTA Techno-Log

37 ELECTRICAL BUILDING

UNIVERSITY OF MINNESOTA, MINNEAPOLIS

NOVEMBER, 1935

WAYNE STONE
MANAGING EDITOR

ROBERT DIXON
BUSINESS MANAGER

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VOLUME XVI NUMBER 2

	Page
POURING METAL	Cover
SAFETY STRESSED	26
HALF ACROSS U. S. BY WATER	28
INSTITUTE OF TECHNOLOGY	30
COONSKIN COATS	31
EDITORIAL	32
NOW HERE'S A BOOK	33
ALUMNOTES	34
STRAY SCRAPS	36
UNIVERSITY FASHIONS	37
CAMPUS NOTES	38

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Safety Stressed

in 1936 automobiles

By Donald H. Erickson, E.E.'38

ADVANCING a new era of outer grace and inner refinement, automobiles are being shown this year with few major improvements. The car buying public, however, has changed in a decided manner with new factors influencing them in the purchase of their car. We wonder what is going to be the big selling point for future years. Our idea is that SAFETY in the modern car is the answer, and not speed, power, nor any of the other killable "advantages."

E. H. McCarty, President of the Nash Motors Company, says, "Because of this tendency toward reckless driving, I am against the stressing of high speeds in automobile advertising. It is only natural that when the high speed of his car is brought constantly to an owner's attention . . . he cannot resist the temptation to use it."

So sellers this year are stressing brakes that stop, lights that don't blind, glass that doesn't shatter, bodies that don't collapse, tubes that don't blowout, tires that don't skid, lower centers of gravity, and increased ratio of glass to steel, improving the driver's vision and, resultantly, the pedestrian's chances.

Scanning the cars for individual improvements we find Nash, Hudson, and Buick leading the field. Anolite (anodized) pistons, pioneered by Buick, are a new development in alloy pistons. They are claimed equal to cast iron for wear and oiling qualities, and have the advantage of a 50 per cent reduction in weight over cast iron pistons.

Buick Takes Lead With New Pistons

The process consists of immersing the aluminum piston in a sulphuric-oxalic acid solution. It leaves a super-hard, smooth surface, providing quick heat dissipation. Oil is actually absorbed by this microscopically porous metal, and sticks to the surface providing the most efficient lubrication yet known. The new pistons reduce loads on the connecting rod bearings to the extent of increasing their life as much as 150 per cent.

The Buick motor is still valve-in-head, completely silenced, lighter, and develops more horse-power. The motor is mounted on five point rubber, others using only three. Cylinder walls, pistons, rings and pins are thoroughly lubricated by means of a constant spray of oil which is forced through a drilled opening in the connecting rod and bearing assembly.

Perhaps the most forward step in engine design in the past 10 years, the new Nash motor is a self-contained unit requiring only two castings, the cylinder block and cylinder head. Intake, exhaust and oil manifolds are cast within the block, eliminating hundreds of bolts, nuts, washers, screws and gaskets having no direct relation to engine operation. Nash springs also give evidence of competent engineering in that dampers of "Silenite" between the spring leaves give positive friction control under all weather and road conditions and make spring lubrication totally unnecessary for the life of the car. To prevent the entrance of dirt and water, springs are sealed permanently in covers of live rubber. Another ingenious arrangement is incorporated whereby full length and width beds can be made up in both the LaFayette and the Nash 400 without special equipment other than six wood blocks.

Air conditioning has been made a feature of the new Hudsons and Terraplanes, with incoming air filtered, and old air drawn out through vacuum suction. Sound insulation is notable, in that four insulating materials, all having different sound frequencies, are employed. It is claimed to be quieter than composite bodies, as it can pick up no vibration of road, engine or other units, audible to the passenger.

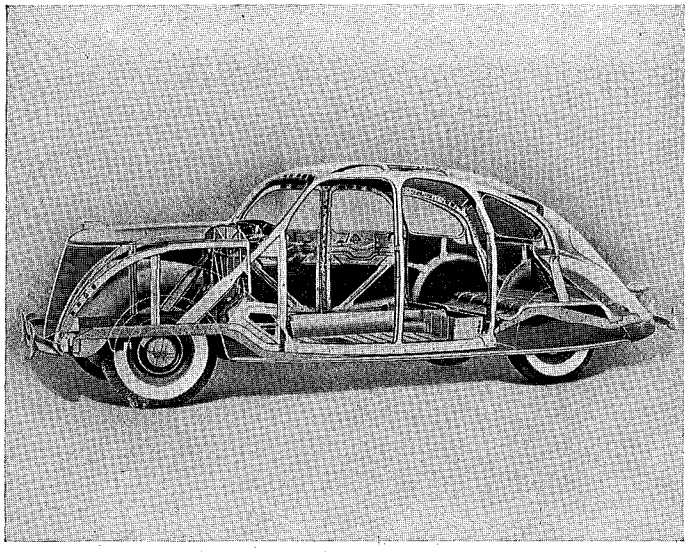
Incorporated in the two cars also is radial safety control which materially improves steering control and ease of suspension. It derives its outstanding advantages from the fact that the front axle in its rise and fall, due to the inequalities of the road, moves in a true arc of predetermined circular path, as described by a horizontal pendulum. Inasmuch as springs are freed from duties other than those of actually suspending the car, they are made softer with a slower rate of oscillation, and consequently a much higher comfort factor.

Their brakes are a noticeable feature, with each car having both hydraulic and mechanical brakes. If the former won't work, the foot pedal can be pressed a little harder and the mechanical brake will hold. Headlights are increased from 25,000 to 50,000 candle-power, with a larger angle of deflection.

Employ Hydraulic, Mechanical Brakes

Several mechanical refinements combine to reduce steering effort on the new Ford approximately 25 per cent. Rear windows are vertically hinged, increasing elbow room by three inches. Another change is the use of straight needle roller bearings on the steering arm sector shaft, so that with this addition all bearings in the gear are of the anti-friction type. The design of the mechanical brakes and other established Ford features remain the same as previously, including the use of transverse springs, front radius rods, and full torque-tube drive, as well as the cast alloy steel crankshaft, precision-set non-adjustable valves, and other Ford developments.

Oldsmobile pistons have slightly oval shape, pre-



This phantom view of the new Lincoln-Zephyr shows the frameless construction in this model. In this method of assembly the body is completed and then the motor, wheels, fenders, and other parts are fastened to it.

venting piston slap when the engine is cold. The crankshaft is equipped with a vibration damper to neutralize torsional vibration inherent in all engines. It is a small weight, resembling a miniature flywheel; and, whenever the shaft tends to twist in either direction, the small flywheel moves in the opposite direction creating a force equal and opposed to the one produced by the shaft. The Olds also has the aluminum oxidized pistons.

Radio receives a forward boost with the new Dodge coming out with all closed bodies wired for radio. The Dodge "levelator," continuing from last year, incorporates a transversely mounted steel bar, the curved ends of which are anchored to the horizontal arms of both double acting shock absorbers with the result that the car is kept on an even keel in rounding corners, in traveling over uneven roads, and the like.

Engineers' experiments for Pontiac result in changing slightly the position of the steering connecting rod, thus neutralizing brake pull with the result that the car comes to a stop tending to point straight ahead. Continuous study of knee-action suspension has pointed to a way to increase tire life through the elimination of toe-in and camber. Torsional flexing is also prevented by a new support arm. For the cooling system, a new device incorporates a spring-loaded lock which closes the passage to the vent tube until about five pounds of steam pressure have been built up. This device permits the engine to run at higher and more efficient temperatures during a greater part of its operating time.

Radio is recognized still more by Reo in that its all-steel top is constructed so as to serve as a highly efficient antenna and is insulated and fitted with a lead wire for this purpose. Their famous self-shifter is still in evidence, being continually improved upon.

Steel Top Provides Car Radio Antenna

Automatic hill holders, for incompetent drivers who stall on hills, permits the driver to use his right foot on the accelerator in the new Studebaker without running the risk of the car backing down hill.

Chevrolet's experience with knee-action is highly indicative of the public's preference for softer rides; it is continued along with changes in other items.

"We do not use anodized pistons" is a statement of Packard. They claim the combined life of anodized pistons operating in cast iron cylinders is less than the combined life of the Packard aluminum alloy pistons operating in cast iron cylinders. They also rebut steel construction with some more very sound facts. Body steel takes a permanent set; wood, on the other hand, never taking a permanent set, lags in returning to its full original position. This lag absorbs and counteracts any high pitch vibrations set up by the metal. Packard has, however, an angle-set semi-floating rear axle, permitting greater road clearance, greater headroom clearance, and lower center of gravity, but most of all, greater tooth contact, as, in effect, the hypoid type of gearing is a worm-and-gear wheel.

Plymouth comes out with an excellent motor again. They offer advice to motorists in the northern zone (temperature below 25° F.) that they should see that the fluid in their hydraulic brakes is the anti-freeze type.

A very, very excellent feature is incorporated in the new Cadillac: it is the peak load generator. Few cars allow for the increased load on their electrical systems when radios, heaters, lighters, fans, and many other accessories are being used. The Cadillac generator keeps the battery at its peak load of charge constantly. Brakes are also improved, the front wheels having larger drums than the rear to get the proper braking ratios, for, as a car decelerates, the weight tends to increase the traction of the front wheels.

Hupmobile comes out this year with a new car, containing 33 outstanding mechanical features. All helical gears and a steering gear with kick shackle to eliminate road shocks are chief among them.

This year, Lincoln gives over half its factory space to the building of a new car, the Lincoln-Zephyr. It is a new streamlined car developed from a model in the Ford exhibit at the World's Fair. It has a 110 h.p. V-12 engine, and is not a 12 cylinder V-8, as some expressed it. The car comprises an all-steel "bridge truss" body of extraordinary strength, in which the engine is mounted and to which the running gear is attached. Is very light in weight in proportion to power, thus giving it fine pick-up and performance. The Zephyr has an extremely low center of gravity, the floor being only 12 inches from the road, yet normal road clearance has been maintained, with side-sway practically eliminated.

There is no conventional hood, the top of the engine compartment, formed like an engine hatch, lifts from the front on spring balanced hinges. Many of the features formerly experimented with in the Ford V-8's are used. Much of the engine is cast in one block. The various members throughout the body structure have been designed to take compression or tension only, the top longitudinal members being in compression and the underbody and floor members in tension. Since Ford is incorporating nothing but strictly accepted and tested engineering principles, we predict success for the new Lincoln-Zephyr.

Half Across U.S. by Water

IF ANY ONE had told me a year ago that I was to travel this next summer, I would have considered it possible but not probable. If he had designated water as the medium, I would doubtlessly have retorted, "In whose canoe?" and thereafter ignored his prognostications unless he had answered, "Your own yacht," whereupon he would have felt hands upon his throat, for I hate sarcasm and was touchy about the size of the vessel with which I tried to appease my yachting desires.

However, if he had managed to gurgle that we would sail on salt water, leave New York City in a rather public manner, establish a couple of records, and then be welcomed home by a flag-bedecked fleet amid cannon salutes, seaplanes, and speeches; or if he had gasped that we would be a featured theatre attraction and I would have offered to me a large fruit ship, he would have enjoyed a short trip himself—in a padded wagon. Yet, to have treated the fellow so would have been to decry his abilities of forecast.

It was all brought about through my reading an announcement in a yachting magazine that so fired me with desire that I was willing to spend five months of experimentation, photography, and organization of material to back up several years of actual experience and prove "Why Valspar Marine Paints and Varnishes Are Best for My Boat."

With mixed feelings of wasted energy and weak hope I dropped my plainsman treatise of a salt-sea subject into the corner mailbox.

When hope had almost died there came a telegram "Congratulations . . ." which sent me looking for my brother to tell him, "Bob, we're yachtsmen now! We own a seagoing schooner!"

Then, before anyone in the family could recover from their surprise (I had somehow neglected to mention to anyone the real reason for the rather extensive paint research), we were off in the 1926 coupe furnished by Frank Haskell, the third member of the crew. Despite the company's offer to ship the boat, we were determined to sail her home.

Cape Cod, Point Judith, Block Island, names almost legends to a land-locked yachtsman, became real as we ran down the coast those first days of our voyage. How hard to describe is Long Island Sound: sunlight, white sails, and blue water; white winged bow waves and rolling wakes; fleets of tiny cats and great sloops heeled down in a warm salt breeze; schooners, ketches, yawls, cutters, and bugeyes racing or cruising everywhere; great diesel yachts, powerful fast commuters, and small motor cruisers leaving clean water trails between distant haze-trimmed shores; a great weekend fleet on the world's most famous cruising ground.

The trip up the Hudson River was pleasant, while the passage through the New York State Barge Canal (the old Erie) was educational. Every one of the thirty-five locks was a problem in hydraulics which, I must confess, was successfully thrust from our minds. However, the canal followed the scenic Mohawk River which at times helped us to forget that it was instructive and let us feel that it might be beautiful.

Cleveland, Ohio, which we reached about three o'clock one morning, almost proved to be the end of our voyage. The coal dock on the greasy, stinking river in which we lay seemed a poor berth, for every passing steamer waited until she drew alongside before trying to blast down the bridge with her whistle. The first few bellows brought my head out through the companionway with great celerity, but soon I resisted the impulse to jump—clear out.

Some sixth sense seemed to warn Frank as he pushed his head out through the forward hatch saying, "Look, Dick, this is the longest one yet."

"Yes," I replied, looking. "It seems as if they intended turning her around."

"I'm not staying in her if they do," said Frank, as we both stood in the companionway while the huge six-hundred-footer swung toward us, and as she swung we knew she would never clear.

"Bob," I said quietly at first, but he seemed to have been shocked into a stupor by the first whistle, for he slept soundly. "Bob!" I yelled, "Wake up and get out of here!" He awoke but I almost had to drag him out, so slowly did he rise from his bunk.

Finally we were on deck, then on the dock where we loosened bow and stern lines and pulled the boat astern as fast and as far as she would go. Only a few feet were allowed us, for a float, placed as strategically as if it had been planned, blocked our escape.

Meanwhile Bob ran forward to where he could almost have stepped aboard the tug swinging the vessel's great bow and yelled, "You fools! Can't you see our anchor light?"

"@§‡Σ†*%—you! I told you there was a boat there," some one on the tug patiently explained to another while the three of us stood there helplessly watching the great prow swing closer.

"They'll never stop her. I wish they had shipped the

poor little devil," I sadly remarked as the mountain swung over the spot where we had lain and down directly upon the helpless little boat. We waited to hear the crunching and popping of ribs and planking before she sank. With still apparently a few inches to go, the monster's swing was stopped and the towering black shadow backed off under her own power.

With the aid of our flashlight we found a new and safer berth below the float which had almost caused us the loss of our boat.

Through the Detroit River, black, winding, and crowded at night, the St. Clair River with its fast current, then out into Lake Huron, a good offshore wind, and bitter cold weather, we ran. Mackinac Island with its horses and bicycles instead of automobiles proved a delightful place after the cold day and night traveling through Lake Huron. Then out we ran into the Straits, more cold weather and rain squalls; into reef filled water, then the open lake. Day and night without sleep or rest, for the pitching vessel prevented that; food, too, was almost impossible to prepare.

At the helm one felt the violent action as the little boat seemed to gather herself together like a bronco and then with a jumping lunge heave her stem into the air. Below one felt thankful for the crowded snugness of the forward bunks as he found himself against the deck beams or suspended in mid-air as often as upon the kapoc. Warmth, of course, was out of the question for we spent the four days of almost freezing weather soaking wet.

"All hands!" as the man on watch found himself caught in a squall with all sails set, produced more pleasure. This call usually came after one lost consciousness from numbness or fatigue. Full consciousness usually returned as a tubfull of ice water caught one on the head while coming through the companionway. Then out one went onto the wet, slippery decks and soon was astraddle the bowsprit. Ten feet in the air one second and the next pushed through a wave, one had to find time in between to take in sail. "Man overboard!" would have been no joke in the black churning water of the night.

Thus we ran into Milwaukee where at the Yacht Club they told us of the bad storm of the past few days, pointing out a ninety-three-foot boat that had come back into the shelter of the breakwater.

After two days in Chicago we traveled down the "Sanitary Canal," the filthiest water we had been in. Luckily, it rained the first and worst sixty miles. Pity the poor sailor on a hot day!

We entered the Mississippi five miles below Davenport, Iowa, where we were royally entertained at the home of Mr. B. N. Richardson, a wealthy yachtman of that town. There, we also met the "Kaiser," so named because of his waxed, upturned mustache. He was the first hitch-hiker we had encountered. He thought the trip upriver would be nice, so since he wasn't doing anything he would be only too glad to go with us. He was not discouraged in the least by my rather sharp retort and followed us around all the next day, finally getting us to autograph our pictures in a magazine he had bought.

Up the river, then, we went, making sure of no stowaways. Going over board to shove off from an occasional sandbar proved our only difficulty.

We had heard there was to be somewhat of a reception at Winona, but we were not prepared for the sight that met our eyes. "Hot dog! Look at the crowd along the shore. It's blocks long," said Frank.

"Yes, sir! Just like Lindbergh, only different," we agreed.

"But wait," said Bob, as we approached the shore. "What are they all doing with fish poles?"

However, we were greeted by the mayor, made guests of honor at a dinner, presented by the Chevrolet dealers with a car to be used during our stay, and asked to make an appearance on the stage of their largest theatre.

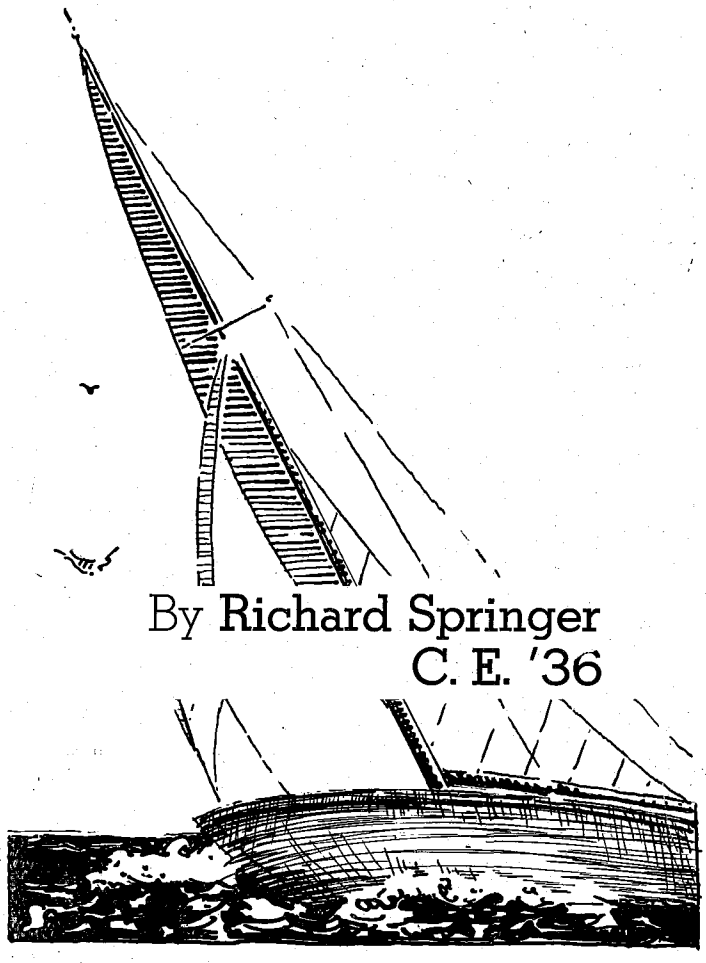
Approaching home, we were met one day by a bright red speed boat. The little racer circled us once at a forty-five-mile-an-hour clip and then pulled up alongside. Much to our amazement the pilot proved to be an exceedingly spry gentleman seventy-one years of age. We discussed the weather, boat and the river. "Yes," he said, "I sure will be pleased when they clean up the Mississippi. Why, I've got to go clear over to the St. Croix to do my aquaplaning."

At Newport where we had been told a pilot boat would meet us we heard an unexpected "Bang Bang!"

"The engine never did that before." I hung over the transom to watch the exhaust outlet.

"That's not the engine. "Look!" and around a bend came a fleet of twelve cruisers with their parade flags flying and a salute cannon barking. Low overhead roared a red seaplane.

With this colorful escort, we docked at the St. Paul Motor Boat Club, our journey ended.

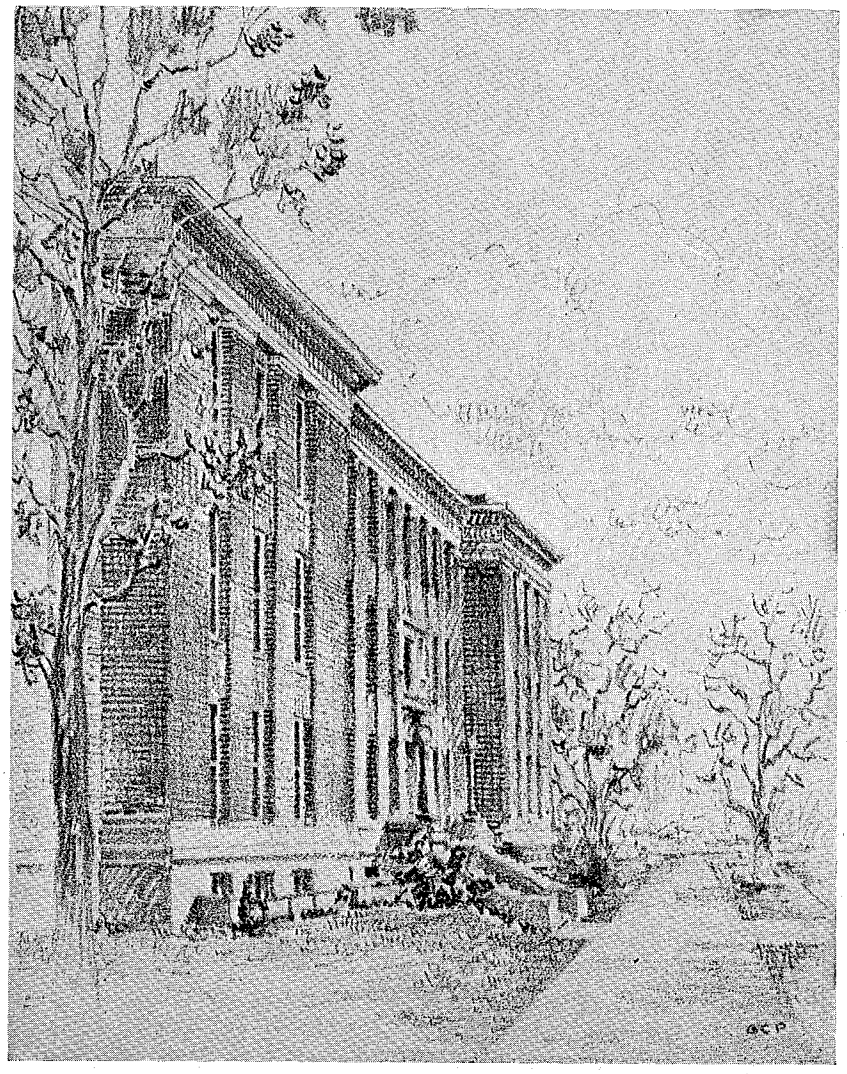


By **Richard Springer**
C. E. '36

Institute of Technology

By Frederick Meyers, Ch. E. '37

THE University of Minnesota's Engineering school has been enlarged and unified by the establishment of an Institute of Technology, which became effective on November 1. Under this plan the School of Mines and Metallurgy is united with the College of Engineering and Architecture and the School of Chemistry. Minnesota has the honor of being the first university to establish an Institute of Technology as a unit within itself.



The Main Engineering Building

In 1919 President Burton favored the creation of an Institute of Technology and the Board of Regents at that time correlated the College of Engineering, Architecture, and the School of Chemistry under one dean with the intention of including the School of Mines at a future date. The present act of the Board of Regents, brought about by an ever-increasing need, is a fulfillment of that intention, and follows the retirement of Dean W. R. Appleby from the School of Mines and Metallurgy.

Dr. S. C. Lind, chemistry professor and Director of the School of Chemistry, has been appointed Dean of the Institute of Technology. Dr. Lind assumed the Directorship of the School of Chemistry in 1926, following one year of work in the Fixed Nitrogen Research Laboratory of the U. S. Dept. of Agriculture. His first faculty position was with the Massachusetts Institute of Technology; the second with the University of Michigan. For the twelve years following he worked with the United States Bureau of Mines. Dr. Lind was born in McMinnville, Tennessee, in 1879, and received his A.B. degree from the Washington and Lee University.

Dean Lind says, "The object of the new Institute is to unify the existing technical schools and to make it easier for the technical student to take courses in related subjects. I believe, too, that simplification is one of the most important features of the Institute of Technology."

Dr. Lind will have the regular powers of a dean, such as the general administration and jurisdiction over budgets and appointments. His duties, however, will be broad and concerned with the administration of the Institute as a whole. Dean Leland has retired from the Deanship of the School of Chemistry, but will continue as the Dean of the College of Engineering and Architecture. Assistant deans to preside over the School of Chemistry and the School of Mines and Metallurgy will be chosen in the near future.

The real beginning of the engineering department of the University of Minnesota was in 1872, when the College of Mechanic Arts was established. The first separate Engineering Building was the present School of Business Administration, built in 1886. The first dean of the college was William A. Pike from 1880 to 1892. He was followed by Christopher W. Hall, of Geology, from 1892 to 1897. Between 1897 and 1902 the administration of the College of Engineering and Mechanic Arts was entirely in the hands of the President of the University, there being no dean over the college. Professor Frederick S. Jones, of the physics department, was chosen Dean of college in 1902. In 1909 Francis C. Shenehon, a graduate of Minnesota, was named Dean. Professor John R. Allen of the University of Michigan succeeded him in 1917, following Shenehon's resignation. In 1919 Luader W. Jones became the first joint Dean of the College of Engineering and Architecture and the School of Chemistry. Dean Ora M. Leland, of Cornell University, succeeded him in the following year and has acted in that capacity to the present.

Coonskin Coats and College Statistics

By **Roderick William Siler**
Assistant Professor of Mathematics

THERE is one feature missing from the football scene of 1935 whose absence grieves me greatly. I refer to the coonskin coats so prevalent back in the 1920's. Styles in college dress have always been more or less unique, and I remember when I was in school, seventy or eighty years ago, the craving was for at least one pair of pants with leather cuffs on the legs. But compared with the longing for a coon coat this desire was of course pretty feeble. These coon coats, reaching from the ears to the ankles, gave the wearer the appearance of being as wide as he was high, and when several thousand of them became agitated in unison in a college stadium during a football game it was a sight to remember. Where all these coats have gone is a mystery to me.

Anyway, the coon coat era was a gorgeous one when it was here, and I think the coats gave to college life a certain glamor in the eyes of the world. Probably this was partly due to the combats that were so frequently staged at that time by the coonskins after football games. Whether the chief cause of these affrays was the coats or just the happy spirit of the time, I don't know, but it is a fact that hardly a Saturday passed during the football season that somewhere in the country the goal posts would not be surrounded by coon coats, one half of them filled with overpowering lust to pluck up the posts and lug them home as trophies, the other half animated by a holy ardor to resist. It is one of the regrets of my life that I never saw one of these skirmishes. But a friend of mine, Minnesota '28, who took part in a struggle pro and con the goal posts, has described it to me. He bought a coonskin while in college, and has it yet, done up in mothballs, waiting for the return of prosperity.

According to my friend, fisticuffs for a man in a coon coat called for a certain technique. In the first place, there could be no thought of retreat out of a [goal post] jam for a man in a coon coat, for it was impossible to get up any speed in one of them. The result was that every combatant took his stand, drew his head as far as possible into his coat, and swung at the coonskin nearest him. The coats were a great protection to the fighters in them, so that the great effort finally became to damage somebody else's coat. Which seems to me a very sensible procedure, it being far better to receive a few honorable scars on a coonskin coat than to have a perfectly good nose dislocated. Whether or not coon coats will ever return to the college environment I cannot say, but I do think a college man would be very foolish to try to get a piece of somebody's goal post unless he had one of them on.

THERE has been an enormous mass of statistics gathered in the last few years on education. I always enjoy studying these statistics because of the pleasure I experience when I find I can get some meaning out of them. Last spring I noted that the statistical fever seemed to have attacked someone at the University of Michigan, for a statistic appeared at that time to the effect that the average Michigan student carried in his pockets two dollars and ninety-eight cents ($2.98). This is interesting, and fixes quite definitely the center of wealth in this country as being located at Ann Arbor. Discussing with a Minnesota student this enormous concentration of money in a single college town, he gave it as his opinion that there had been an error made in the printing, whereby the decimal point in 2.98 had been moved two places too far to the right. In other words, he inclined towards $0.0298 as the correct figure. He reached this conclusion after making a very careful study of financial conditions in the Minnesota College of Engineering. He took data provided by twenty men, representative men of the college, and using a five place log table found the average amount of cash on hand to have been $0.02863. This would be a pretty close check on the Michigan figures if we could get them to shift the decimal point. If they refuse to do that they stand branded as proving the unequal distribution of wealth in this country. It looks to me as if a man, always accustomed to having $2.98 in his pants pockets during his college days, is going to find it tough when he quits college, goes to work, and gets married later. The best training for the life of work and matrimony, judging from my own experience, is never to have more than $.02863 on one's person while in school. All of which simply proves what a thoroughly practical institution the Minnesota College of Engineering is.

This was about all I could draw from the isolated 2.98 statistic. However, the Michiganders, not satisfied with exposing their wealth, namely, the two-ninety-eight in everyone's pocket, went to work and figured how much Michigan men spent on beer. I discovered this last item in the Minnesota *Daily* several weeks after the 2.98. Believe it or not, but the statement was made that Michigan men spent $1478 a week on beer. I assumed this meant the expenditure of beer money by undergraduates, and not by faculty men or those studying for the Ph.D. This

(Please turn to page 36)

The MINNESOTA Techno-Log

NOVEMBER, 1935

WAYNE STONE
Managing Editor

ROBERT DIXON
Business Manager

What Do You Want?

YOUR editor and business manager recently attended the annual convention of Engineering College Magazines Associated in Philadelphia. At this convention the two vice-chairmen of the association cornered your editor and asked him to explain the secret of the TECHNO-LOG's success as a college engineering publication. Later the chairman of the association spoke to your editor and stated that "the TECHNO-LOG is slipping" and asked, "What are you going to do about it?"

These two incidents clearly illustrate two things. First, the TECHNO-LOG has, for the past several years, held a high national reputation for excellence, and second, that recently the TECHNO-LOG has been losing ground as compared with other similar publications. The TECHNO-LOG is probably as good today as it was a few years ago, but it has become stagnant. It has not enjoyed that constant improvement and growth that a healthy magazine should.

There is a definite reason for this decline. It is lack of interest. You readers are apparently not interested in your TECHNO-LOG. We never receive a comment on the magazine—not a suggestion, not even a criticism. Your editor and his staff are stumbling along blindly trying their best to put out a magazine that will please you without the slightest idea what you want in your magazine. The half-a-dozen men on the editorial staff of this magazine are trying to decide and satisfy the wishes of nearly fifteen hundred students. We can't do it. We're not mind readers. If you are not satisfied with your TECHNO-LOG, tell us what you want. Drop into the office and talk it over or write a letter. Every suggestion will be given the most careful consideration.

At the Desk

WE rather like the picture on the cover this month. Pouring molten metal is always spectacular, and this is an interesting picture of that process. The photograph was made by Harry Poague at the Minneapolis-Moline Power Implement Co.

Dick Springer had an experience last summer that has been our secret ambition for some time. He cruised in a sailboat from Cape Cod to St. Paul by way of the Atlantic Coast, Hudson River, Erie Canal, Great Lakes, Hennepin Canal, and Mississippi River. He kindly consented to tell us of his experiences and his story appears on page 28. The staff devoured it word for word. We hope you enpoy it.

The new 1936 automobile! What will it be? What has one of the most advanced and alert engineering fields to offer the public this year? Don Erickson has studied pages and pages of material direct from the individual automobile companies, viewed the new models on display in the local showrooms, and talked with the salesmen. He has written his impressions and they appear in this issue on page 26.

Did you know that you are now attending the Institute of Technology of the University of Minnesota? This important change in our school took effect on November 1. Fred Meyers, after personal interviews with Doctor Lind, the new Dean of the Institute, and Dean Leland, has told us just what this important change is and how it will operate. His article is on page 30.

We have a new columnist this month, Neil (W. Winchell) Herman. Neil is going to broadcast the doings of you and me so that all may read. Be careful what you do or Neil (Peephole) Herman will find out.

Your Representative

Did you know that you have a representative in a student governing body in this engineering school? The Technical Commission, little heard of but as sponsor of Engineers' Day, is the student government of the College of Engineering. This Technical Commission is composed of the chairmen of the technical societies; A.S.M.E., A.I.Ch.E., A.I.E.E., etc. While these chairmen are elected to their position by the members of these societies, which compose only a small percentage of the engineering school enrollment, these men do represent every man in the engineering school. They are your representatives. If you have any suggestions or any criticisms to make concerning this school, bring them to the chairman of the society of your department. Prompt consideration will be given to it at the next meeting of the Technical Commission.

Now Here's A Book

By Clifford I. Haga

Instructor in English

LAST month I promised to tell you of "a great novel." At the time I made the promise, I had not read the book, but I had read two or three reviews of it by critics in whom I have considerable faith. They had praised the book as I have seen few first novels praised; "great" was only one of the soul-stirring adjectives they used. Well, thought I, it must be great if all these fine fellows say so, and I read it. "A great novel"—fiddlesticks!

Consequently, I am more than disillusioned this month; I have not only wasted time on a book hardly worth it, but I have also lost a good bit of the respect I had for some of our better, run-of-the-mill journalistic book-reviewers. As for my readers and the promise I made them, I can reassure them that all hope is not lost. Although I cannot give you a formal eight-course dinner, I can dish up a lively picnic lunch.

A picnic lunch is perhaps an inappropriate name for it. I am afraid the principal character in the book I am going to talk about, "Life With Father," by Clarence Day, would have called picnics "low," for C. Day, Esq., was a most proper and violent gentleman who hated irregularity, informality, vulgarity, and all the other things which are at war with propriety and gentility. A violent, irascible, choleric man who never got along with anything or anyone, yet a man of charm and virtue as both his friends and family could attest. He was a gentleman by birth and breeding, an honest and industrious businessman, a good citizen, a proud and virtuous man full of all the intolerance, obstinacy, caprice, selfishness, wrongheadedness, and even cruelty that the possession of such fine qualities could engender by a sort of perverse reflex. What you will call him when you learn to know him depends upon your point of view. If you paint him black, it will be because your 1935 eyes cannot see things as he did with his 1880 eyes. For my part, I am willing to accept him on his own terms as his son does: a good and honest man with vast stores of contempt and disgust for a badly-managed world.

An earlier book, "God and My Father," most brilliantly pictures the elder Day's irritation at the ways of the world. Even God could not escape being called to account. Even in prayer, when the suppliant uttered that ageless, final cry which is at the core of every prayer, "Have mercy," it was a command to stop trifling, "Have mercy, damn it!" Such a man in a large house with wife and sons and servants seemed to invite outrage and disaster—yet he always comes out on top and with our sympathy for him increased.

Of course he was master in his own house and was served with fear and trembling. Yet, fearing his rage as they did and trembling when he roared, their wills were not always bent to his. Mrs. Day loved him too well, and he loved her; the boys admired him, and he was proud of them—and there was never an end to the pitched battles fought in that self-willed, hot-blooded family, nor was there ever any decrease in their respect for each other. After all, they were all Days.

It is Clarence Day's triumph as a raconteur that he can tell us all this and makes us share the respect he has for his father. The too-hasty characterization I have given of Mr. Day has very properly pictured him as a quite impossible person. I say "quite properly," because I am not Clarence Day. I have not his gift of casual, oblique speech, so artlessly eloquent and so truly evocative of the whole character and personality of a man. Man is not a machine; he is a spirit. And it is Clarence Day's genial talent—tolerant, amused, sympathetic—which shapes that spirit with subtle cunning. If you want to know why Clarence Day made "Life With Father" (as well as "God and My Father") a successful recapture of the breath of life, go back to an earlier book, "This Simian World." There you will find contempt expressed with wit, irritation translated into humor, rage into sarcasm, and disgust into irony. At bottom, father and son are alike. The only difference between them is that, similar though their temperaments were, the elder reacted immediately with a snort and a roar, with damns as fluent as peas poured from a sack, while the younger stoppers his emotion and allows it to exude more quietly and in a form more charmingly poisonous. Wit is not supposed to be an Anglo-Saxon heritage, but rather a Latin-French gift. Humor is our great trump card, the broad effects of the ridiculous and the hearty, rib-bursting bellow of the slapstick. Clarence Day is unique among American writers, for he combines the two—with one hand he swings the Paul Bunyan club of humor and with the other he darts, feather-light, steel-strong, the dazzling rapier of wit.

I assume, of course, that you will read all three books. I feel sorry for you if you do not—you will be missing so much.

ALUMNOTES

HOMECOMING was a reality for many of our alums, old and not so old. For those who had the opportunity of coming back for a few hours of visiting on the campus, there was many a friendly greeting of recognition and a renewal of acquaintances with old classmates and instructors.

Those who stopped in to see old friends here and there, left a bit of news that in most cases was more than welcome. Some have written to their former professors of late. Some have not been heard from at all. All in all, 'tis news that goes betwixt when old friends meet. Just what are our alums doing in the world at large?

Milton Bergstedt, Arch. '31, was married to **Beatrice Johnson,** also of that class. Beatrice was a former St. Pat's Queen. They left for Europe on their wedding journey in early September.

Ernest Knuti, engineering prelegal, spent this last year at the University of Helsinki (Helsingfors), Finland, studying Finnish law. While in Helsinki he married an American girl of Finnish descent who was a graduate of Smith college.

An M.E. '35 graduate, **Joe Kuns,** is sales representative for the Bakelite Company of New York. His territory is Minnesota, Wisconsin, North and South Dakota, and Manitoba, Canada. By the way, Joe found this job himself by a lot of persistent applications and interviews.

Here's a record. **R. R. Kelly** and **Borton Juell,** '26 civils, are working for the Public Service Company of North Illinois. Kelly has been doing sub-station maintenance work since 1930. He is married and has a boy seven years old. Came up on the "400" with about two hundred Northwestern students for our Homecoming.

George A. Maney, C.E. '11, is a professor of structural engineering at Northwestern University.

Alice Linsmayer, Int. Arch. '34, is doing interior decorating for her father.

Maynard Cooper, C.E. '34, is in the money now with the United States Air Corps at Pensacola, Florida. At least, he's in the sunshine.

Don Pung, Arch. Eng., is with the Insulite Company of Minneapolis.

The Northern States Power Company is having **Archie Stone,** E.E. '35, take a line inventory for them. Archie is making his headquarters in Eau Claire, Wisconsin.

Allen Burnett, M.E. '34, is working for General Electric on special equipment for the U. S. Navy. In charge of this work is Ray Shepherd, M.E. '30. Allen says: "I have enjoyed one of the most pleasant and undoubtedly most educational eight months of my life since coming to the General Electric Company."

Thomas G. Thornton, M.E. '33, is in the Engineering Department of the Carboloy Company. Tom says, "At the present I am going to night school taking machine shop work, with special reference to grinding practice. I've discovered that we college graduates sometimes don't know as much as we should about practical shop details." That's a good piece of advice for some of us.

Lawrence Clousing, E.E. '28, Aero E. '32, Editor of the *Techno-Log* in '28, is teaching Aeronautical Engineering at Northwestern University. Lawrence piloted a navy plane up here for homecoming accompanied by a navy lieutenant.

Eugene H. Eyster, Chem. '35, is an assistant at the California Institute of Technology.

Allen E. Martin, Chem. '35, is an assistant at Pennsylvania State College.

Of the '35 Ch. E's, **Harry G. Brown** is with the Dow Chemical Company of Midland, Michigan, and **Winston A. Churchill** is working for Procter and Gamble of Cincinnati, Ohio. **John S. Coppage** is with Firestone Tire and Rubber of Akron, Ohio. **C. Gale Patterson** is working for the Dupont-Remington Arms Company in Bridgeport, Connecticut. **Arnold F. Sward** is with the Mellon Institute (Carbide and Carbon Company) of Pittsburgh, Pennsylvania.

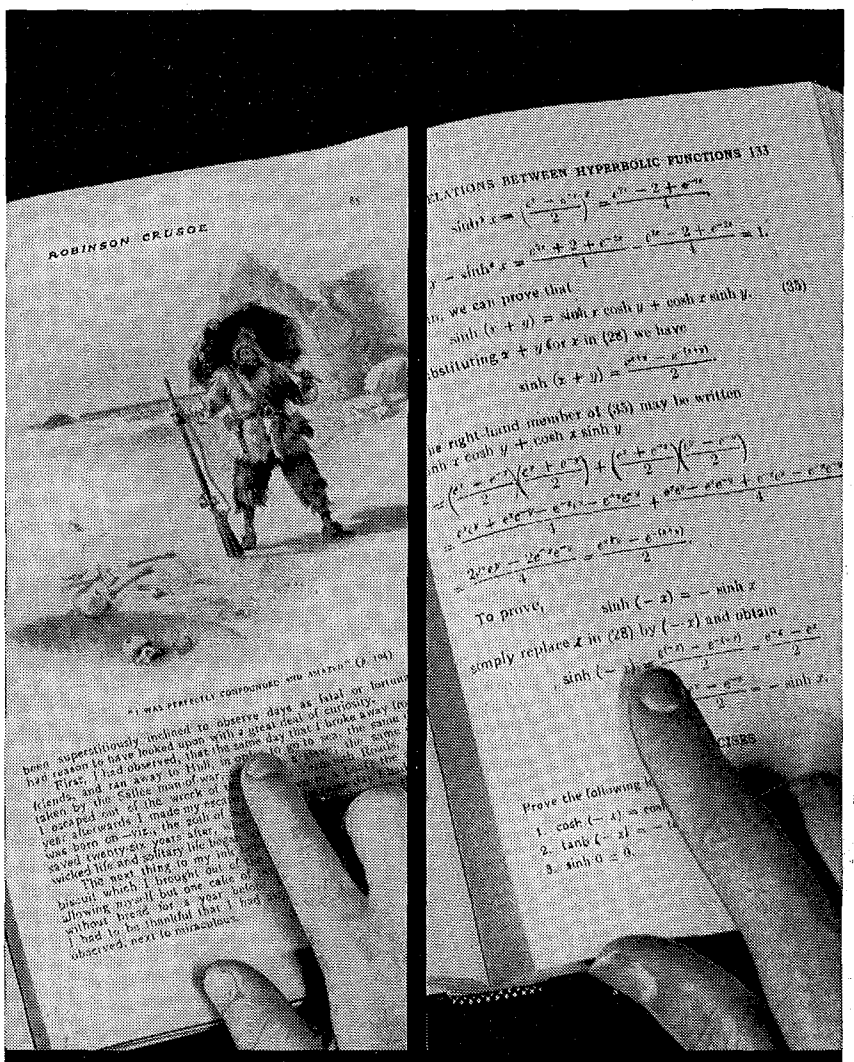
Rahland C. Zinn, Aero '34, is employed by the Pan-American Airlines and is working in their maintenance office at their Florida base in Miami.

Employment Improves

The following is the employment status of the graduates of the June class of 1934 and 1935. These data are based on information on hand at the present time. Frequently graduates fail to inform the Engineering College of their employment and as a consequence these records are only close approximations.

	1934			1935		
	No. in Class	Employed	Per Cent Employed	No. in Class	Employed	Per Cent Employed
Agricultural Engineering	2	2	100	4	3	75
Architectural Engineering	11	6	54	7	3	43
Architecture	17	10	59	14	10	71
Interior	2	2	100	3	2	66
Aeronautical Engineering	31	11	35	22	17	77
Civil Engineering	37	29	78	33	29	88
*Electrical Engineering	54	18	33	58	41	70
Mechanical Engineering	42	25	59	29	24	83
Chemistry	16	4	25	20	6	30
Chemical Engineering	27	14	52	32	23	72
Totals	239	121	50	222	158	71

*One graduate died.



You haven't stood still since 1925

. . . *neither have we*

YOU have made great progress in the past 10 years, in your reading and your study. Now let's see *some* of the things the Bell System has been doing in that time.

Since 1925, we've cut the average time for completing Long Distance connections from 7½ to 1½ minutes. We've made the service more immune to weather—94% of our wires are now in cable. We've increased the telephone's scope about 80%—you can now reach nearly 31,000,000 telephones, in every quarter of the globe.

The *next* 10 year period may bring equally important advances. That is one of the ever-present thrills in telephone work!

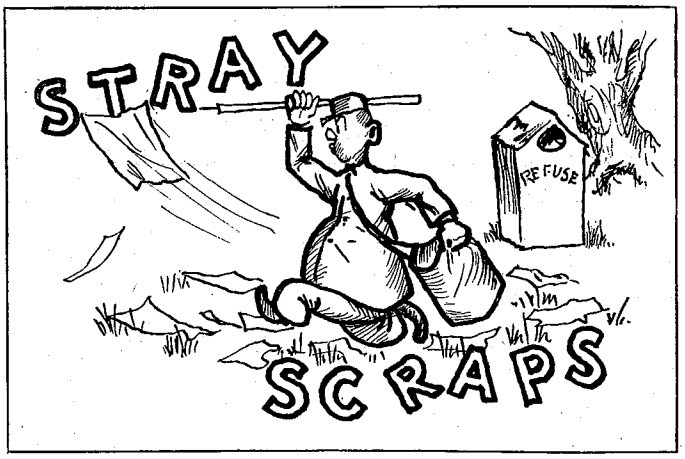
See for yourself how fast you can "go home" by telephone. Bargain rates on station-to-station calls after 7 P. M.

BELL TELEPHONE SYSTEM

Coonskin Coats

(Continued from page 31)

strikes me as a remarkable piece of statistical gathering. The citizens of Ann Arbor must spend money on beer, and just how the student beer money could have been discovered among the citizen beer money is beyond me to understand. It could only have been done through the use of 'some instrument able to detect by the feel and thickness of a nickel what sort of a man had handled it last. Anyway, being thoroughly aroused by this statistic I got pencil and paper and did some figuring. Assuming there are 5,000 male undergraduates at Michigan, this would make the average expenditure per man equal to 1478 divided by 5000, equal to $.29. Granting the Michigan boys their 29 cents a week for beer, and realizing that it is a physical impossibility for Minnesota boys to squander more than $.02863 per week for the beverage, I would suggest that this investigation be carried further by finding how the Mich. and Minn. boys compare scholastically, athletically and socially. Thus would we learn not only what is the effect of beer on education, whether good, bad or indifferent, but also what is the result of a college man constantly having on his mind two dollars and ninety-eight cents in his pants pocket. Otherwise I can't see why this last statistic was gathered.



WE got the idea the other day that some of the things that happen around and about the Engineering Campus are too good to pass unnoticed, so we have made an attempt to assemble and present them to you for your own amusement or embarrassment. All comments and contributions will be appreciated.

* * *

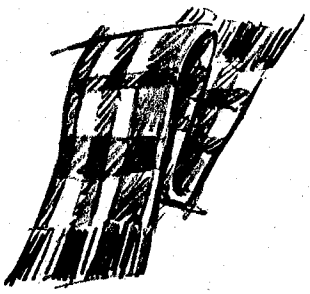
What price education? Approximately one out of every seven seniors filling out application blanks at the information desk does not know the name of the degree for which he has been studying. Do you? It is rumored that every foot of land surrounding the Federal Housing Project in north Minneapolis is secured under option by local enterprising realtors. San Francisco's fourteen hundred foot cantilever bridge span will be the longest in the world. If all the money placed in all the jackpots on all the football games on one week end were placed in the same pile it would be a lot of money—also it might provide room space for the Architectural Engineers, who are practically in the same fix as the man without a country. The difference, we are told, between a Doctor and an Architect, is that a doctor can bury his mistakes; also the difference between an Engineer and a Forester is ten credits.

* * *

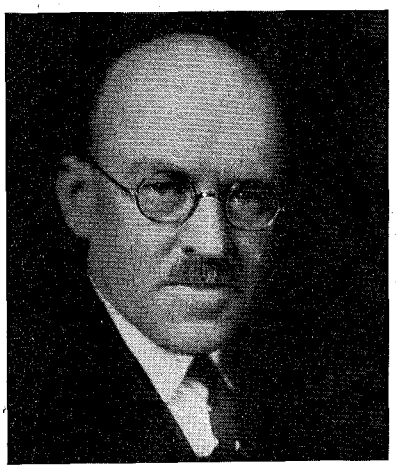
You answer these: Who is the pretty brunette giving Carl Holvick, Alpha Rho Chi heartbreaker, a run for his money along with the law school? Where Bob Aslesen found the little gal from St. Louis? What a certain Wisconsin lady sees in taking long walks with Gil (ladies' man) Bauer? Whether or not the inebriated woman, who was going about cutting off the ends of the men's neckties Homecoming night, collected enough to complete her patchwork quilt? Why it is that you can always locate an engineer at Nellies or the Larilyn? What teacher of higher mathematics wears a hat that looks as if it had been handed down for three generations, and whether a fund couldn't be established to buy hats for the math department? Also we would like to know if there is anyone who would enjoy having his home practically in the middle of a railroad yard, which was approximately the impression conveyed by a local professor, who is a prominent authority on the subject of housing?

University Fashions--

WINTRY blasts and November football days herald the entrance of the overcoat with changes in style in an article of apparel which is assumed by many to be unchanging in design or color. The university man with an eye for color will heartily approve of the bolder designs, plaids and checks, which will advance in importance this winter. This has been caused largerly by the return in fashion of the ulster. For football games, winter sports, and for town wear as well, the ulster is in great demand. One model is a double-breasted, raglan-sleeve coat with a semi-convertible collar and a two-piece half-belt. An additional feature is a deep center vent. Another ulster features a four-button double-breasted coat with large lapels and collar and a half belt. The guard's coat, named in honor of the Royal Guards Regiment, this year is regaining its popularity. For day-time wear it is very smart and as a formal dress coat for evening wear it's "top's." It is double-breasted, cut long, has a half-belt and an inverted pleat in the back. Blue is the predominating color, and practically the only one worn. The great coat, because of its comfort and room and also because it accentuates the width of the shoulders, is extremely popular with college men. One model shows a yoke back with a deep center inverted pleat running from the yoke to the bottom. It has an all around tie belt. Color and life feature the mufflers for this fall and winter season. It is quite important and necessary that there be color to the winter ensemble and the well-dressed man has turned to the muffler to add that certain sparkle. For the town ulster printed wool, wool plaid, and printed polka dot mufflers are very good. Hound's tooth checked woven wool, striped knitted wool, and crocheted silk mufflers are worn with the guard's coat, and for the great coat, printed wool, hand woven plaited wool, and printed silk mufflers are quite correct.



Flanders, National President, Visits Local A.S.M.E. Chapter



Ralph E. Flanders

On tour of student branches, Ralph E. Flanders, national president of senior branches of the A.S.M.E., visited the local mechanicals Thursday, Nov. 14. The meeting was held in the Union at 2:30 p. m., all M.E. classes being excused for the afternoon. The Minnesota chapter held one of several receptions planned for Flanders and other senior officials by chapters throughout the country.

Flanders, also head of a Vermont machine company, spoke on "The Engineer and Social Progress," and discussed recent happenings in the society's affairs.

Following the afternoon reception, many student members attended the evening dinner meeting of the senior Minnesota section at the Union. Flanders also spoke there.

Appointed to serve on the Business Advisory and Planning council by Secretary of Commerce Roper, Flanders has devoted a large amount of time and effort to the welfare of the engineering profession. With the Jones and Lamson Machine Company, Springfield, Vermont, of which he is president, he has attained a reputation as national authority on machine design and construction.

Two Technical Films Shown to A.I.E.E.

After an organization meeting and the national convention, which 5 students attended, the local student chapter of the A.I.E.E. held its second meeting October 31. Two technical films, on automatic synchronized converters and vacuum tube synchronizing equipment, followed the business meeting. The last meeting was an inspection trip, Nov. 12.

Hugh Laing, senior; Frank Parker, junior; and Wilfrid Brierley, sophomore, were appointed to the executive board. William Brastad, chairman, and Prof. John H. Kuhlman, faculty adviser, reported on the A.I.E.E. Great Lakes convention.

At the national convention, at Purdue Oct. 24, two papers were presented from Minnesota, one by Brastad on the "Aluminum Electrolytic Condenser," and the other by Cyril Baranovsky on "Radio Frequency Sidebands."

A. I. Ch. E. Holds First Meeting

The American Institute of Chemical Engineers held a smoker in the Minnesota Union at 8 p. m., November 6. The meeting was the first one this year and was well attended.

Dr. Mann gave the opening address. He encouraged membership in the A. I. Ch. E. by explaining the value of the Institute in establishing contacts and in learning facts from men in industry.

Mr. Grove, new Chemical Engineering instructor from North Carolina, gave a talk on the development of the A. I. Ch. E. at Raleigh. The chemical engineering developments of North Carolina and their relationship to his university were discussed by him. He also told of the way in which chemical engineering was represented by a state fair booth sponsored by the A. I. Ch. E. of Raleigh.

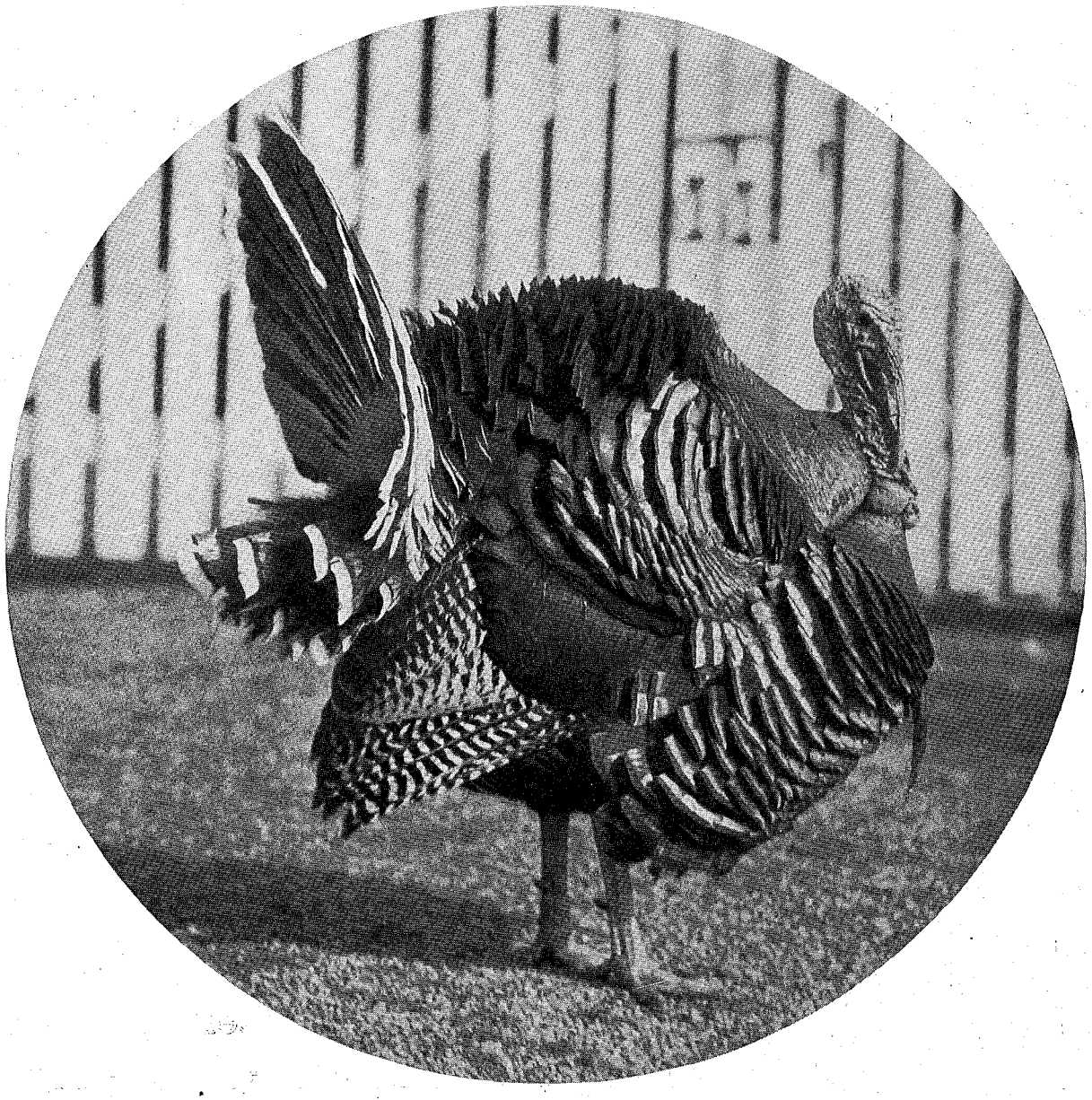
A "highly technical" movie of two negro comedians, and paper read by Willard Stinger furnished much amusement. Stinger's paper was on research of the physical and chemical properties of woman and of a kiss. Two young girls entertained the Institute by singing and dancing. They gave three numbers in costume.

Harry Cottingham, president of the local society, outlined the plans of the Institute for the year and announced plans for a chemical dance with Ralph Oace as chairman. After the program a lunch consisting of doughnuts and cider was served.

University Tests Concrete Pavement

After ten years of service, the paving on 17th Avenue S. E., by the Administration and the Engineering Buildings is being drilled and tested to determine its durability under service. This paving is made up of many different sections of concrete, each section differing from the others in the percentages of cement, gravel, etc., used.

Two samples of each section are taken by drilling out a core from the pavement with a specially designed machine. These cores are taken to the Experimental Engineering Building and are capped with a hot, plastic mixture of sulphur and lime-stone dust. After the cores have been capped on both ends to the depth of ½ inch with the lime-stone and sulphur mixture, they are placed in an oven and baked for several hours at a temperature of 270° F. This solidifies the caps and gives a flat surface to the two ends of the core, thus preparing it for the testing machine. The baked cores are taken to the compression testing machine and are tested separately for compression strength. A small scale which is attached to the machine measures the compression in pounds. The readings, together with the recorded composition of the sample, are filed away for future reference.



● THE gentleman pictured above is a great advertiser, but the results are not always satisfactory—to him.

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● WE have unusually good facilities for producing satisfactory results.

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This Quick, Convenient, Comfortable Way!

(Sample schedules from Twin Cities)

WINNIPEG—*less than 4 hours!*
Leave Twin Cities at 9:15 A. M., arriving at 1:25 that afternoon. Returning, leave at 3:05 P.M., and arrive home at 8:30 that evening.
ROUND TRIP $35.00

SEATTLE—*half a day!*
Two round trips daily. Leave here at 9:15 A.M. for 7:25 arrival that evening. Or take the overnight trip which leaves Twin Cities at 11:00 P.M., arrives Seattle next morning at 8:50. Convenient return trips, both daytime and overnight.
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CHICAGO—*commuting service!*
Three round trips daily. Leaving at 8:00 A. M., 3:50 P. M. and 8:25 P. M. Return trips arrive at Twin Cities at 9:15 A.M., 12:25 P.M., and 10:45 P.M. Less than 3 hours one way.
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NEW YORK—*less than 8 hours!*
New through service makes direct connections at Chicago with American Airlines, TWA, and United Air Lines. Example: leave Twin Cities 8:00 A.M., arrive New York (Eastern time) 4:22 that afternoon! Many other fast, convenient connections, both ways. **ROUND TRIP $116.31**

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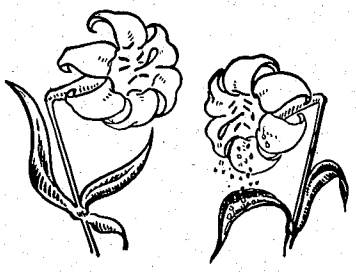
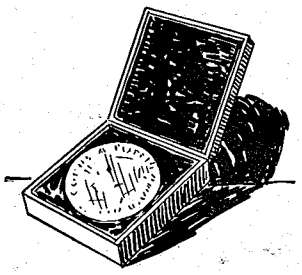
G-E Campus News



PATENTED LILIES

WHEN left to their own devices, regal lilies get themselves all spattered by yellow pollen. It's a messy business—like a man in a white linen suit spilling egg yolk all over his vest. So the florists have to watch these blooms carefully and pluck the pollen-laden anthers before they have a chance to burst.

In the General Electric Research Laboratory, C. N. Moore, Dartmouth, '05, has for years been investigating the biological effects of x-rays. Among other things, he treated 75 regal-lily bulbs with varying amounts of x-rays. Untreated bulbs of the same batch grew up normally. Among the treated bulbs, there were some monstrosities and some apparently normal flowering plants. The results were different the next season. The progeny of two of the bulbs that had received 30-second doses of x-rays produced flowers with nonshedding anthers. Each year the new strain has continued true, and the nonshedding property is considered a fixed characteristic. The Roentgen lily, as it is called, is now established as a variety of regal lily.

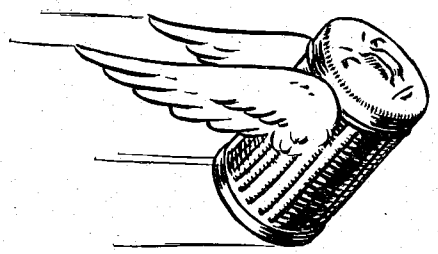


AWARD FOR COURAGE

IN the face of a difficult and serious competitive situation, the entire personnel of the Tennessee Electric Power Company, of Chattanooga, under the leadership of its president, proceeded to develop one of the most unique sales programs ever carried out by an American public utility. Every individual in the organization, regardless of position, became a salesman for the company's kilowatt output. One of the bases of this program was a substantial reduction of rates. The result was a great increase in electric-appliance sales, and a 26-per-cent increase in residential consumption.

The company co-operated in the sale of appliances with dealers, with the TVA, and with the EHFA. Its industrial department has been at least partly responsible for the location of 29 additional industries, employing 1995 workers, in the territory it serves.

For these accomplishments, the Tennessee Electric Power Company received the annual award for 1934 of the Charles A. Coffin Foundation, which was established by General Electric in 1922 in honor of its first president. The award comprises the Charles A. Coffin gold medal, a certificate, and a check for $1000 to be deposited in the treasury of the utility's employee welfare association.

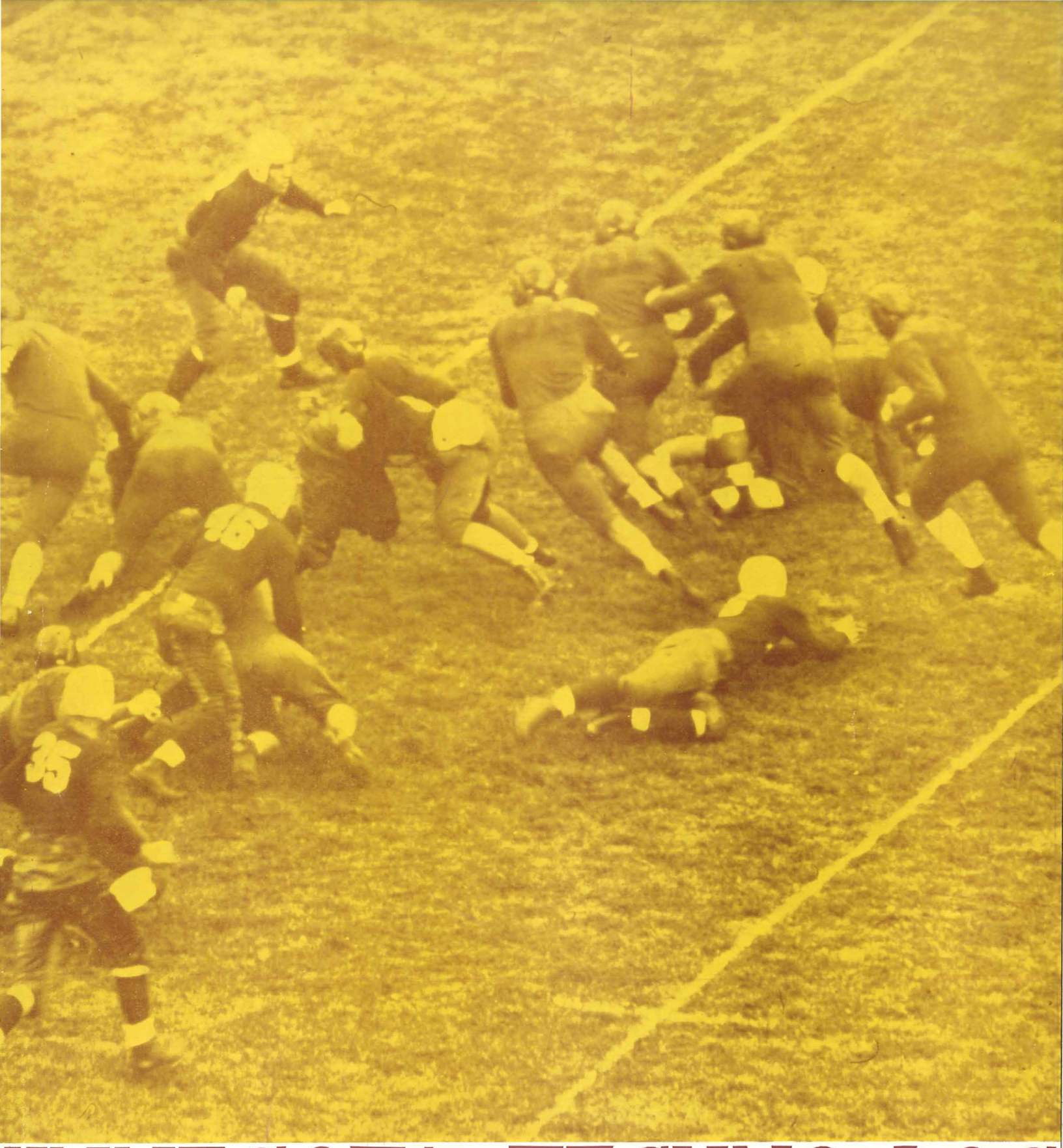


GOOD-BYE, GARBAGE CAN

THE oil furnace has placed the skids under the ash can. And now, a new device developed in a General Electric laboratory promises to do away with the garbage can. This new device, operated by a ¼-horsepower electric motor, grinds the waste food. Grinding knives made of Carboloy—a metal next to diamond in hardness—shred all types of waste food, including bones and other hard substance. The only things it cannot handle are glass and tin cans. Reduced to a fine pulp, this waste is flushed by water into the sewer.

The grinder is simple to install and operate. The entire unit weighs about 75 pounds, and may be installed under any style of sink as a part of the outlet plumbing. The hopper inlet is covered by a perforated cap, flush with the sink bottom. When the hopper is full, all one has to do is turn a handle which projects conveniently from beneath the sink. This closes the hopper and starts the grinder. In the average family, the grinder will operate not more than five minutes a day, and its average cost of operation per month will be about one-half that required for operating an electric clock.

96-179DH



MINNESOTA TECHNO-LOG

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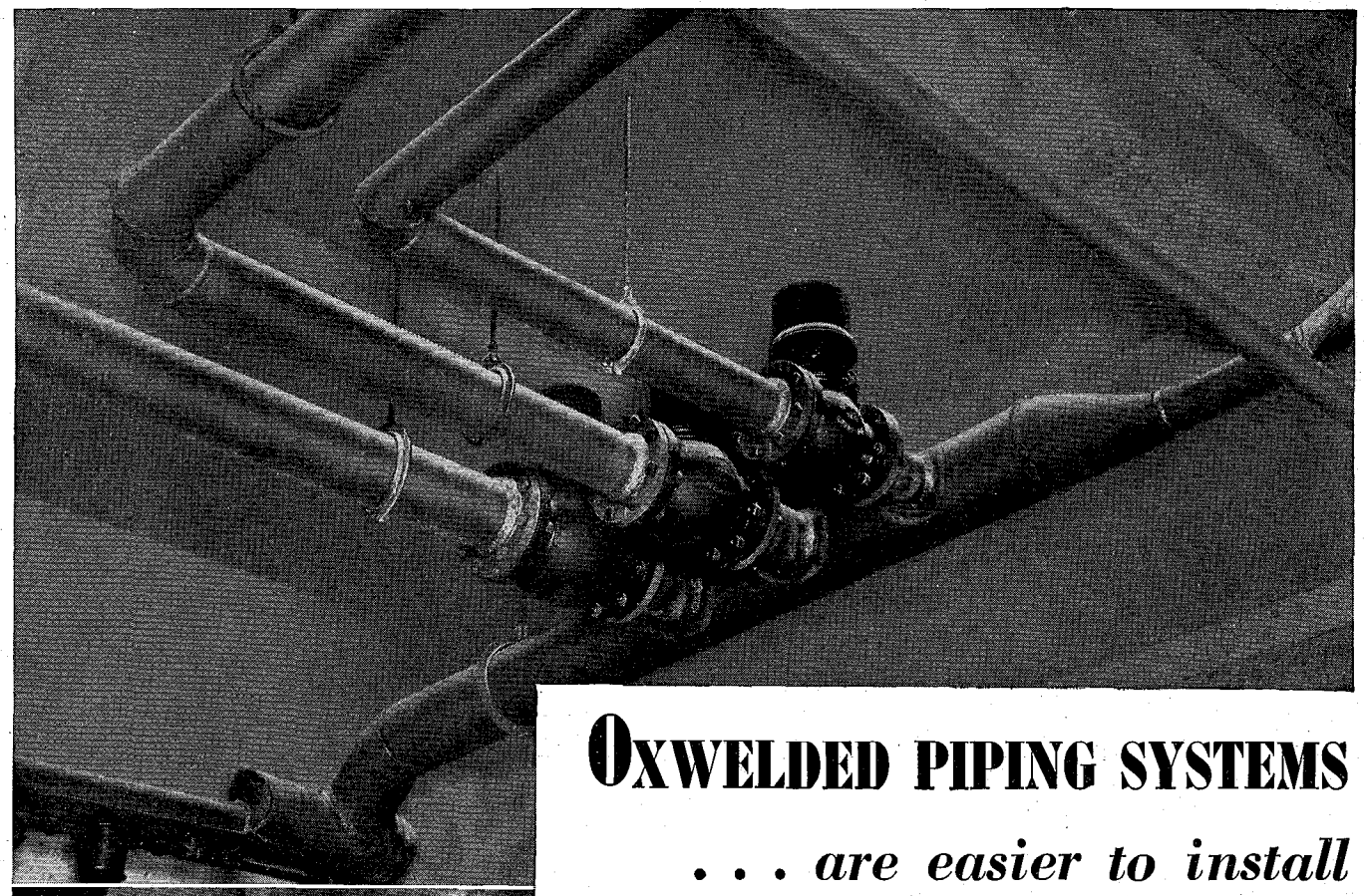
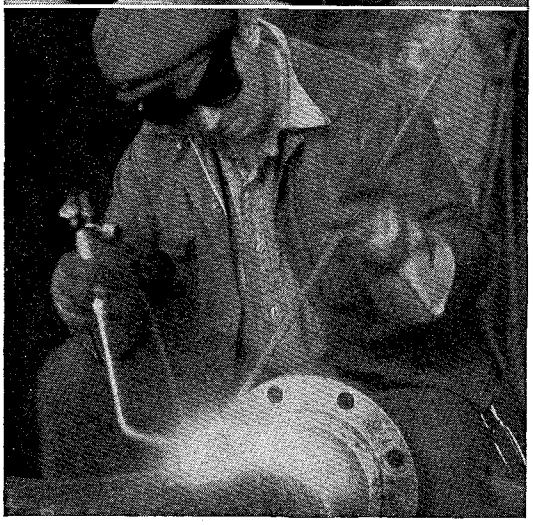
December
1935





On the installation shown above, the contractor fabricated by oxy-acetylene cutting and welding the bends, reducers, and other specials in his shop and installed them with tie-in welds on the job. The lines and bends were installed with a proximity which would have been impossible by other methods of joining. The insulation contractor estimated a 30 per cent saving on insulation labor because it was a welded installation.

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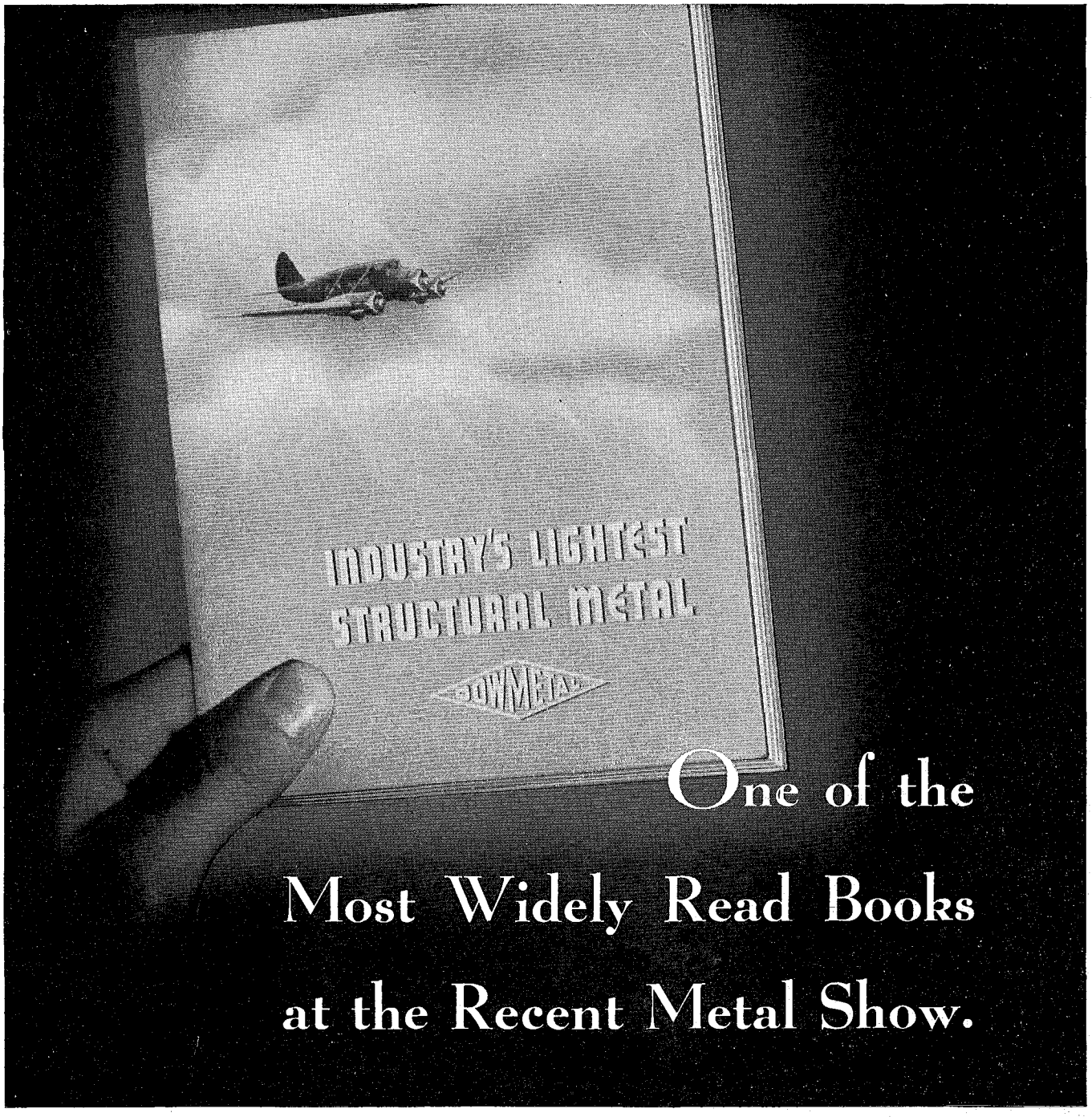

One of the Most Widely Read Books at the Recent Metal Show.

THOUSANDS of copies of this new Dowmetal book, "Industry's Lightest Structural Metal" were distributed at the National Metal Exposition held in Chicago. If you have not seen it, write for your copy. It suggests uses, discusses methods of working and finishing, and lists available forms.

New uses are being discovered for Dowmetal almost daily. When the question is "Still too heavy?" Dowmetal invariably supplies the answer to weight reduction. Much interesting and valuable information is contained in this new Dowmetal book. Most of it is non-technical.

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MINNESOTA Techno-Log

37 ELECTRICAL BUILDING

UNIVERSITY OF MINNESOTA, MINNEAPOLIS

DECEMBER, 1935

WAYNE STONE
MANAGING EDITOR

ROBERT DIXON
BUSINESS MANAGER

Published monthly from October to May inclusive by the students of the Institute of Technology of the University of Minnesota

VOLUME XVI NUMBER 3

	Page
SEVENTEEN VICTORIES	44
37½ MILES OF TUNNELS	46
THE LONGEST WAY HOME	49
USES OF THE SOYBEAN	50
EDITORIAL	52
NOW HERE'S A BOOK	53
ARCHITECTURALLY SPEAKING	54
PROGRESS	55
ISO-TOPICS	56
ALUMNOTES	58
UNIVERSITY FASHIONS	59
CAMPUS NEWS	60
STRAY SCRAPS	62
MENTAL TILTS	63
CLASSIFIED PAGE	64

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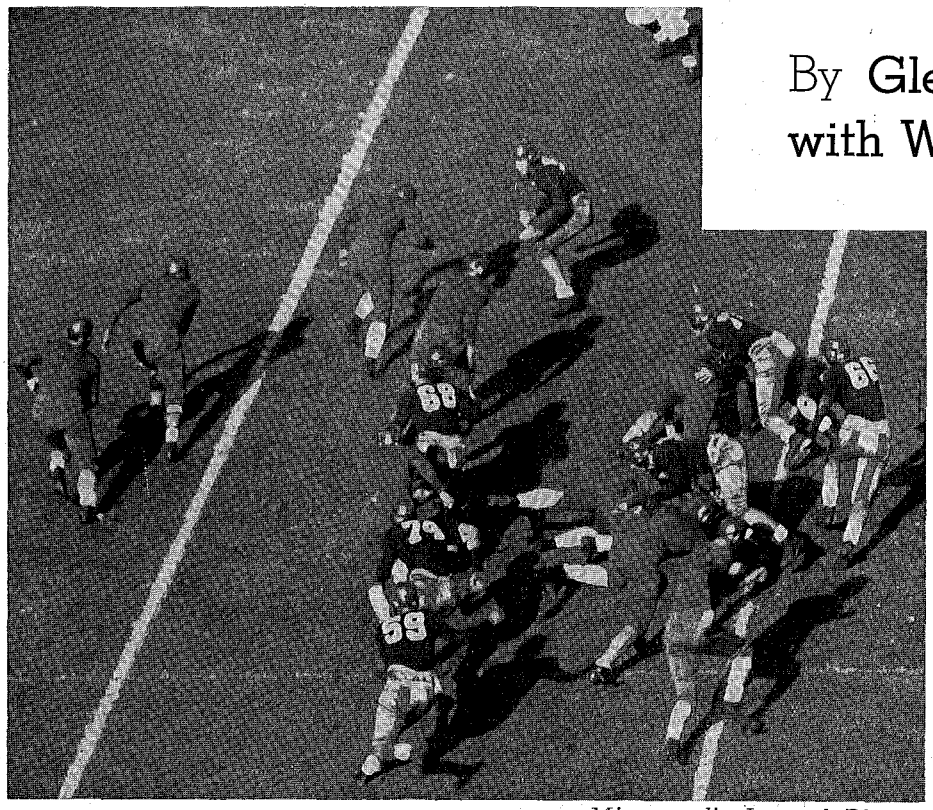
Seventeen Victories

By Glenn Seidel, M. E. '36
with Wayne Stone, M. E. '36



—Minneapolis Journal Photo.

"Hello, Glenn."

"Hello, Stone."

"Say, have you got that Steam assignment for today?"

"Yeah."

"I haven't. How the heck do you spend all your time on the football field and yet get all of your assignments in when they're due? What do you do, budget your time?"

"Sure, first football and then studies."

"It is really the fall quarter that is toughest though, isn't it?"

"Spring quarter is a little tougher I believe. Of course we do not make trips, but we have scrimmage every day, while in the fall we have only signal practice between games, so the fall quarter is really easier than the spring quarter."

"Yes, but how do you study when you come home from football practice? Aren't you tired and sleepy?"

"Some, but I am afraid that I would not be able to study if I could not get some exercise."

"A sport for relaxation—is that the idea?"

"That's right."

"It clears up the befuddled mind when it is full of calculus?"

"That's just about it."

"Say, Glenn, what does a quarterback think about while he's out there quarterbacking in front of fifty thousand spectators with sports experts and thousands of radio listeners eager to criticize his next decision?"

"We don't pay much attention to the crowd. You hear a lot of noise but don't pay much attention to whom it is for. Cheers don't mean so much—sometimes they only make it harder to hear the signals. Of course they would be missed if they were not there. The crowd seems to do something for the team to make them play better football. A game with only a few spectators would not be nearly as good as if there were a large crowd, because even though we don't consciously notice the crowd, it has an inspirational effect on the player."

"But aren't some of the players afflicted with that malady sometimes known as 'stage fright'?"

"I don't think so. It might a little the first time they get in the game. I started my first game in my sophomore year against North Dakota and I am rather hazy on the events of the whole game. It is rather like a dream. I do not know whether it was the crowd that had me scared or just the fact that I was starting a football game for a Big Ten team."

"Do you have a general plan for a game before you start it?"

"We have somewhat of a plan depending on what scouts have said that the other team will probably do, but this plan is rather sketchy and is liable to be junked at any time during the game when it appears that the plan is not working properly."

"How about the individual plays, Glenn? Are they all touchdown plays or are some of them setups for other plays?"

"Every play we have is a touchdown play. Some coaches put in plays that are not—plays, for instance, to gain only a few yards. Under Bernie's system every play is a touchdown play if properly executed. But the other team is trying to execute their defense perfectly too

—and at the same time. There are eleven men trying to make a touchdown and eleven men trying to stop it. If a majority of the offense succeed in coming through, you will get a touchdown; if the majority of defense succeed, the offense is stopped."

"What about the psychology of getting a touchdown in the first few minutes of the game? How does it affect the spirit of the two teams?"

"In 1933 we used to score in every game in the first three or four minutes, but then we would let down. Then sometimes the other team would score and we could not pep up again. If you happen to meet a team keyed up it is a good thing to score right away, because it takes the edge off from them. Last year the Iowa team was all keyed up. They were keyed up so much that they did not know what was happening. We scored right away and ran up a 34-0 score in the first half. The second half Iowa had cooled down a bit and came out and played us even."

"I suppose one of the toughest obstacles in maintaining a championship rating is the fact that every team you play has been pointing for the game with Minnesota and is keyed to the highest pitch when the game starts."

"Yes, all the teams point for the team that happens to be on top. They all want to knock the top team off from its perch."

"How do you think we compare with the East in football?"

"Of course I have lots of ideas about that. We naturally think the Big Ten competition is the toughest; however, we have played Pittsburgh and Nebraska, and they both have been plenty tough. Tulane did not seem so hard, but they had a strong team. Major Griffith mentioned recently that Big Ten teams had an average of winning about 70 per cent of all intersectional games. This indicates that the average Big Ten teams are stronger than the average teams of other conferences."

"How about Bernie Bierman, Glenn? Is he a pal or a tyrant to the players?"

"Bernie's every bit a friendly coach. He does not use profanity on the field. It's his personality that puts him across. He is quiet but he has something that makes the boys work for him."

"He ranks about top among the coaches now, doesn't he?"

"In our opinion, yes—and I think this opinion is prevalent nationally."

"Do you think it is due to his ability that Minnesota has made this football record or is it the exceptional material he has had to work with?"

"His coaching ability is of course the greatest reason for this team being on top; however, I believe that the team would be a good one under any coach. There is much natural ability on the team, but Bierman has developed and combined this ability into a championship team."

"From the stands it always looks as if the team has a marvelous ability to come through in a pinch. What causes that?"

"That is the spirit of the squad. It is something out there. When the going is tough they go a little bit harder. The tougher it is the better they like it."

"Do you think then, Glenn, that the Gopher spirit among the boys is superior to the spirit in other teams?"

"There must be other teams that have it. Take the three or four top teams—they must have that spirit. If they haven't they probably would have lost at least one game."

"What is the attitude of the boys down there when on the field? How do they act?"

"They don't do much talking. It depends on the individual a great deal. Bevan had a lot of fun but he was very serious too. Roscoe is another kind. He plays very good football but he doesn't take it very seriously. In the Tulane game whenever we took time out he was trying to convince me we should go out pheasant hunting Sunday."

"What do you think of the prospects for next year?"

"They look good to me. It looks as though we should have another championship team."

"How about the field judges, Glenn? We hear a lot about unfair judges. Are they pretty square in their decisions?"

"As a rule, yes."

"Can the judges influence the result of a game much by unfair decisions?"

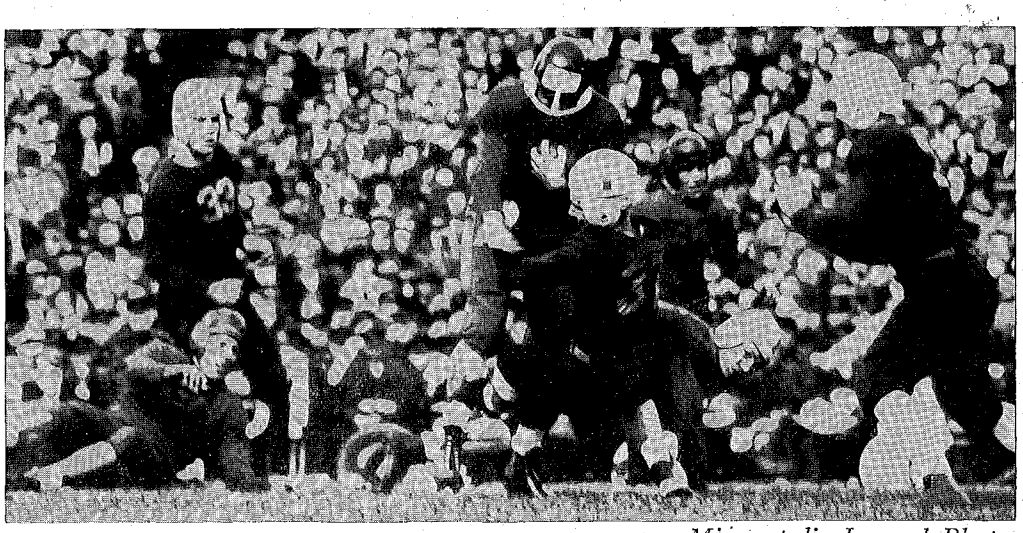
"Yes, they can make it pretty tough for a team. For instance, off-side decisions are hair-line decisions. If the judges are biased they man make it hard for a team. In fact, most decisions are hair-line decisions, like roughing and interference on passes."

"But do the decisions usually break about even?"

"Yes, if the officials are square, and most of them are."

"Are the officials friendly on the field?"

"Yes, they're human. In the Michigan game, Masker, of Northwestern, was the referee. Bernie kept shooting kids in. Gmitro would make a long run, then Thompson would run for a touchdown, then Roscoe would throw a pass and Le Voir would catch it and go thirty yards more. Just before the half Masker came running up to the sidelines. He had had to follow those boys every time they made a touchdown, and was puffing. He called in, 'For God's sake, Bierman, don't send any more of these fast halfbacks in. I am all tired out.'"



—Minneapolis Journal Photo.

37½ Miles of Tunnels

In Twin Cities Sewage Project

By Lloyd Bredvold, C. E. '37

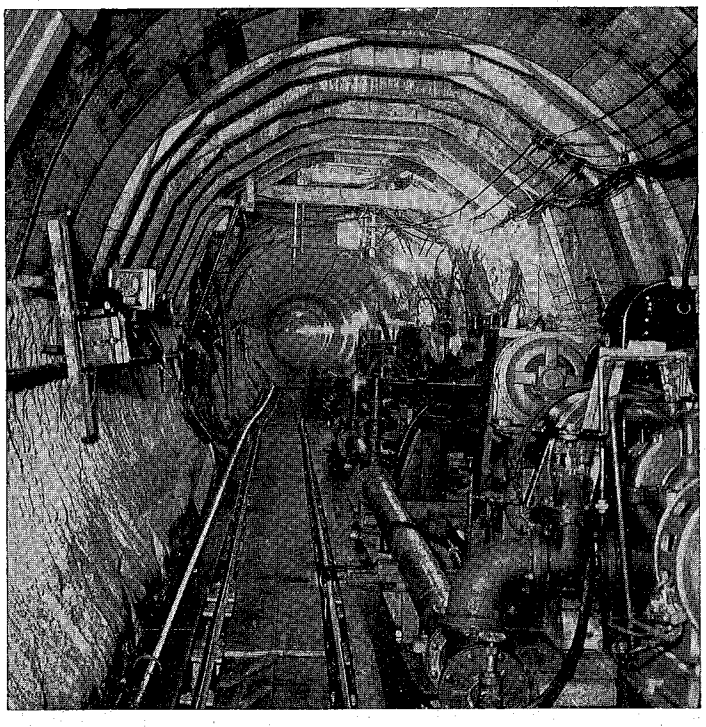
In a future issue a second article will present the layout and methods to be used at the treatment and disposal plant. The author wishes to thank Mr. C. C. Wilbur, chief engineer of the Minneapolis-Saint Paul Sanitary District, for his kind assistance in furnishing information and photographs relative to the project.

UNDER a Public Works Administration fund of $18,048,000 provided in the fall of 1933, the Minneapolis-Saint Paul Sanitary District is progressing rapidly on its immense project of providing 49,000 feet of sewage interceptors and a disposal plant to treat the sewage of the Twin Cities. The estimated total cost has since been reduced by $2,500,000 through the adoption of a new disposal treatment. To complete the system the city of St. Paul is constructing 14.2 miles of connecting tunnels for its exclusive use, and Minneapolis is building 14 miles of tunnels and 4 miles of open cut, enclosed conductors on the surface.

At the present time approximately 60 per cent of the tunneling to be used jointly by the two cities has been completed, and 88 per cent is now under contract. The disposal plant and the tunnels used jointly are constructed by the Sanitary District, while each city must provide those interceptors which it will use exclusively. The entire project is to be completed in 1937.

The progressive canalization of the Mississippi River has been making constantly more objectionable the dumping of untreated Twin City sewage into the river. Traditional rivalry between the cities prevented a joint disposal system until the state board of health in 1933 ordered that the discharge of raw sewage be stopped. In October of that year the Minneapolis-Saint Paul Sanitary District was created to take over the work of the Metropolitan Drainage Commission, and a definite plan of procedure was adopted. Construction was begun July 13, 1934, after obtaining a loan from the federal PWA, part of which was an outright grant.

Rubber-fitted booster pumps at a tunnel portal; developed for use in the hydraulic removal of sandstone muck.



The construction work under the direction of the district consists of a 9-mile trunk interceptor beginning near the Town and Country Club, at the western limits of St. Paul, and passing under the heart of the city. Comprising this section are two open-cut box sections, 2,500 and 6,100 feet long, where the tunnel grade lies near or at the surface; one 600-foot inverted siphon under the railroad tracks near Dayton's Bluff in St. Paul; and 39,570 feet of elliptical or circular (contractor's choice) tunnel having an interior diameter of 11 feet 3½ inches to 13 feet 10 inches. Nine firms hold contracts for tunnel sections, with two contracts still to be let. The average is from $300,000 to $600,000. The accepted bids have averaged 3 per cent less than the preliminary estimates.

St. Paul has 75,000 feet of interceptors to construct, all in tunnel. Varying in size and shape, the largest is a 5½-foot concrete-lined elliptical section. Built in sandstone, some of the smaller tunnels are lined only in the lower half or in the invert. This work is all done by contract.

Minneapolis, following an established practice, is doing its construction work by day labor. Its interceptor system consists of 14 miles of tunnels and 4 miles of open cut. The largest tunnels are 9½-foot elliptical, and the smallest, 3½x6 feet, all concrete-lined.

Underlying the Twin Cities is a bed of St. Peter sandstone, ideal as a material through which to tunnel. It is very stable when undisturbed, and requires a relatively small amount of support. All of the St. Paul and Minneapolis tunnels traverse this sandstone, but part of the district's tunnels lie in glacial drift (material deposited by glaciers, such as clay, sand, and boulders). The cost of driving a tunnel through this drift approximates two to three times that of a tunnel through sandstone. Whereas the standstone is comparatively stable, the drift exerts a tremendous pressure on the tunnel lining. This is aggravated by the ground water, the main tunnels running below the water level. From a geological standpoint, there have been no particular difficulties. An in-

Reinforcing steel in a 13 foot-3 inch semi-elliptical tunnel section

teresting point in the Minneapolis tunnels was the discovery of several large caves in the limestone. One of these, reported to be 600 feet long, was intersected near its roof by the tunnel, and was subsequently filled with excavated material which would otherwise have been taken to the surface.

At designated locations, shafts are sunk to the level of the tunnel, and headings are driven both ways from these shafts, which are concrete lined, 11 feet 6 inches interior diameter. The maximum depth of the tunnel from the surface is 225 feet. After completion of the tunnel, the shafts will be covered with concrete slabs and used as entrance-ways through which to lower boats to the tunnels. Periodic inspection of the interceptors will be by boat inside the tunnels.

On most of the jobs, the heading-and-bench method is used for excavation. In advancing the heading face, the first step is to undercut the face with an air saw. This is a high-pressure jet attached to a ¾-inch pipe, and may have one or more fingers. The facility with which this saw cuts a slot through apparently hard rock is amazing.

After the horizontal cut has been made, sharp-pointed air chisels cut off slices of rock which disintegrate to fine sand. As the heading advances, 3x10-inch timbers, laid flat, tightly jointed, and in five segments, are placed in the arch. They bear on a wall-plate set on the bench. Some of the contractors use semi-circular steel channel ribs carrying 2-inch lagging for roof support.

A narrow ditch is carried along the heading floor, through which the sand muck is flushed from the heading face back to a collecting pool beyond the bench, usually about 30 feet. In many cases the flow of water from seams in the rock carries the sand to the pool, but usually water from a hose is used.

The bench is advanced along with the heading progress in much the same manner as the heading. A wide shoulder is left along each wall to support the arch timbering. These shoulders are removed when the walls and floor are trimmed. At that time, 24-inch drain tiles are laid in a trench in the floor to remove ground water. In places the inflow of ground water has exceeded 4,000 gallon per minute within 100 feet of the shaft.

Contractors, taking advantage of the characteristics of the sandstone, have developed an unusual method of muck removal. The rock is easily broken down to a fine sand with air chisels, spades or by blasting; the sand is then mixed with water and can be pumped through long pipelines to the portal. Booster pumps lift the mixture to the top of the shaft, where the water drains out and the sand is loaded in trucks and hauled to the dump. Experiments with a vacuum-type steam pump proved the method feasible, and centrifugal pumps, fitted with rubber bearings, rubber impellers mounted on steel disks, and rubber-lined casings, were installed. The metal parts of the standard pumps wore out very quickly under the abrasion of the sand, necessitating the use of the rubber-lined equipment.

The pumps are rail-mounted and located at the collecting pools. They have a net capacity of 400 gallons per minute, after allowing 100 gallons per minute for water lubrication. Electrically operated, the motors used are from 30 to 50 horsepower, depending upon the length of the pipeline.

Tunneling in glacial drift differs from tunneling in sandstone in that the spoil, water-saturated clay, must be carried to the shaft in rail dump-cars or on conveyors. In one of the headings, a power shovel is used to load the cars, which are pulled to the shaft elevator by a small electric locomotive. Trucks at the surface haul the muck to the dump.

Steel liner plates are used in the tunnels through drift from the shaft at Pine and Grove Streets in St. Paul, instead of timber roof supports. These plates are bolted together through flanges, and are then blocked away from interior circular steel I-beam ribs spaced about 16 inches apart. The ribs remain in the concrete wall, serving as an addition to the standard steel reinforcement.

In the drift the tunnels are lined with 26½ inches of

reinforced concrete. In sandstone the walls are only 12 inches thick. The increased strength is necessary in the clay because the material does not have stability, and consequently creates a tremendous pressure on the lining. In sandstone the lining is steel-reinforced to allow for temperature changes and for the weight of about 15 feet of rock directly above the cut. A tunnel through sandstone tends to assume the shape of a Gothic arch, since that is structurally the most stable form for such a material. The rock between the circular section of the tunnel and the arch which it would assume would therefore bear on the lining wall, and must be supported.

The metal interior forms for the walls are placed with rail-mounted jacks. The floor or lower section of the tunnel is first placed, and then the walls and arch are filled by pneumatic guns. In the smaller Minneapolis tunnels, pumping the concrete into the forms has been very successful. External vibrators are used on the forms to increase the density of the concrete, which is hauled to the forms in small rail dump cars.

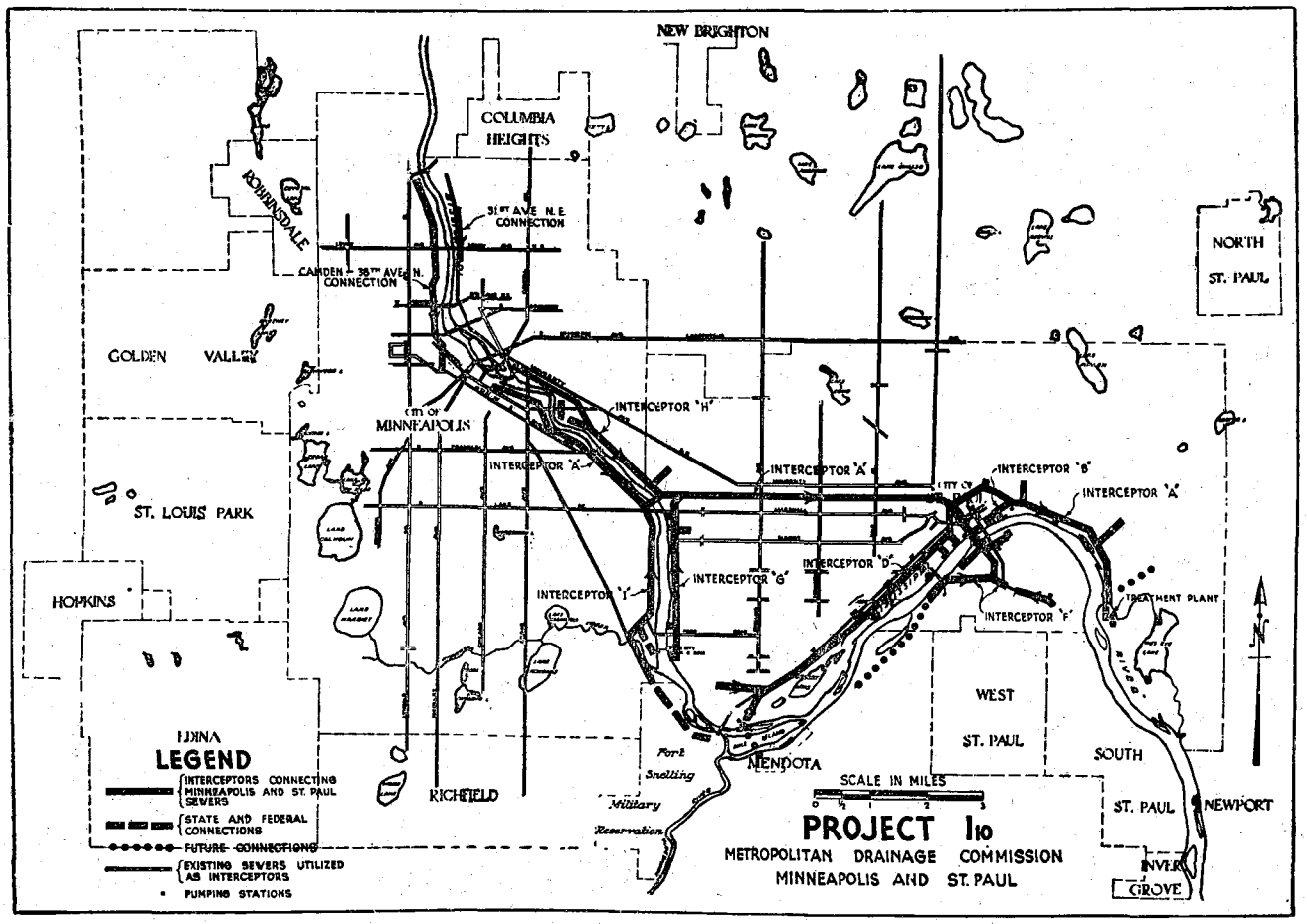
Specifications call for 3,300-pound-test concrete, with one part cement to 5½ of mixed aggregate. Water is limited to six gallons. The contractor may use whatever proportions he wishes of coarse and fine aggregate, but must meet the specifications. The concrete is about half transit-mixed and half ready-mixed.

The open-cut conduits are rectangular in cross-section, and are divided into two barrels. The inverted siphon consists of a rectangular tube divided into three barrels. This division simplifies separation of the sewage into the two complete treatment units at the disposal plant.

The grade of the main system varies from 0.45 to 0.69 feet per 1,000 feet, in the various sections, which will produce a flowage velocity of 3.7 feet per second. The volume of sewage to be handled when the system is opened will be about 100,000,000 gallons per day, divided approximately two to one between Minneapolis and St. Paul. The tunnels are of sufficient size to handle the flow until 1970, at which time the estimated volume will be 170,000,000 gallons per day. The maximum capacity of the system is 610,000,000 gallons per day, but allowance must be made for storm water. The main interceptors and the disposal plant will be permanently maintained and operated by the Sanitary District. For the first 10 years the assessments against Minneapolis and St. Paul will be based on the total property valuation of each. It will be a uniform charge upon the entire district. Subsequently the costs of operation, maintenance and repair of the sewers used jointly will be allocated in proper proportion to each city within the district on the basis of the total volume of effluent contributed by each city. Property owners and industries will be charged by direct assessment, depending upon the volume and type of sewage of each. Undoubtedly the rental charge will be handled much the same as water bills. It will approximate $1.25 per capita per year.

At the present time 2,200 men are employed on the project, with an engineering and supervisory staff of 98. The work of the Sanitary District is under the direction of C. C. Wilbur, Chief Engineer, and the sewers used exclusively are under the direction of the City Engineers, Fred T. Paul of Minneapolis and George M. Shepard of St. Paul.

The disposal system will utilize the present sewer system as feeders for the interceptors now under construction.



The Longest Way Home

By Roderick William Siler

Assistant Professor of Mathematics

A good many years ago I took a trip through England, Holland, and Belgium on a bicycle. I suffered under a delusion in those days to the effect that a man ought to know each morning where he would be that night. (I am speaking of travel, understand.) I soon realized my mistake on this ride. The way to travel on a bicycle, I found, is with the wind. If the wind is from the south at breakfast time, go north; if it reverses itself at lunch, return south. This is the method I followed, and never before did I travel so far with so little effort. Since then I have always traveled this way, and I recommend it to anyone intending to go places, whether by foot, hitch hiking, blind baggage, or in his own car.

Let me illustrate. About the first of last September I left a place called Houlton, on the eastern border of Maine, bound for Minneapolis. From Houlton I followed the Penobscot River south to its mouth in Penobscot Bay. North I then went to Moosehead Lake in northern Maine. South from there to the White Mountains of New Hampshire. North to Burlington, Vermont. Through the Adirondacks of New York and south to central Pennsylvania. North to Niagara Falls, into Canada, and on to Toronto. North to Lake Nipissing in northern Ontario. South to a place called Port Alexander on the Ottawa River. North to North Bay. And from there, for a change, I ran due west to the Soo. I did not veer north or south off this last stretch because there are practically no roads to do it on. And as it was then very near the end of September I came direct from the Soo to Minneapolis. It took me a month by this route to come from Maine to Minneapolis. For future engineers the lesson here is, when laying out transcontinental roads for travelers like myself, never to make them straight when it is possible to make them crocked.

One advantage of taking the long way home is that the traveler undoubtedly sees more. For instance, for the first time I experienced this summer life on a ferry boat in a storm. The particular ferry boat of which I speak is one that transports autos and passengers across Lake Champlain from Vermont to New York. As far as I know there are no names for the landing places of the ferry, and there is no reason why there should be, because there isn't a house in sight at either spot. When I arrived at the landing on the Vermont side I found nothing but wind, rain, and a small stand dedicated for the purpose of keeping magazines, candy bars and hot dogs from getting wet. Out on the lake nothing was to be seen but foam, fog and seagulls.

It was almost an hour before the boat appeared, coming from the New York side, and those people who have never seen a ferry boat pitch and roll in a rough sea have yet to see something. In the new era which is approaching they may streamline all ferry boats, but this one was built on the model which has prevailed in ferry boats for the last century, and was wider than she was long. This shape doesn't make for speed. Ferry boats always look to me as if they were built by the mile, and cut off in lengths as ordered.

When we started on the voyage for New York there was one other car besides mine aboard, and I parked next to the engine house, on what sailors call the lee side. This is the side where the wind is not, supposedly. But there was plenty of water and plenty of smell of gas engines. In stormy weather these ferry boats exude much gas in order to keep from sailing backwards, and what between the gas and the way the old ship kicked up her heels when the waves hit her I thought for a while I might enjoy a touch of that sickness which is supposed to be reserved for ocean voyages. My final thrill came when I paid the fare at the end of the journey: one dollar and a half. Ah this same rate per mile I later figured it would cost a man three thousand dollars to cross the Atlantic. Ferry boats may not be much for beauty, but they ought to be good providers for their owners.

Another thing I saw on my way home this summer, even more remarkable than a ferry boat on a stormy sea, was—or were—the Dionne quintuplets. Their home is just a few miles from North Bay, Ontario. At eleven o'clock of a fine September morn I saw them. Twice a day, at 11 a. m. and 3 p. m., they appear before their public, each held aloft by her nurse. A building has been put up for them, and in front of it is a great parking place for the cars which come from all over creation bringing those who want to see five little girls born at the same time of the same mother. There were scores of cars on hand the morning I was there, and there have been scores and hundreds of cars at every presentation for months past. As far as I was able to judge, the little girls look just like other baby girls. I took care to count them, and there are really five of them. Of course, everyone ought to see them who can. After all, one traveling can always see cities, rivers, mountains, oceans, and the other wonders of the earth. They last forever. But the Dionne quintuplets won't always be babies.

Uses of The Soybean

in modern industry

By Frederick Meyers, Ch.E. '37

THE soybean, once an obscure Oriental plant, has found its way into modern industry. It frequently exhibits its versatility by furnishing products which, probably, are used in a greater variety of unrelated industries than any other agricultural product. Automobile makers, paint manufacturers, food industries—all are looking toward the soybean to solve their problems and to furnish the products which will meet required specifications.

Before discussing the processing of the bean, let us consider the integral plant. The soybean has been cultivated for ages by the Chinese and Japanese. A proof of this fact is mention of the soybean in the Chinese remedy book written by Emperor Shen Nung in the year 2838 B. C. The plant is a legume which will enrich the soil in which it grows in the same manner as alfalfa and sweet-clover. By selective breeding a better bean has been developed in the United States than can be obtained from Asiatic countries. A single plant may bear as many as 300 pods. The production of soybeans has been confined largely to the southern states and to Illinois. It will, however, grow successfully in any climate in which corn can be grown, and it shows a remarkable adaptability to both wet and dry seasons. Of the great many varieties of soybeans, about forty-five are approved and handled by seed dealers. The manufacturers of oil and meal show preference toward the yellow-seeded varieties because they yield more oil and the flour made from the mash has a lighter color.

Before 1917 there were less than 500,000 acres of soybeans in the United States but by 1924 the acreage had jumped to 2,500,000. It is interesting to notice that this increase was caused, not by industrial markets, but rather by the adoption of the plant as forage. The acreage at present is about 5,000,000, the increase a result of commercial demands. It is expected that a very rapid increase in acreage will take place in the next few years.

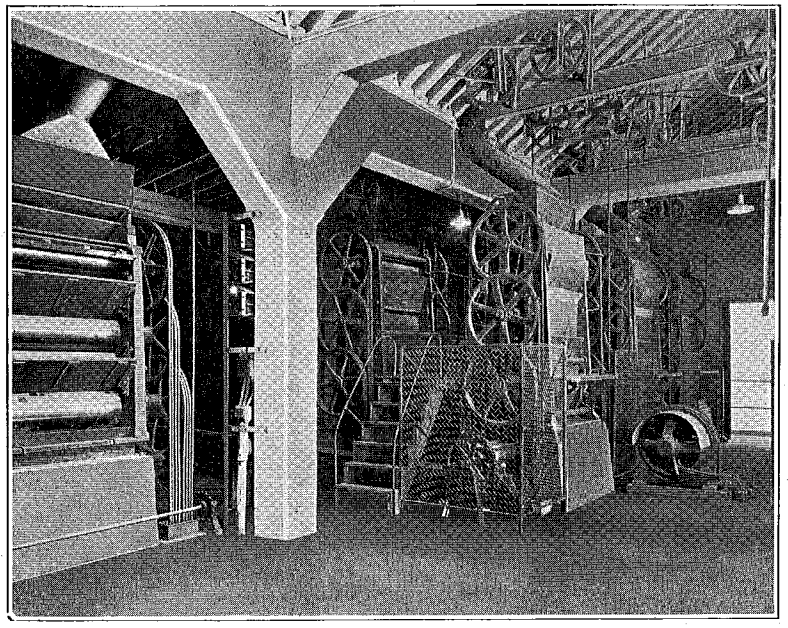
The average percentage composition of the soybean is as follows: Oil, 21%; protein, 35%; water, 9%; fiber, 5%; ash, 5%; carbohydrate, 25%. There is practically no starch present, which makes soybean food products ideal for diabetic persons. There is more protein and oil present in one pound of the beans than there is in two pounds of beef. On a price basis the protein of wheat costs 50% more, and that of beef, eggs, and milk costs 900% more than the cost of an equivalent amount of protein in soybeans. What more can the budget-minded housewife ask for!

The oil is separated from the bean by one of three processes, depending on operation costs and on the purposes for which the oil and mash are to be used. The three processes are: the hydraulic press method, the expeller method, and the solvent extraction system. In the hydraulic press method the beans are cleaned and broken in a disk huller, after which they are rolled into thin flakes. The mash is cooked and taken to the cake-former in twenty-pound batches. These batches are shaped into cakes surrounded by press cloth, and a number of them are transferred to the hydraulic press. The machine employs a pressure up to 4,000 pounds per square inch, but in spite of this enormous pressure it leaves 5% of the oil in the cake. The oil obtained by this method is especially valuable for use in the varnish industry. The mash, on the other hand, is not suitable for food without special processing because the oil and enzymes cause rancidity. This fact is one of the few disadvantages of the soybean. It is difficult to convince those who have experienced the bad effect that this tendency is now under perfect scientific control.

The expeller method provides a continuous operation in contrast to the hydraulic method, which is a batch process. The beans are crushed in the same way as previously mentioned and are dried before they are put in the machine. The beans are fed into a screw that resembles a meat grinder. The oil exudes from the beans as they are forced into the small end of a conical choke. Small particles of meal escape with the oil and must necessarily be strained out before the oil is sold. This type of

The crushing units crush the soybeans into thin flakes so as to expose the oil cells, but not pulverize the mash.

—Archer Daniels Midland Co.

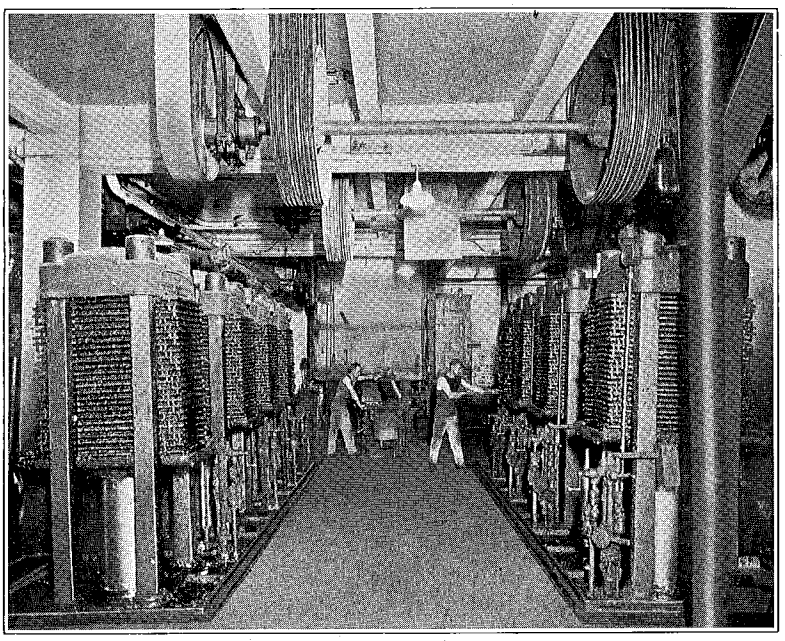


machine is more economical to operate, but leaves a greater amount of oil in the cake than does the hydraulic method.

The solvent extraction system is by far the most efficient in removing the oil, and extraction by this method is finding favor among oil manufacturers. There are a number of machines under this heading but all of them employ essentially the same principles. The three steps required are (1) preparation of the seed by cleaning and crushing, (2) dissolving out the oil with a practical solvent, and (3) distilling the solvent from the solution.

The beans are cleaned by screening out grit and foreign material, although they are usually quite clean when they are received. The crushing is accomplished by running them through a single set of large, heavy rolls. This action causes them to flatten out in thin flakes in which almost every oil cell has been broken. The solvent can now reach every particle of oil and absorb it in its passage.

Extraction is accomplished in a continuous system by spraying solvent over the mash in such a way that the mash which has been longest in contact receives a final bath of pure solvent, removing all but 1% of the oil. The oil is freed by distilling off the solvent, which is condensed and used over again.



—*Archer Daniels Midland Co.*

These hydraulic presses extract the oil from the soybean mash by forcing it through horsehair filter cloths.

Soybean oil and mash form the nucleus of many interesting products. The oil may be used in making glycerin, explosives, varnish, butter substitutes, edible oils, soap, rubber substitutes, linoleum, celluloid, printing inks, lubricating oils, and waterproofed material.

The oil must be deodorized after it has been extracted from the mash if it is to be used as a food. A steam aspirator which produces a high vacuum accomplishes this result. The "beany" flavor disappears and a smooth, good-tasting product, which will compare with the best of cooking oils, is obtained. The human body is capable of absorbing practically one hundred per cent of the oil and protein in the soybean. Besides their high calorific value and adaptability to cooking, the beans contain vitamins A, B, C and E.

Soaps which have good hard-water lathering properties may be made from soybean oil. A mixture of the oil with tallow or cocoanut oil is more easily saponified (turned into soap by treatment with alkali) than the pure soybean oil. The manufacturers obtain 9% glycerin as a by-product of soap making.

The oil has found an excellent market in the paint and varnish industry. The Ford Motor Company and General Motors are now using soybean oil as a medium for their car enamels. The oil has good drying properties and yet maintains a tough, non-chipping quality. Soybean oil is, in general, replacing linseed oil, partly because of its excellence, and partly because the soybean plant is far better for the soil in which it is grown.

A valuable by-product, lecithin, may be taken from the bean by extracting the oil with a mixture of benzol and alcohol. The lecithin is, in turn, removed from the solvent by blowing in steam. Lecithin is an emulsifying agent that finds a ready market in ice cream, malted milk, candy, and margarine industries. The soybean contains one-fifth as much lecithin as do egg yolks, which were formerly the sole source—and a very expensive one, too.

The mash left after the extraction of the oil was formerly considered a nuisance, and manufacturers were glad to sell it for a pittance to stock raisers for feed. It is now used in making breakfast foods, diabetic foods, macaroni, crackers, glue, flour, and plastics. The whole dried beans are used in making soy sauce, coffee substitute, vegetable milk, cheese, and plain baked beans—an item that is apt to be forgotten in the search for scientific uses.

Flour made from the mash must first be heat-processed in order to destroy the enzymes which cause rancidity. If the flour is stored in a dark dry place, no trouble is experienced in keeping it fresh. White bread incorporating 20% soya flour makes a good tasting, well balanced food of high nutritional value.

Strange as it may seem, salted peanuts can be made from soybeans! The beans are soaked in salt water for a day, then roasted in very hot grease. Similarly, a product resembling peanut butter may be formed. The flavor is so nearly the same that a half-and-half mixture of the two products can not be differentiated from the pure peanut butter by taste alone.

An exceedingly interesting application of the soy mash has been developed recently. Chemists have found that the soybean casein can be utilized in making a plastic by treating it with formaldehyde. A more recent development is heating the extract meal with phenol, caustic soda, and paraformaldehyde for a short time, and molding at a higher temperature. A soybean plastic resembling bakelite is used by the Ford Motor Company for the following automobile parts: horn button, gear shift ball, light switch handle, distributor base and cover, window trim strips, and other molded pieces. The plastic shows resistance to moisture and chemical action in addition to having a high dielectric strength. More than fifteen pounds of soybeans are used in the production of each Ford. This, of course, takes into consideration the oil which goes into the enamel.

The MINNESOTA Techno-Log

DECEMBER, 1935

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Extra-curricular Activities

A GOOD many engineers feel that they must choose between acquiring an education and indulging in outside activities. The overburdened do not see how they can possibly do their studying let alone accomplish things in the way of campus affairs. Yet you see these "overburdened" students wasting their time in "bull sessions" or in dreaming while they think they are actually studying. If this extra time were used in constructive work in outside activities the engineer would acquire a broader outlook on life and still would not lose the rest and refreshment that his mind requires after continuous mental effort. He would find his brain sharpened by contact with a subject which smacks of something besides engineering.

A shining example is Glenn Seidel, a man who has been able to command a football team and still get A's and B's in his studies. Is he endowed with a natural "A" mind or has he trained himself to take advantage of his time? We are inclined to believe the latter has somewhat aided his success.

Where can one find a more diversified field of activities than a university? Publications, politics, athletics, music, all may be found. To be sure, some of the activities are petty in nature, but nevertheless they are a counterpart of similar functions in society. And the outside world watches the progress of a university closely. The contacts gained through participating in these affairs sometimes go a long way in helping one get a job after graduation.

At the Desk

WE think the picture on the cover this month is a nice piece of photography of the Minnesota "power house" in action. It was made by a photographer of the Minneapolis *Journal* and loaned to us by that paper.

The first article "Seventeen Victories" was a little experiment on the part of your editor. He cornered Glenn Seidel a few days ago, and with a stenographer nearby to take down every word, asked Glenn a few questions. Here's what the steno got, on page 44.

Lloyd Bredvold didn't wander through "37½ Miles of Tunnels" to gather material for his article, on page 46, but he did walk through several miles.

Mr. Siler tells us how to travel. "With the Wind" he recommends on page 49.

Soybeans, according the Fred Meyers in his article on page 50, may be made into anything from soap to peanuts.

The Architect's page, some science news notes, Alumnotes, our regular fashion column, two news pages, Stray Scraps, and Mental Tilts complete the issue. And the editor heaves a sigh as this issue goes to press for now he must study or he will not have the Merry Christmas that he wishes you.

It May Be So—

Living in the country is nice, if you are close to a city where you can get fresh vegetables.

A scientist says women have superior minds. No man, for instance, can think up enough words to keep a phone line busy for 20 minutes.

America's duty to meddle seems especially clear if you are above draft age and are a profiteer.

That is, we sympathize with colored peoples who defend their country if you leave out the Apache and Sioux and such.

Sissy game, beneath the dignity of a he-man: Any game at which your wife can lick you.

Liquor and women really have nothing in common except their ability to help a man make a fool of himself.

Americanism: Trying a man for his life; deciding the case on the points scored by the lawyers.

Nature always provides. If you don't worry, you get fat and have something to worry about.

—*Marquette Engineer.*

Now Here's A Book

By Clifford I. Haga

Instructor in English

THIS month I have three books about which to write: Grover Loening's "Our Wings Grow Faster," Anne Lindbergh's "North to the Orient," and Jimmy Collins' "Test Pilot," all about flying and all new accessions to the Engineering Library. It is not merely because they happen to be about flying that I lump them in a single review; rather is it their diversity which prompts me to consider them at the same time. Those differences are obvious when we identify the points of view represented by their authors, and these contrasting viewpoints become significant when we note how they correspond strikingly to the different ways in which flying appeals to the large non-technical public the books are addressed to.

Briefly, one may say the three books could be summarized in a single phrase: Three Ways to Fly—Loening, Onward; Lindbergh, Around; and Collins, Up—and Down. That is to say, Loening, the engineer and sportsman, rapidly skims the history of flight from Wright to the 440 m.p.h. Italian seaplane, a history which is essentially a mechanical dramatization of Farther, Faster, Higher; Lindbergh, the amateur, casually and lightly glides from one impression to another, integrating in literary form those sensations—æsthetic, moral, romantic, poetic—by which reflection complements the single sensation of flight; Collins, the flying crank, tells tall stories and lively yarns about going up very fast and coming down even faster. Thus did the books arrange themselves in my thought, and I believe most readers will agree with me that each one succeeds in presenting vividly the many possibilities of flying as pure experience, in opposition to flying as a problem in aerodynamics or economics or politics or whatever else flying may be as well.

To compare the three books and to say this one is good, that better, and this best is quite pointless. Each reader will, of course, have his favorite, but the selection will not be made on the basis of quality as literature or as history. The selection will be determined almost entirely by the reader's predominating interest, whether in technical progress, in the pleasures of flying, or in hair-raising thrills.

For the readers whose interests are of the first group, Loening's "Our Wings Grow Faster" will be the best. Written in a rapid-fire, wise-cracking style seasoned with colorful anecdotes, copiously illustrated, and brief, very brief, Loening's book forms a stimulating footnote to the history of man's conquest of the air. It is as informal and exact as the free and easy talk of experts in an expansive after-dinner mood. The anecdotes are racy and even spicy at times, but almost invariably so pertinent and illuminating as to furnish more information than a chapter of sober exposition.

For the amateur to whom flying is largely a means to new sensations or to old sensations made keener, Anne Lindbergh's book will be the most attractive. Of the three, it is the only one with any claim to literary value and at best its style has a simple, clear elegance almost too prim to carry the reader through the well-planned recklessness of the flight from Maine to China. To say that the only reason for reading "North to the Orient" is that Colonel Lindbergh's wife wrote it is a double injustice, first to the wives of heroes in general, and second to Mrs. Lindbergh in particular. If there is any meaning in the phrase, "the feminine point of view," this book warrants its use.

For the thrill seeker, whose sensations must be reinforced by sensationalism before experience can become satisfying, Collins' "Test Pilot" will be the most interesting. Although the Sunday supplement flavor is strong here, the experiences are real and the manner of their telling is authentic. A test pilot does many things as a part of the day's work, but, whatever may be the words of his contract with the airplane manufacturer, he is paid for doing just one thing—risking his neck. The neat fatalism of the daredevil is strong meat and Collins serves it rare. His last chapter, in its contrast with the gaiety of the rest of the book, is particularly impressive.

As far as I am concerned, the three books were equally interesting and I read each one at a sitting. To say that one reads a book at a sitting may sometimes be more a compliment to the upholstering of the chair than a favorable judgment of the book—but not this time, for I can't remember the chair I was sitting in. Or was I even sitting? Perhaps I was flying—flying with Loening, the Lindberghs, Collins.

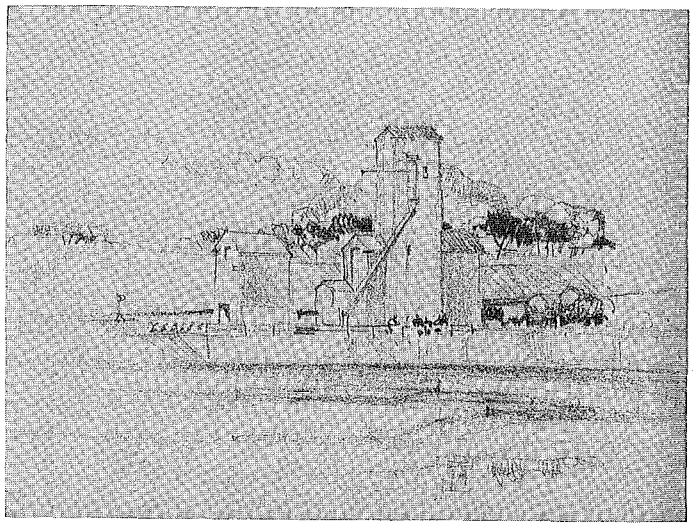
Architecturally Speaking

Advice for Freshman —— And Others.

ARCHITECTURE is a funny thing. It is the strangest combination of incongruous elements, being at once an art, a science, and a business. So, a grasp of the profession demands a grasp of a great many subsidiary trades, professions, rackets, etc.

I hope I don't sound pompously academic when I say the freshman year in Archtitecture is one of the best of the five because there is so little architecture to interfere with one's laying down a base for the wide background so necessary for a proper appreciation of architecture itself. The background, of course, goes on forever. One has time for what is known as culture—"good" reading, art, music, genteel tippling, development of social ease and small talk—all the little things one finds so handy. The campus opportunities alone are numerous. Reading—for instance, the Arthur Upson Room in the Main Library. This room is for recreational reading only—a grand place, quiet and luxuriously comfortable. Art—the Little Gallery in Northrop Auditorium is one of the better intimate galleries. Off the campus you have the Minneapolis Art Institute and the Walker Gallery with its marvelous jades. Music—foremost, of course, are the concerts of the world famous Minneapolis Symphony orchestra, both on Friday evenings and more economically on Sunday afternoons. There are also the various concerts, usually free, of the Music Department and the excellent disk programs of the University Radio Station, WLB. For the other things, I leave you to your own devices. It is an appreciation and understanding of all these things, and many more, that gives one some realization of the place of architecture in the artistic cosmos, a realization that it is really something beyond snappy draftsmanship and rendering.

So much for the general side of the matter. As to the specific side, when you are plunged suddenly into the complex thing called Design, you will want to have some knowledge of both the theory and practice of it. The theory is on tap in large amounts in the Architectural Library. Now, in your first year, when you have the time, get to know the books and magazines it contains, what is in them and just where it is. There is a lot of interesting stuff in that room and the more of it you ferret out the better off you will be. A good working knowledge of the Library is one of your greatest assets. Don't stop at the pretty pictures, read some of the books, too. They won't bite.



The above sketch, "Industry -- 1935" by Robert Auvinen, is an excellent example of extra-curricular outdoor sketching of subjects not related directly to work in the classroom.

Of course, you need practical knowledge, that is, drawing and rendering, and plenty of it, to graduate. So I would suggest spending some time in the drafting rooms. Watch the problems going through the mill—no one will mind. Study the problems on exhibition; try to determine why the designer did what he did and whether it is any good or not. Going to the general crits is a good habit. These are meetings at which one of the jury tells why they did what they did and points out the good and bad qualities in each projet. And if possible "nigger" on the problems. This consists of helping the designer in the mechanical work of drawing his projet up and rendering it. Working this way alongside, and under the direction of a more experienced man is about the best way to pick up the innumerable little tricks of the trade. Even merely watching some one draw and render helps a lot.

I hope this short discussion will help you in orienting yourselves in the school and, in a general sort of way, in architecture. —*G. W. B.*

"never-ending Progress to perfection"

Memory Experts

RELAYS that "remember" are being used on the main-line electrification of the Penn Railroad between New York and Washington. Although the trolleys are protected by numerous circuit breakers, which have impulse, or rate of rise, tripping, and G-E directional distance relays, there are no circuit breakers in the electric locomotives, faults being cleared by automatically grounding the trolley and letting the station breaker open the circuit. Thus there will be zero volts along the trolley, on which the relay must work. Correct operation is assured by having the relay record what the voltage was just before the fault occurred. "Memory action" is obtained by using the properties of a tuned circuit. Should a fault occur which results in zero volts, the potential circuit is short-circuited, while the potential-coil current continues at the same frequency, but with a decay in magnitude.

Attraction

A new product of research, Alnico, the new magnet alloy, is powerful enough to lift 60 times its own weight. Originally developed as a heat resisting alloy, it is a cast material, composed of aluminum, nickel, and cobalt, and cannot be machined but may be finished to shape by grinding. Like other permanent magnet materials, Alnico does not magnetize easily, but, once magnetized, it retains a large proportion of that magnetism when, in use, it is subjected to demagnetizing force. Unlike steels hardened by quenching, it is produced by a precipitation-hardening process, with the magnetization promoted by heat-treatment. In use it withstands a demagnetizing force twice as strong as does cobalt magnet steel, is more resistant to vibration and stray magnetic fields, and maintains a large part of its magnetic field at much higher temperatures.

"Day by Day--"

Bigger and better than ever is the new 3600 horsepower diesel-electric locomotive of the Santa Fe road, the most powerful engine of its kind in the world. Time on its 63-hour run will be cut by 10 hours, due to elimination of fuel stops and engine changes, and also to the fact that the maximum safe speed of the new locomtive has been set at 98 miles an hour. The engine, which weighs 240 tons and is about 127 feet in length, is a multiple unit of two identical sections, each section having two 900 h. p. Winton V-type 12 cylinder high-compression two-cycle oil engines. High thermal efficiency is gained through the rate of fuel consumption, giving a thermal efficiency of from 30 to 35% as compared with 5 to 7% efficiency of modern steam locomotives. The fuel consumption of the engine ranges from 0.38 to 0.43 lb. of fuel per bhp-hr. with fuel oil of 19,500 B.T.U. per pound.

Golden Lumens

The new type of sodium lamp which produces 10,000 lumens, the maximum yet available for commercial applications, requires an over-all energy input of but 220 watts or less. Incandescent lighting installations require approximately 550 watts to produce 10,000 lumens. The 10,000 lumen lamp, itself, consists of a long glass bulb with a special sodium-resistant coating inclosing at each end a coiled oxide-cored filament, which serves as a cathode, and an open-ended sleeve of molybdenum, which serves as an anode. The anodes are connected electrically to one side of the filament coiled so that only two conductors lead from each assembly. A small quantity of sodium and some neon gas are in the bulb, the neon being used to start operation. A double-walled evacuated flask is used with the lamp to retain the heat, which is essential for proper vaporization of the sodium. Pre-heating is required, then a 75 arc potential is struck, after which approximately 33 volts are required to maintain the correct current of 6.6 amperes.

ISO-TOPICS

Wool from Cows

AND now it's artificial wool from casein. *Oil, Paint and Drug Reporter* tells of a plant in Italy now producing 2,000 pounds of artificial wool per day with an expected increase to 50,000 pounds daily about the first of next week. Casein, from milk, is dissolved in a solvent and ejected through the regular rayon nozzles into threads. Advantages of the new product over wool are given as its adaptability to dyeing, and its lower heat conductivity and uniformity.

—Aeroplane engines mounted on a forty-foot pedestal and equipped with an eight-foot propeller blow the frost away from California orchards.

—William Penn, Quaker, and all that, had his own malting house and beer gardens?

Wyoming Research

A.S.T.M. has approved 32 of the tentative standards and has altered an additional seventeen.

What is Bentonite? *Chemical Age* tells not only this but also its uses, even though *Chemical Age* is a British magazine and Bentonite is a product of Wyoming.

Profiteers? — $0.209 per Barrel

SECRETARY of Interior Ickes has driven his goad deep into the flanks of the oil men—by his report which lists the average cost of crudes per barrel as $0.725 and the sales price $0.984. Looks like a clean $0.209 profit ber barrel for the oil men—but A. M. Rowley leads a cry of protest in the *Oil and Gas Journal.*

A powdered rubber has appeared in the market which its producers say can be molded at 300° F. to form a product with a tensile strength of 1,500 pounds per square inch, and an elongation of 500%.

A Plaque for Dupont

DECEMBER 6 was a big day for the E. I. Du Pont de Nemours & Company for on that day their organic department was awarded a plaque for chemical engineering achievements. The award was given by *Chemical and Metallurgical Engineering,* the McGraw-Hill publication. The last edition of the magazine tells of the work which made Du Pont eligible for the presentation. The work is the production of Duprene from acetylene and the manufacture of synthetic camphor from turpentine.

Auto Trade Journal says 8% of car owners who have chains bought them from force of habit and that another 7% don't remember why they did. Do you think that 10% of those with cars can remember why they bought them?

Creamier Malteds

A DISCOVERY by the California Fruit Growers Exchange may improve the taste of drugstore malted milks. Pectin mixed with the malted milk powder adds a "creaminess" to the flavor heretofore impossible without using an excess of cream or ice cream.

Chemistry's Loss

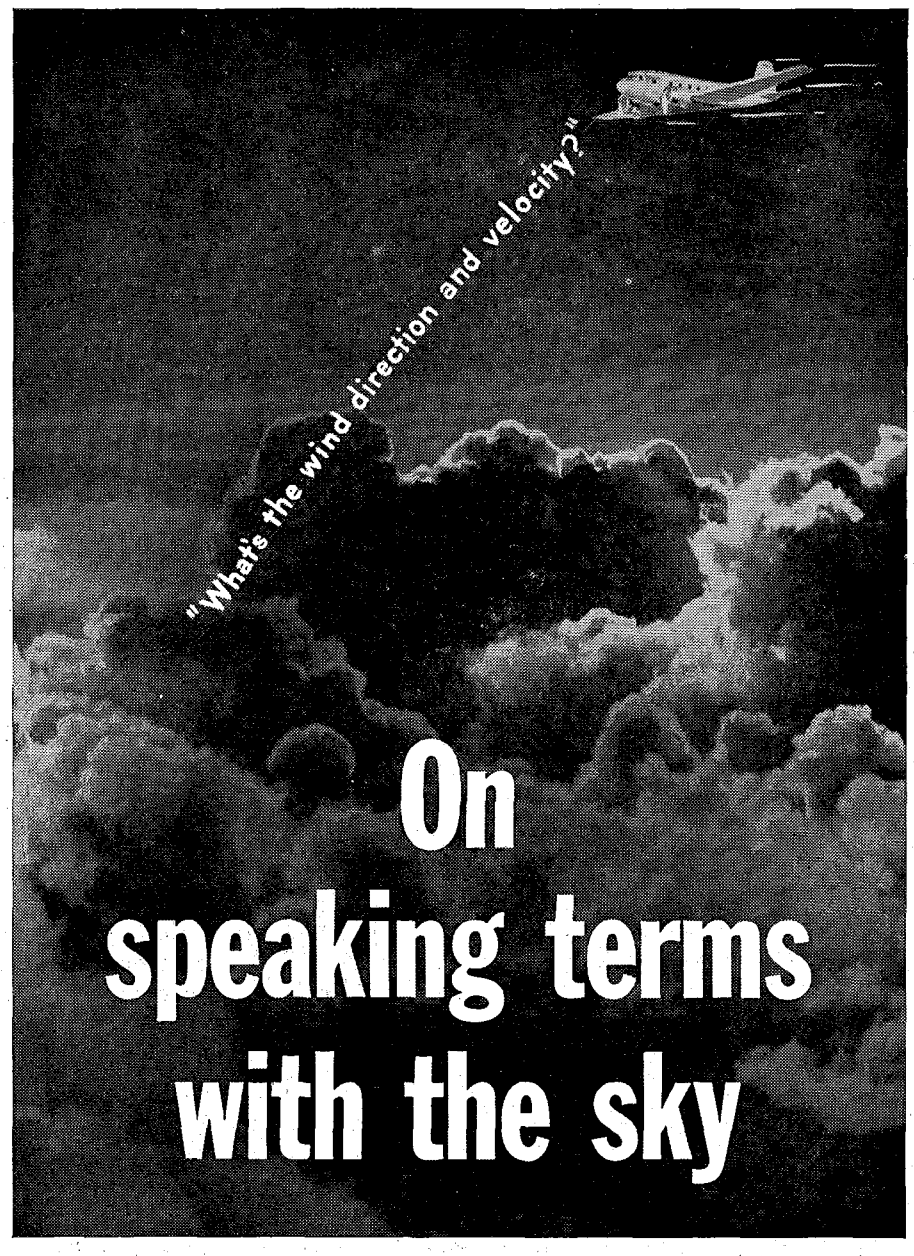
IN the last news edition of *Industrial and Engineering Chemistry* is an editorial which pays tribute to Dr. Arthur D. Little and Otto Schott, pioneers of chemical engineering who recently died. Dr. Little has headed the American Chemical Society, the American Institute of Chemical Engineers, and the Society of Chemical Industry. Schott, less conspicuous in the country, was the leader in glass research in Germany and has done much to make Jena glass famous.

A Japanese variation of the test for free sulphur and rubber is given in the annual edition of *Industrial and Engineering Chemistry* and differs from other procedures by the separation of the thio-cyanate from the cyanide by treatment with acetone. Amazing accuracy is claimed.

Fusion Welds for Acid Tanks?

WE see that the I.C.C. has granted Grasselli's request to try fusion-welded tank cars for the shipment of hydrochloric acid, but at the same time has shaken a negative finger at E. I. Du Pont's request to use the same type of container for nitric acid. The trouble back of it is that some question remains as to the ability to weld the metal suggested by Du Pont.

The Bureau of Standards has announced the installation of the new section on organic plastics.



FAR above the clouds, on all the leading airlines, your pilot is always within hearing and speaking distance of airports—via Western Electric radio telephone. ¶ This equipment, made by the manufacturing unit of the Bell System, is helping the airlines to set a notable record for fast, safe transportation. Teletype—another Bell System service—speeds printed weather information to airports. Long Distance and local telephone facilities, too, play important parts in airline operations. ¶ Bell System services reach out in many directions to the benefit of industry and commerce.

You can "fly" home by telephone, in a couple of minutes. Why not do it tonight? Station-to-Station rates are lowest after 7 P. M.

BELL TELEPHONE SYSTEM

ALUMNOTES

HERE'S progress! **Selmer G. Von Stocker,** M.E. '28, came around at homecoming and Professor Du Priest had to look twice before he recognized him. From appearances he must of gained about fifty pounds. Selmer is superintendent of the American Aluminum Corporation's plant at Manssena, New York. The plant manufactures rolled structural shapes and employs about two thousand men. Responsibility must be nutritious in Selmer's case.

Another homecomer was **Philip S. Dey,** M.E. '29. Phil is assistant chief engineer of the Electric Boat Corporation of Groton, Connecticut.

Realto (Pat) Cherne, M.E. '29, has been sent to Australia for a period of three years by the Carrier Engineering Corporation for which he is working.

Bob Orth, M.E. '31, came home to see his parents, but we wonder if it wasn't the homecoming weekend that lured him here. Bob is working in publicity and says, "There are big fields for technically educated and trained men in industrial advertising and publishing."

Herbert N. Harmon, Aero '35, is instructing in aeronautics and mechanical engineering at Purdue University.

Richard O. Jacobs, Aero '35, is now traffic manager of the Watertown Airways of South Dakota.

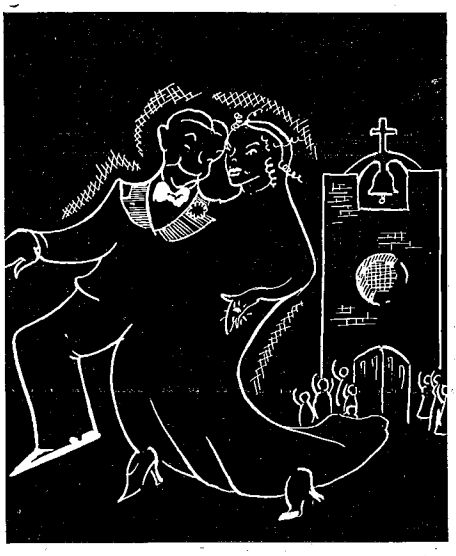
Raymond J. Kochevar, Aero '35, is employed by the Kellet Auto-Gyro Corporation of Philadelphia, Pennsylvania.

A. J. Vrooman, M.E. '34, is now application engineer with the Air Reduction Sales Company. He was in charge of the company's exhibit at the Industrial show held in Chicago the first part of October.

William A. Weber, M.E. '35, is doing engineering work with Bell and Eiss Company of Minneapolis, Minnesota.

Working on scholarships in the aeronautical graduate school are **E. Jean Barnhill, Boyd C. Stephens,** and **Robert R. Gilruth** of the class of '35.

Shifting around here and there and everywhere are: **Bob I. Erickson, Robert H. Lacy, Robert H. Lindner,** and **Roland G. Nygren,** '35 Aero's, who are now United States Navy Flying Cadets with no permanent base of operations.



Ex '37 Arch's. At least **Spencer Smith** and **Wilson Brozer** would have been '37 Arch's if they had stayed. As it is, however, they are continuing their study of Architecture at Yale University.

Are these architects getting married? Look at this: **Fred Anway,** '29, married a Chicago girl in '32 and is working with The Certainteed Corporation; **Jane West,** '28 Int. Arch., was married to **Alfred Clauss** last year. Jane and Alfred collaborated and won the Main Street Competition sponsored by Libbey-Owens-Ford. Their reward was one thousand dollars. Clauss is regularly employed on T.V.A. work. **Janet Lib,** '29, was married to **Robert Lewis,** an engineer of New York City, in August, '32. Janet designed a trailer which is complete in all the comforts of a home and had her husband make it. They are at present living in New York City but hope to be traveling quite often in their moving home. **Vernon Erickson,** '31, was married in August. He is working in the United States Engineers Office at Duluth.

Don't call me that any more! **George Krauch,** E.E. '35, has changed his name to George Krauch Master and is sales engineer for the Allen Bradley Company of Milwaukee, Wisconsin.

John D. Peterson, M.E. '35, is working for the Ingersoll-Rand Company of Philipsburg, New Jersey. In a letter to Professor Du Priest, John says, "I am in a group of men who represent engineering schools from all over the country and I find that the fundamentals I learned and the training I received in the engineering school at Minnesota allow me to stand shoulder to shoulder with the best of them."

Technical lawyer is **Milford A. Juten,** M.E. '32, who has been junior engineer in the Patent Office at Washington, D. C. He has now completed his law course at Georgetown University and has been admitted to the bar at Washington, D. C.

Bob Cerny, '32 Arch., is back again after traveling last year on the Robinson Traveling Fellowship which he won for design competition. He is now with the T.V.A.

Harold W. Shaw, '35, dropped the *Techno-Log* a line about a month ago and wanted a subscription for this year. "That's a good way to keep informed of the progress my class is making," says Harold. "As for myself, I've been with the Carbide and Carbon Chemicals Corporation of South Charleston, West Virginia, doing testing work in their gas department."

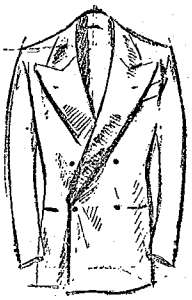
University Fashions--

By Bob Dixon

THIS month the column might have been titled, "A Tale of Tails," for it emphasizes the fact that the tailcoat has risen in popularity and is being worn in ever-increasing numbers at "formals" and at other dress occasions. It goes without saying that at the Inter-professional Ball, the Junior Ball, and the Senior Prom many men will be wearing the tailcoat.

The customary black for evening wear has recently been replaced, to a great extent, by the midnight blue. The reason for this innovation is that the blue appears blacker than black since the latter, under artificial light, has a gray or a greenish hue. The tailcoat this season features a higher waistline, longer tails, and covered buttons. The lapels are wide but not extreme, and the coat is cut full through the chest to add greatly to the appearance and to give more comfort. The trousers are cut full with pleats in front on either side, and they are considerably higher waisted. Correctness demands that there be no break of the trousers over the shoe, also that the waistcoat not extend below the fronts of the coat.

The double-breasted dinner jacket continues as one of the more popular formal attires for the engineering student. This model will appeal to those who like double-breasted coats—and there is an ever-increasing number who are backing this jacket. It has that comfortable, smart, and correct appearance about it. In the last few years the double-breasted jacket has come into prominence and promises to be one of the best-liked for a long time. The coat is cut draped with full shoulders, full through the chest, wide lapels, and narrow waist. The trousers are pleated and have a high waist. The shirt bosoms, as a result, are shorter. The double-breasted dinner jacket appears in the midnight blue unfinished worsted.



Waistcoats are either single or double breasted with no lapels, and the opening is smaller. The bold wing collar gets the call this season. Shirts are of the one or two-stud model, and have a short, narrow bosom. Generous-sized ties with rather large knots are in order this season. Shoes for formal wear have not changed—patent leather or varnished kid is the correct footwear.

K-40, New Potassium Isotope, Discovered By Physics Student

Mr. Alfred O. Nier, graduate student in the department of physics, working on his Doctor's thesis, under the direction of Professor J. T. Tate, has proved conclusively that Potassium has three isotopes instead of two, K-39 and K-41, as was previously supposed. The third weight, Potassium-40, had been thought to exist but no conclusive evidence of its existence had been gathered until Nier found his information this summer. By means of a very complex piece of equipment, called a mass spectroscope, Nier was able to break the Potassium element into its various known weights and because of the high sensitivity of his equipment was able to delve further into the element's secrets.

The fact that the radio-active properties of Potassium could not be explained by the action of its known isotopes, caused some scientists to suppose that Potassium-40, or at least another isotope, existed, and until Nier gathered his information, K-40 remained more or less a theory. The fact that K-40 was shown to exist strengthens the theory that K-40 causes the radio activity of Potassium.

A generalization of the method employed in determining this isotope is somewhat as follows: Potassium vapor is introduced into the spectrograph tube. High-speed electrons collide with the Potassium atom and knock off electrons, thus forming the positive Potassium ions. These ions are directed through an electric and magnetic field in such a manner that their relative atomic weights may be determined. By this method isotopes 39 and 40 were detected and an isotope with a mass-40 was also found. Some indication of the rarity of this isotope may be had from the fact that only one atom in every 9,200 has the mass-40.

Students Organize Gliding Society

The Gliding Club, first organized last spring as a branch of the Minnesota Society of Aeronautical Engineers, has recently been changed to a division of the Flying Club. The Flying Club modified their constitution to include the Gliding Club as a unit.

At the election of officers, Harold Thompson, junior aero, was chosen president. Marvin Walseth and Tom Feeney, both seniors, were elected secretary and treasurer of the club. Membership in the club is open to anyone attending the University. The club will make flights under the direction and tutorship of faculty advisors. No one, regardless of previous experience, will be allowed to make flights without preliminary instruction and ground flying at the first few meetings. The faculty advisors are the Professors Howard Barlow and Charles Boehnlein.

The Gliding Club owns three gliders of different types, which are being repaired and assembled for use. One of the gliders, an Alexander model, was purchased from a sophomore aero, Ambrose Karpen. The first flight of the club will be made on Lake Minnetonka when the ice layer becomes thick enough to support the weight of a tow-car.

A. S. M. E. Views Football Films

Glenn Seidel's talk on sidelights of the 1935 Gophers and Phil Brain's pictures of the games will climax the meeting of the A.S.M.E. in the Union on Thursday, December 12.

Seidel, a senior in mechanical engineering and a member of the local chapter of the society, is expected to give his fellow members some "inside dope." Brain, tennis coach, makes the pictures of the Gophers his hobby and will give descriptions of the highlights of the games. Doughnuts and cider are on the refreshment list.

Electrical Engineers Inspect WTCN, Ford, and Riverside Plants

The local branch of the American Institution of Electrical Engineers made three inspection trips recently in the Twin Cities. The first inspection trip was to the Ford hydo-electric plant on Nov. 6 to see "Old man river" do the work of making electricity (as well as Fords). The trip through the assembly plant was brief, for many of the students had seen it before, but the trip through the power plants proved more interesting. After viewing the water turbines and listening to a lecture on the plant, the "electricals" climbed up on the generators and gave them the "once over." The same procedure was followed in the trip through the steam plant, nearby. An inspection of the power distribution system ended the trip.

The Northern States Power Company's Riverside plant was the objective of the second inspection trip on Nov. 12. Mr. Gartahus (E.E. '24) and Mr. Carlson (E.E. '22) lectured to the group on the history and development of the plant. After a description of the plant, the inspection trip was made.

On Nov. 29, a third trip was made to the WTCN transmitting station. The station is the most modern one in the Twin Cities; all equipment being specially designed for it by the Western Electric Company. The equipment is stationed in a separate room and cannot be reached except when the current is shut off. Shortly after the student branch arrived, the station went off the air, and they were able to enter the sealed rooms and inspect the apparatus.

Pi Tau Sigma Adds Five New Members

Five new members were initiated into Pi Tau Sigma, national honorary mechanical engineering fraternity, at a dinner meeting, Dec. 6, at a downtown hotel. Hugh B. Wilcox, professor of mathematics and mechanics, was toastmaster, introducing pledges and the speaker, George M. Schwartz, associate professor of geology.

Fall quarter pledges for Pi Tau Sigma were: Sherman W. Finger, Jr., Vincent Johnson, and William Hansen, juniors, and Arnold Matthies, senior. James J. Ryan, associate professor of mechanical engineering, was named honorary member. Dr. Thiel spoke on "Geology of the Twin Cities."

Professor John V. Martenis, faculty representative, was re-elected national president of Pi Tau Sigma at its national convention at Purdue, October 14 to 16. He was presented with a bronze plaque in recognition of his services. Five Minnesota student members attended the meeting at which 16 schools were similarly represented.

At the convention, Iowa State University was granted a charter to start a new chapter.

Membership in the fraternity is made up from the upper one-sixth of the junior and senior classes. Candidates must pass, satisfactorily, tests, written and oral, given by the group. Present actives are: Wallace Andeen, Dave Buck, Milo Bolstad, Malven Olson, Millard LaJoy, Dale Stevenson, and Glenn Seidel.

♦

Our fund to buy hats for the math department is growing at an alarming rate, with the most recent contributor being Bob Manly, whose donation consisted of a plug nickel. Any other contributions from those having a high regard for their math professors will be cheerfully accepted. We understand Haile Selassie wears a derby—If he could only only teach calculus. . . . . We wonder, if the junior and senior civils were greatly disappointed this fall when they found that Mr. Brinker had accepted a position in far off Hawaii, or whether it was Eskil E. Olson's thirst for higher education or his need for the five extra credits that caused him to take Philosophy. . . . . Did you know that we had a Musical Dean? We have it on good authority that he plays a mean banjo.

For the benefit of Jim Acker. Jean Harlow is about to give up trying to find out who the fellows were that promoted themselves into her home last summer as representatives of the "Minnesota Daily." For those who have been wondering why Thorle Vieau has been spending a good deal of time at the University Theater rehearsals, we have an idea that a certain Kay—might have something to do with it. . . . . Rumor has it that a certain Alpha Delta Pi beauty will be the number one in line with head man Glenn Seidel at the Intercollegiate Ball during the Xmas holidays. . . . . A certain Lucille Martin is the reason for all those trips that Arnold Lahti, the new Delt playboy, is making in the direction of Sanford Hall. . . . . Phoebe Hallenberg is still allowing Fred Warner to ring the doorbell after all these months.

Unemployment relief. Forty seven legislatures in forty-seven states passed fourteen thousand laws this past year pertaining to the levying of additional taxes on the people. Think of all the people required to collect all the money. . . . . On one of the Government dams recently built across the Mississippi river near here, a huge side wall has been displaced nearly a foot from its original position. Now the engineers have to solve the problem of getting the tremendous mass of concrete back again so it will stay. . . . . The old Savage building on the river through an early morning mist is our idea of what a medieval fortress must have looked like in the old days. . . . . It is reported that the graduating Civils are planning on throwing a barnburner before the holidays as a farewell gesture to the old school.

Since so many of you engineers have so much time on your hands we hasten to suggest that you turn those idle moments into something more substantial than dreams of that pretty girl you met last night. Just try a few mental gymnastics on these problems we've been tearing our hair about for the past week. The Business Manager will slip a buck to the fellow turning in the first set of correct answers. By the way, if any of you engineering aspirants have a pet problem of your own, bring it around to "Slip-Stick Joe."

♦ ♦ ♦

While hunting up north a few days ago we chanced upon a rather amusing spectacle, that of a fox being pursued by a neighboring farmer's greyhound. Our curiosity got the better of us and we determined to find out just how soon the poor little fox was going to be caught. Thanks to our engineering training we instantly (well, almost) observed that the fox was 60 leaps ahead of the hound. While the fox was making 9 leaps the hound was making 6; but 3 leaps of the hound were equivalent to 7 of the fox. We forgot to take our slip-sticks along, so we're still wondering how many leaps the hound made to over-take the fox, or was the fox ever caught?

♦ ♦ ♦

Here's another cute mental twister that will take the freshmen at least five minutes to solve. (For some cockeyed reason we always get more unknowns than equations.) Three radio towers are erected at the corners of an equilateral triangle 200 feet on a side. One tower is 90 feet high, one is 100 feet high, and the third is 190 feet high. From the top of each tower to an anchor post inside the triangle, guy wires are stretched, all three guy wires of the same length. Now just where, with respect to the sides of the triangle, is the anchor post located?

♦ ♦ ♦

And now the climax: if you solve this one as quickly as you have the preceding ones, come around and we'll award you the distinguished "Problem Solverer" medal.

At some time or another (1873, I guess) three triangular ingots were formed by mixing together metals in different proportions. One pound of the first contains 7 ounces of silver, 3 ounces of copper, and 6 ounces of pewter; one pound of the second contains 12 ounces of silver, 3 ounces of copper, and 1 ounce of pewter; and one pound of the third contains 4 ounces of silver, 7 ounces of copper and 5 ounces of pewter. Now all that is required is a one pound ingot formed from these which shall contain 8 ounces of silver, 3¾ ounces of copper and 4¼ ounces of pewter. How much of each of the three ingots must be taken to form this fourth ingot?

♦ ♦ ♦

James C. Lewis won the buck offered for October by turning in the only correct solutions to the problems.

"TECH"

The Gopher Mascot

joins with these merchants in wishing all engineers the season's greetings and thanks them for their patronage during the past quarter. "Tech" says that these advertisers have proven themselves reliable and are catering to the demands of the technical students.

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G-E *Campus News*

LIGHT READING

It has won a prize, but you will not find it in the bookstore. The movie rights will not be sold; it will, alas, never be a best seller.

The title is: Non-Riemannian Dynamics of Rotating Electrical Machinery; the author: Gabriel Kron, University of Michigan, '24, G-E engineer. The award is the first prize of the George Montefiore Foundation of the University of Liege, Belgium—10,000 Belgian francs.

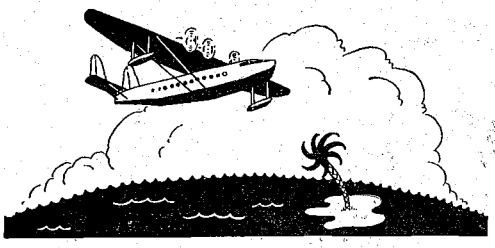
Tastes in literature differ; Gabriel Kron's preferences run to higher mathematics. Some years ago, he went on a walking tour around the world, and he took with him for light reading a book full of integral signs, tensors, matrix transformations, and elliptic functions. Instead of the usual souvenirs, he brought back the material for the paper that won him the Belgian prize. He also reports that the total cost of the trip was only $200! It suggests a tip for those who have trouble with padded hotel bills. Try carrying a calculus book on your travels!

SECOND SIGHT

The complete electric man is being built piecemeal. Electric eyes and ears came first, and loud-speakers with electric vocal cords. Now comes the machine with a memory and the gift of second sight. It has been developed by G-E research scientists to study the causes of failure of electronic tubes.

Something unusual happens in a tube. It is all over in a few hundredths of a second. Then, when peace has settled down, a camera shutter clicks and records on the film the story, not only of the disturbance and its aftermath, but of the events that led up to the disturbance.

Two modern devices make this possible: the cathode-ray oscillograph and the thyratron. The oscillograph is on the job, day and night, tracing on its fluorescent screen the history of the faithful operation of the tube. Then, unexpectedly, after months have elapsed, perhaps in the wee hours of the morning, the tube goes haywire. The disturbance sets off the thyratron tube which, in turn, trips the camera shutter, The disturbance has been over for a fiftieth of a second, but the trace still lingers on the oscillograph screen, and is photographed. No longer need the scientist hover anxiously over his apparatus. He can lie comfortably in his bed, knowing that the prerecording oscillograph will remember all that happened during the night and tell him about it in the morning.



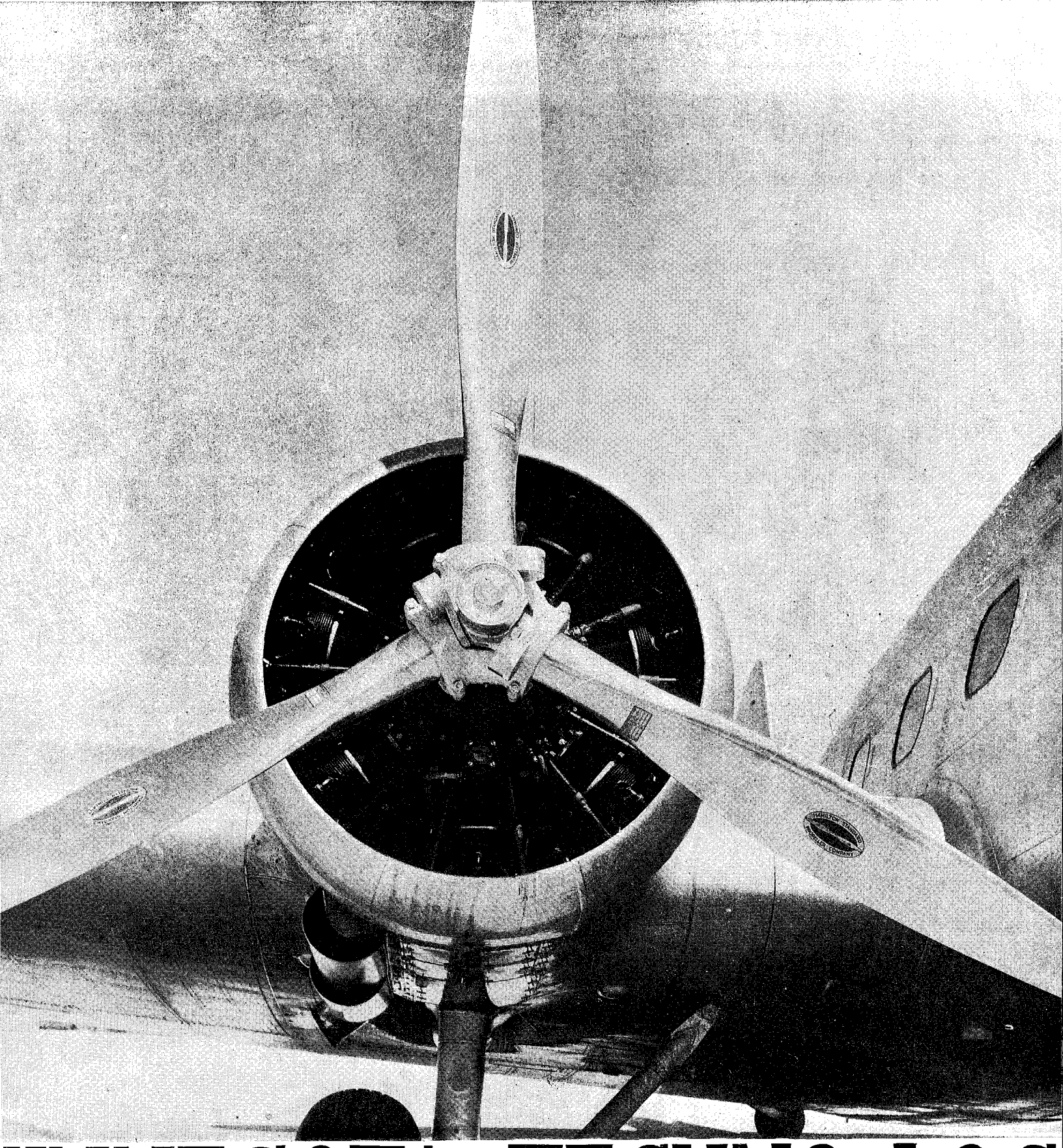
CHINA CLIPPER

The Pan-American *China Clipper* which recently inaugurated trans-Pacific mail and passenger service in its epoch-making flight from California to the Philippines and back, carries several aids to flight which have been developed by General Electric especially for aviation service.

Each of the giant ship's four 830-hp Pratt & Whitney Twin Wasp engines is equipped with built-in G-E superchargers. Complete sets of G-E electric tachometers and electric oil-temperature gauges help the engineering officer at his post in the first compartment to check on the performance of the engines.

96-218DH

GENERAL ELECTRIC



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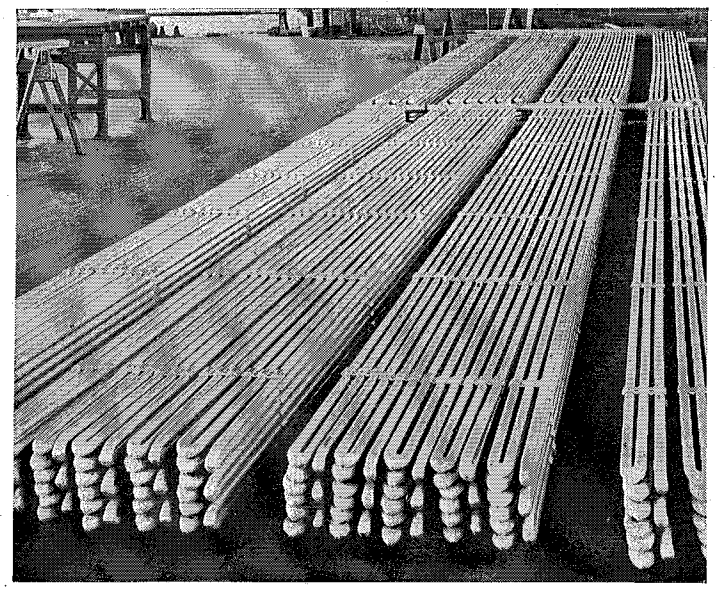


SEVEN HUNDRED WELDS—were needed to make this assembly of aluminum piping.

New Metals Emphasize Desirability of Jointless Design

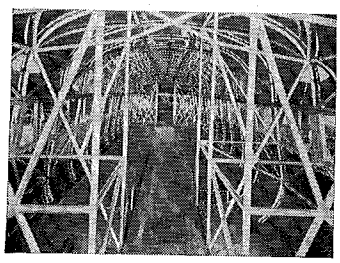
Welding Preferred Method for Fabricating Jointless Designs from New Materials

By H. E. ROCKEFELLER*

Welding is an important aid in securing the full benefit of the newer light weight alloys, corrosion- and stain-resistant steels and other ferrous and non-ferrous metals. Jointless welded designs in these new metals make the finished product attractive in appearance, efficient and economical to use and enable it to be priced salably.

In All Industries

Fabrication by welding can be undertaken without heavy capital expenditures and carried out at low cost. Welding is used in every industry for maintenance, for construction and for the fabrication of many products. The welding of mechanical refrigerators and gas ranges is typical of its production applications. Other typical applications include welding of chromium steel for resistance to sea water corrosion on seaplane pontoons, welding aluminum fuel tanks for airplanes, welding of the frame work of alloy steel on the new high speed railroad trains, welding of stainless steel beer barrels and innumerable other familiar products.



HERE'S HOW—the framework of the light weight, streamlined rail cars for high speed is Linde-welded from chrome-molybdenum steel tubing.

Welding is Simple Production Tool

Welding is the preferred method of fabricating almost every design in modern metals. Jointless welding can be done rapidly with a minimum of preparation of the pieces to be joined. Under procedure control providing jigs for positioning pieces, production can be as rapid and as free from rejections as any highly developed factory process. From the plant equipment standpoint it is easy to adopt welding. From the personnel standpoint the welding technique is quickly acquired through instruction by competent engineers.

For Jointless Strength and Safety

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Specialized Welding Assistance

To utilize the new alloys and metals fully, the advice of competent engineers in welded design is advisable. The Linde Air Products Company, a unit of Union Carbide and Carbon Corporation, has for many years specialized in the development of new ways to use oxy-acetylene welding. Linde Engineers will gladly consult with you without obligation, and help you use welding and organize for welding production. This assistance can be secured by a telephone call to any Linde Sales Office. They are located at Atlanta — Baltimore, Birmingham, Boston, Buffalo, Butte—Chicago, Cleveland — Dallas, Denver, Detroit—El Paso—Houston—Indianapolis—Kansas City—Los Angeles—Memphis, Milwaukee, Minneapolis—New Orleans, New York—Philadelphia, Phoenix, Pittsburgh, Portland, Ore.—St. Louis, Salt Lake City, San Francisco, Seattle, Spokane and Tulsa.

IN JIG TIME—using jigs, welded joints can be made quickly in any commercial metal or alloy.

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* Engineer, Development Section, The Linde Air Products Company, Unit of Union Carbide and Carbon Corporation.

MINNESOTA Techno-Log

37 ELECTRICAL BUILDING

UNIVERSITY OF MINNESOTA, MINNEAPOLIS

JANUARY, 1936

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MANAGING EDITOR

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VOLUME XVI NUMBER 4

	Page
LARGEST BRIDGE	67
ICEBERG TRAVEL	70
PROGRESS	73
HIGHWAYS	74
EDITORIAL	76
NOW HERE'S A BOOK	77
ANODIZING	78
ALUMNOTES	80
ARCHITECTS' PAGE	82
CAMPUS NEWS	84
AN ENGINEER LOOKS AT LIFE	85
MENTAL TILTS	86
STRAY SCRAPS	87

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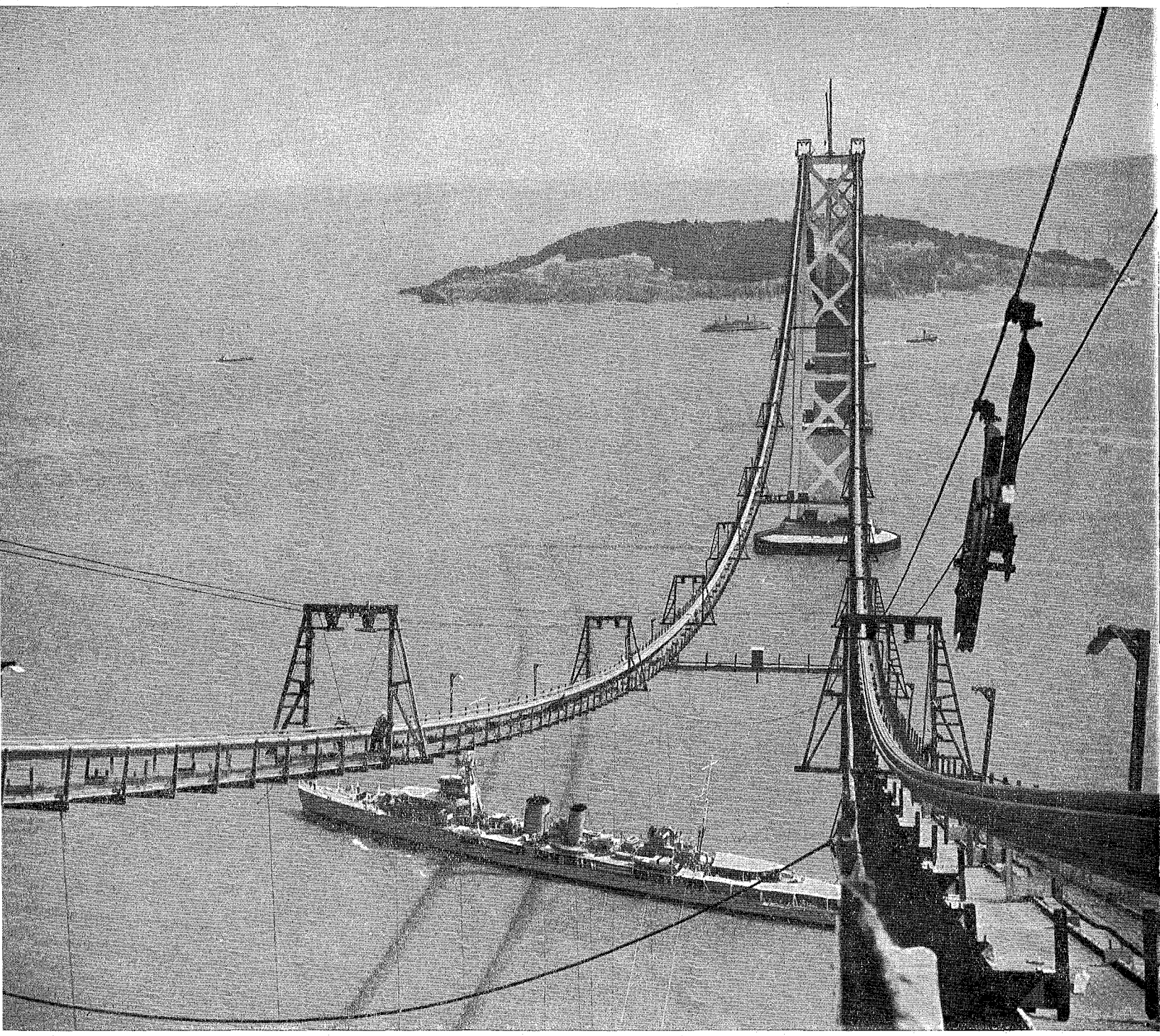
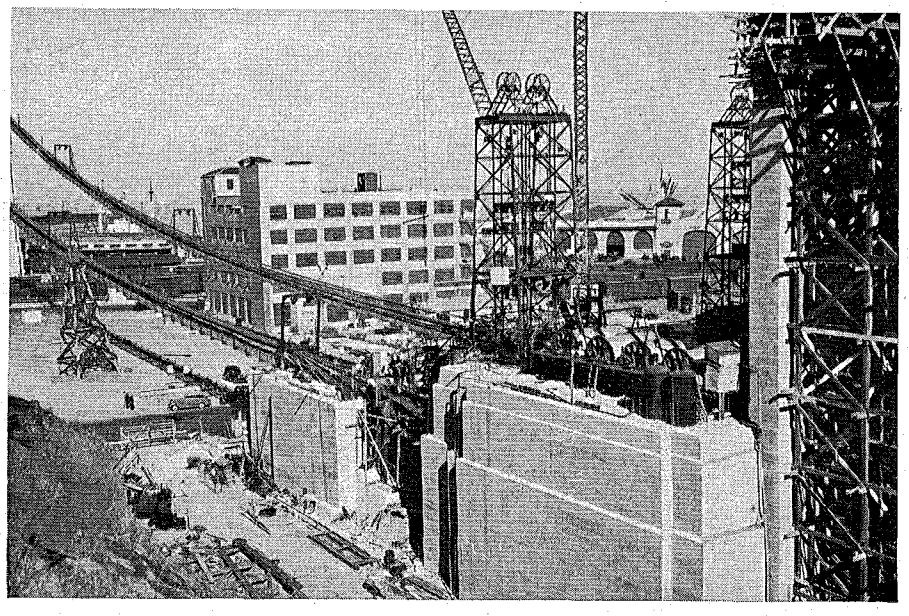


—Courtesy General Electric Review

Largest Bridge

A 1000 YEAR MARVEL FOR THE WORLD

By Robert Teeter, M.E.'37



A cable anchorage. All pictures are by courtesy of the General Electric Review.

A SURVEY of bridge engineering done in the past century would show a marvelous record of achievements. In this short span of years wooden structures, cast and wrought iron structures, and reinforced concrete structures have successively been replaced.

The latter will have been superseded by coördination with structural steel and steel wire cabling in the construction of the largest suspension span and cantilever span ever built, when the San Francisco-Oakland Bay Bridge is completed this fall.

The new bridge over the bay will have many features making it unparalleled in the history of bridge building. Needless to say its construction has combined man's abilities—that of the workman to follow directions, and that of the engineer to give adequate directions with his designs—with his resources in nature.

Perhaps no bridge was ever built for which there was greater need. It will provide the shortest, cheapest and fastest means of transportation between communities surrounding a metropolitan center of over a million and a half people. There are at least 50,000 daily commuters to San Francisco from Oakland and surrounding cities. They lose several hours a week riding ferries on present arbitrary schedules. The new bridge not only will allow the bay to be crossed more quickly, but at the commuter's convenience. The toll necessary to finance the bridge will be less than present ferry rates and will run no more than 20 or 25 years. In truth, the bridge fills a need hard to realize by one not familiar with the vast population problems of a seaport built around the great natural harbor of San Francisco bay.

The San Francisco-Oakland Bay Bridge project is being constructed under the direction of the California Toll Bridge Authority and is a state project. It is being built by private contract under state public works supervision. The toll bridge authority finances and builds road bridges over the many bays and rivers along the state's seashore, and directs collections and payment of the bonded indebtedness undertaken.

The project consists of two complete bridges, tunnel and cuts across Yerba Buena Island, and the approaches from San Francisco and from the three population centers on the east side of the bay, Oakland, Alameda, and Berkeley.

The general contract was with the Columbia Steel Company, subsidiary of U. S. Steel, for 22½ million dollars, but total cost will pass 77 million. The bridge is financed entirely without taxation, its cost defrayed by sale of 4¾ per cent bonds issued against the prospective revenues of the bridge. These bonds have been purchased at a discount increasing the yield to 5 per cent, by the Federal Reconstruction Finance Corporation, and may eventually be sold to the public.

In addition to the bonds purchased by the Reconstruction Finance Corporation, the State Gas Tax Fund loaned $6,600,000 for the building of the approaches, which sum must be repaid the Gas Tax Fund out of tolls before the bridge can be made free to the public.

From Oakland to the island two complete suspension bridges, with a common center anchorage span the water. Through the rocky island a tunnel and cuts have been made to permit uninterrupted flow of traffic. From the island to San Francisco there are more than 25 individual spans, most important of which is the largest cantilever span in the world, to permit ocean ships to enter the harbor.

At present cable spinning on the two suspension spans has been completed. The piers and towers have been

complete for some time, the project having been started in July, 1933. All that remains is the construction of the double deck roadway to carry automobile traffic on the upper road and trucks and interurban cars on the lower way. The boring of the tunnel through the island has also been completed.

Construction of the cantilever span is nearing completion as are the approaching roadways and the administration building. Engineers regard the erection of the cantilever span as an even greater feat than that of the suspension bridge construction due to the weight of the two decks of the immense cantilever.

To gain an idea of the magnitude of the project one might consider the following facts. The bridge proper is 4⅓ miles long; including approaches, it is 8¼ miles long. It will be the largest bridge in the world spanning the largest body of water ever bridged.

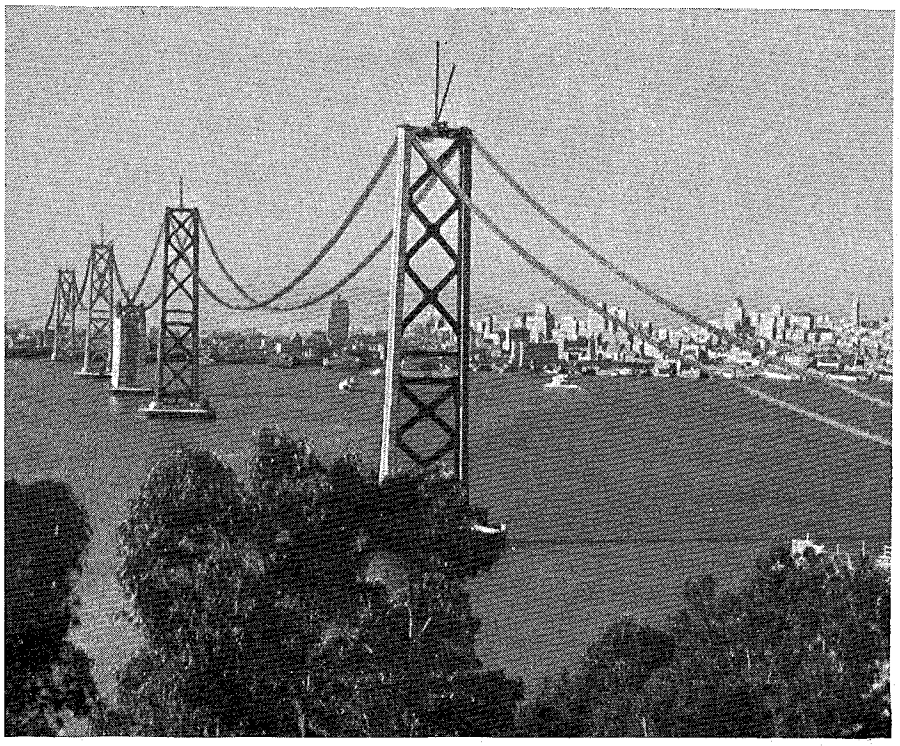


Fig. 1. A view of the double suspension span.

The following figures point to the reason why the chief engineer of the Russian railway bridge department, who bridged the Volga, recently said, after studying the project, that the bridge would stand for a thousand years as the greatest bridge of the world:

Western suspensions, 10,587 feet; tunnel 540, and cuts, 1,667 feet; 8 eastern spans, and 1,400 feet cantilever, 5,018 feet; 18 trussed spans, 5,226 feet; San Francisco and Oakland approaches, including two miles of dredge fill approach from Oakland, 13,908 feet; Oakland cloverleaf, 49,986 feet.

The project incorporates the largest bore tunnel built in connection with a bridge; piers sunk to new depths, one to 235 feet; and 700 foot towers, each equivalent to the construction of a 60 story building. Also, in the two parts of the project, 44 underwater foundations were made, making it the greatest underwater engineering project yet undertaken.

Since they are the more novel from many standpoints, much may be written about the twin suspensions of the east crossing. The suspension type of span was chosen because of its beauty and because adaptability to the foundations available and the conditions to be met made it the least expensive, durable structure. The east bay, being shallower than the west, permitted more stable anchorage and bracing against internal and external forces.

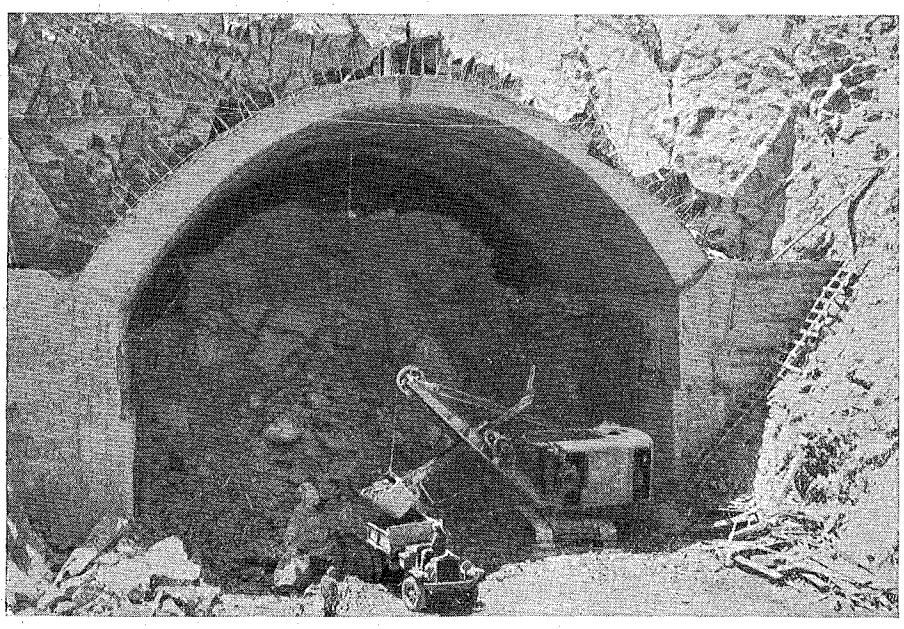


Fig. 2. Tunnel through Yerba Buena Island, showing manner of boring.

The suspension span has proved really less expensive than the cantilever and truss type, since it had in this project fewer hazards to meet. Piers were set in water 70 to 105 feet deep by an original caisson method. On the Oakland mainland, a gravity anchor of massive concrete construction formed the anchorage for the cabling. On the island the cabling was embedded in solid rock, forming a wedged anchorage.

Other piers were sunk in water 70 to 125 feet deep. After the piers and towers were built, the next problem was that of laying the cables which support the roadways and carry the load.

Contrary to popular fancy, cables were not spun but were laid parallel to each other; the two cables were not constructed at the same elevation, one of them being nine inches higher than the other to accommodate the extra load caused by interurbans running on one

side of the bridge. And the cables were not laid in the position they will eventually occupy.

The first step in laying the cables was to put down catwalks. These catwalks were strung over the entire length of the bridge and were strong enough to accommodate heavy construction loads. With the spinning completed by working from the catwalks (see Figure 3), a gigantic pair of jaws used like a die compressed the cables to a diameter of 28¾ inches. They were then coated with red lead and wrapped to preserve them from deterioration in their salt-air environment. The individual wires that make up each cable have a total length of 17,704 miles, and weigh approximately 4,675 tons. Work on the cables began in April, 1935, and was completed by the end of the year.

Strange as it may seem, the cables were laid shorter than they will be in the finished bridge, since steel is a perfectly elastic material, provided it is not stretched beyond its elastic limit. Provision had to be made throughout the bridge for expansion and contraction due to unequal loading, changes in temperature, and changes in the direction of heat from the sun. It was known that the towers would bend considerably away from the sun, following it in its path. From multiplicity of these factors it was estimated that roadways might change in line as much as ten feet. This may seem to be a large variation; but, when compared to the miles of bridge, is small. The roadways also will be provided with expansion joints as were the towers and cabling.

The east spans are supported on concrete pedestal towers having one end rigidly anchored while the other end rests on a group of steel rollers. Another device was employed, also—that of having one fixed anchorage alternated with an expansion anchorage, permitting movement in either direction.

In the west crossing, the difficulty in sinking foundations and in making cable anchorages to rock 300 feet down prevented proper bracing against stresses, wind and earthquakes for a suspension span. The cantilever construction was used.

Little need be said describing the west crossing from the island to San Francisco, since it is made of a more common series of truss spans. The cantilever itself, which permits ocean vessels to enter the bay, is 1,400 feet long followed on either side by several 450 foot railway type spans and eighteen other spans, about 280 feet each.

Two approaches circle out of neighboring sections of downtown San Francisco, a few blocks in from the Embarcadero. There are three approaches from Oakland and neighboring areas forming a cloverleaf. They lead from the three eastern metropolises, Oakland, Berkeley, and Alameda.

A tunnel was necessitated through Yerba Buena Island. Boring in this case has been a novelty to the layman. Three pioneer tunnels were carried through and broken into each other in a common horseshoe bore. Then a concrete arch was made, leaving within it a core of solid rock which was removed by blasting and steam shoveling. The tunnel is of the largest bore ever built in connection with a bridge, being 76 feet wide and 58 feet high.

Roadways are being constructed most actively at present. After the roadways have been placed, there remain the lighting and communication systems to be installed, the permanent control rooms, the administration building, and the permanent system of airplane and ship warning lights.

The bridge will be lighted by 10,000-lumen sodium lamps placed alternately 150 feet apart at a height of 25 feet. Power will be supplied equally from both sides of the bridge, but each supply will be independently powerful enough to light the whole bridge. Completed with illumined road signs and beacon lights, the bridge will be one of the best illumined in the world.

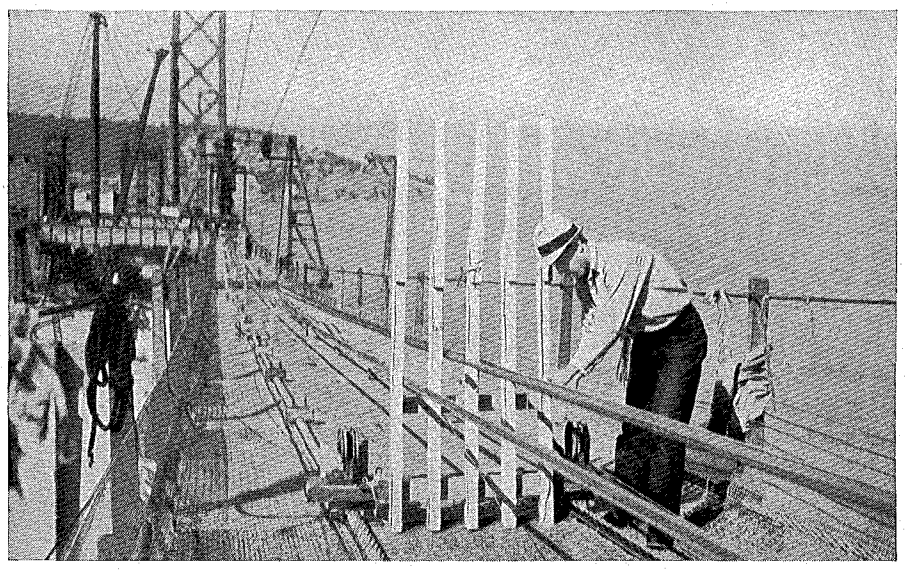


Fig. 3. Catwalks and cables in early process.

Red beacon lights will be installed on each of the towers, along with five flashing beacons, to be placed as aviation lights. Red, green, and white navigation lights will be placed along with warning sirens and bells for use in foggy weather.

Because of the confidential nature of the work of the army and the navy, it is impossible to estimate the part these departments have had in making the bridge possible, but it is well known that to have the bay bridged is considered a strategic move in national defense.

With piers, towers, cables, and tunnel finished, there is not much to stand in the way of the scheduled completion of the project by August of this year. The authority hopes to have it open for the Stanford "Big Game" of 1936. Little more than three years will have been taken up in its construction.

Few new industries are going to locate in a metropolitan area, parts of which cannot be easily and cheaply reached. Thus the bridge will remove the one important obstacle that has stood in the way of the growth of all the communities of the bay region.

Iceberg Travel

In Svalbard

By Harlow C. Richardson
ASSISTANT PROFESSOR OF ENGLISH

IF YOU wish to visit the Arctic and are not equipped with plane or dirigible to make a speedy dash for the pole, I suggest that you go less romantically but more leisurely and comfortably on one of the cruising vessels that ply during the summer between certain north European ports and various places beyond the Circle.

Last summer, as I was planning a visit to the Scandinavian countries, I discovered that the Stavangerfjord of the Norwegian-American line was to be taken off its usual trans-atlantic run and would make one trip to northern waters. It would go to the North Cape, to Spitzbergen, and to the Pack Ice. This was exactly what I wanted to do. I found that the date of sailing from Oslo was convenient and that the cost of the cruise was reasonable. I booked passage.

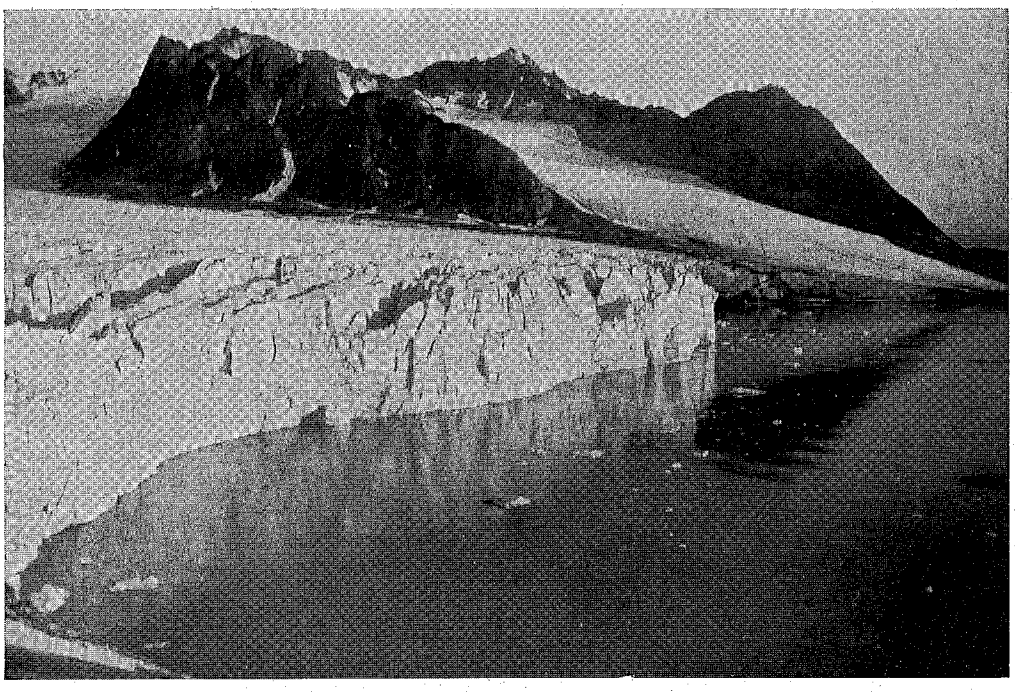
The cruise began at Oslo, July 19 and ended at that port August 5.

The liner accommodates 1,200 passengers. There were 750 aboard. The prime minister of Norway, the former prime minister, and various heads of governmental departments composed an official party making an inspection trip to Svalbard (Spitzbergen). Mrs. Edward Grieg, widow of the composer, was on board as far as Bergen.

The great advantage of a leisurely trip to the Arctic is the opportunity it gives to visit the scenic lands en route. Norway's fjords are world famous. The liner entered many of them and we felt the thrill of sailing close to the towering granite walls. The beauty of the waterfalls of Norway cannot be overstated. In fact, it seemed that almost anywhere in Norway one could not be far from the sound of falling water. Sometimes we left the ship and were conveyed through valleys and over mountains by train and by bus on roads that must be the joy of an engineer's heart. The zigzag mountain roads of Norway afford thrills a-plenty.

We reached Nordkap (North Cape) at 10 p. m., on July 26. This is the northern most point on the mainland. Here is the Land of the Midnight Sun. The weather was perfect and the sun was blazing in the heavens as we climbed the 960 feet to the top of the Cape. At midnight the captain fired the sunset gun and followed it immediately with the sunrise gun. A new day had begun in the midst of sunshine! We were well beyond the Arctic Circle.

Then came the open sea to Svalbard (Spitzbergen). On July 28 we reached Adventfjord and anchored off Longyearbyen. This coal mining settlement is located among rugged, snow-covered mountains. The official party inspected the mines and the rest of us hiked here and there, glad to get some exercise in this bleak-looking place.



Referring to my diary, I find the following entry:

July 28, 1935.

We left Adventfjord about 1 p. m. and proceeded to Tempelfjord, which we were due to reach in two hours. We were lingering over our late luncheon. The prime minister of Norway, Mr. Johan Nygardsvold, had just made a speech about Svalbard (Spitzbergen) and proposed a toast. As the toast was being drunk, the ship gave a shudder. I thought the

steward had bumped against the back of my chair. A man had risen to respond to the toast, but people paid little attention to him. The ship continued to go forward with a shaking motion. It reminded me of a Japanese earthquake I had once experienced. I looked out the porthole near our table and saw a gleaming blue iceberg nearby. The same thought must have come to each of us. Out the door we went onto the deck. The ship had stopped and a small boat was already in the water. It cruised about, sounding. An area of brown water appeared where the ship had been.

About 5 p. m. the following bulletin appeared on the board:

"The ship touched today in the Tempelfjord an unknown shoal, not marked in the chart and not known to the pilots.

"No damage has been found, but for safety's sake Norwegian Savings Co.'s boat 'Starkodder' has been called from Advent Bay to examine the bottom by diver. We will now, according to the program, anchor in Greenfjord by the Whaling Station.

" 'Starkodder' will arrive 7:30 p. m. The passengers will be informed of the exact circumstances by bulletin. Captain."

Bulletin: Posted July 29:

"Diver's certificate (in Norwegian) shows that ship had not received any damage but that the paint had been scraped off all along the after half part of the bottom.

"The following message has been received from the captain of the ship Veslekari, at present carrying on soundings and making new charts of Spitzbergen: 'The shoal examined and position determined and charted North Latitude 78° 24′ 12″. East Longtitude 16° 27′ 18″. Sand and small stones. Lowest depth of water, 6 meters (20 feet). Signed, Hermansen.'

"Does anybody like to give his or her name to the new-discovered shoal?"

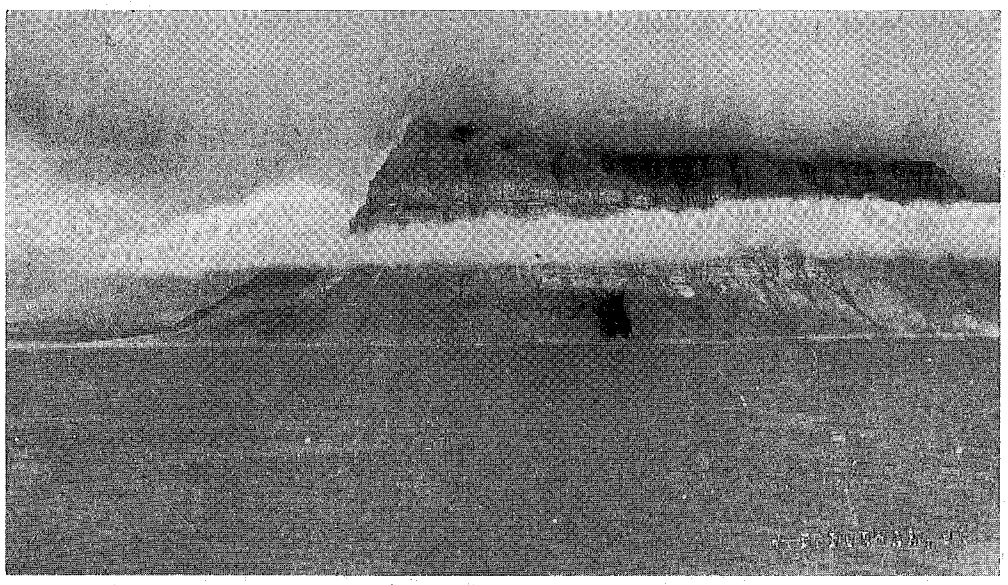
This question, no doubt, comes from Captain Irgens. He likes his joke and so do we.

Today has been full of thrills. We have been at King's Bay (Kongsfjord) where the polar expeditions take off for the Pole. The landing place is Ny-Alesund, where are several buildings, most of which are boarded up, and an abandoned coal mine. The chief interest, of course, centers in its historical significance. Various explorers have used it as a base—Amundsen, Ellsworth, Nobile, and others. The hangar is here which housed the dirigible and the steel mooring mast to which it was tied. A stone monument has the names of Amundsen, Dietrickson, Ellsworth, Feucht, Omdal, Riiser-Larsen, and the date, 21 Mai, 1925.

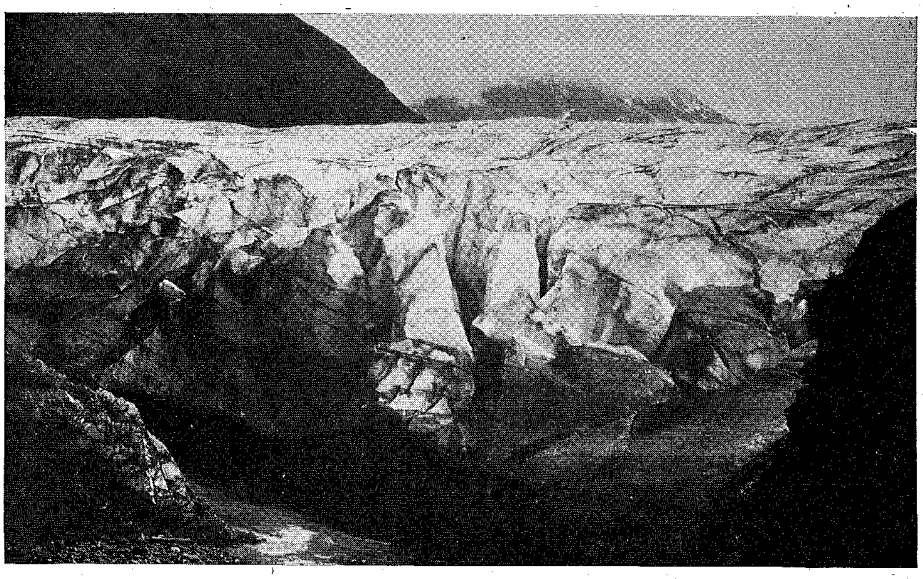
On the base of the monument was a beautiful wreath of fresh flowers tied with the Norwegian national colors, red, white, and blue, on which were the words, "Stavangerfjord Besetning" (crew) in gold letters.

I walked alone some distance toward one of the glaciers. Returning by a different route I almost had my beret pulled from my head by rather large, screaming birds. They were white and not so large as seagulls. Evidently they resented my intrusion because I was too near their nests in the rocky ground. There are no trees or bushes in this region. Other passengers had the same experience. Not far from the monument I saw a little striped bird (somewhat larger than a snipe) with a long bill and with stripes of black, white, and brown running lengthwise. It was standing over two or three baby birds just out of the shell and very much alarmed at my presence. The birds were on the ground without any apparent nest. The mother didn't fly or run away but alternately walked a few inches to one side and returned to cover the little ones with her wings.

I mailed a letter or two from here with the hope that they would be stamped and placed on our boat. This is farther north than Longyear and stamp collectors will perhaps be pleased if the plan works.



We left in the early afternoon for Krossfjord, a distance covered in about one and one-half hours. There is no place to land in this bay. We went in to get closeup views of the glaciers and to rub noses with the icebergs. The weather was glorious. It is impossible to describe the grandeur of these scenes. The mountains were green in part—pretty far north for vegetation! After getting as close as we dared, we turned and went for the open sea. The captain had posted a bulletin to the effect that if he found fine weather ahead we would go on to the Ice Barrier and see the Polar Ice under the Midnight Sun. However, we ran into a stiff wind with fog, and he turned back and went into Magdalenafjord. Here we found the German liner, Berlin, of the North German Lloyd Line, which we had first seen in Krossfjord. It was on a long cruise—almost a month, I believe. It had landed its passengers. They looked like ants on the beach. We approached incredibly near the shore and anchored. The water here was calm and the midnight sun so brilliant that colored glasses were almost a necessity. Our captain sent out a flat boat or pontoon which was beached and served as a landing place for our launches.



Ice Barrier at 9 a. m. We stopped at 81° North Latitude and 10° East Longitude. The sky was cloudy, which we considered an advantage. We could look at the Ice Pack without colored glasses. Floating ice was all about us. To the north, northeast, and northwest nothing but ice was visible. It was not so solid and wall-like as I had expected. The captain explained that a strong wind had been blowing from the north for some time, the ice had broken, and was floating southward. We could have proceeded farther into the moving ice, but we agreed with the captain that it was better not to risk a propeller. The air was cold. We looked for polar bears but didn't see any—just a great expanse of white-blue ice making a long line along the northern horizon.

We remained in this position for perhaps an hour, looking through field glasses and exclaiming at this sight and that. Finally the ship turned slowly around, pushing the floating ice gently aside as it did so. We had attained our objective. We had been within 500 miles of the North Pole!

The Germans had erected a temporary bar and were serving cold sausage sandwiches and beer to their passengers. It was a midnight lunch actually although it looked like a midday picnic.

A Norwegian young man, an attorney of Oslo, Axel Heiberg, who has a secretarial position with the government, was my fellow hiker on this trip. We first went to an arm of the bay where we saw a small part of an immense whale lying on the shore. Nearby was a small hut where someone has recently lived. A case of French condensed milk (left for some future occupant) was found in the hut.

We started climbing through the rocks and snow to get a better view of one of the glaciers which was "calving" as the guide books say. It came down, a huge wall of blue and white, to the water's edge. It was melting in the intense sunlight and pieces were falling into the water. Two large sections fell with a loud report and caused a small tidal wave which made people scurry back from the beach. Where the ice had fallen off was now a surface of exquisite blue.

As we climbed we were suddenly halted by two shots fired in quick succession. It was our captain firing the sunset and the sunrise gun. My watch said 12:15 and July 30 had begun. We were so warm climbing in the sun that we left our top coats on the rocks and went on up without them. We talked with some German sailors. They were all exceedingly friendly. The views were inexpressibly beautiful in every direction—midnight sun, glaciers, rugged peaks of rocks and snow, and the silver blue water of the fjord!

On our way back we went over to a point where the government has erected a simple stone monument to Svalbard Explorers, 1600-1750. Here were numerous graves with skeletons and coffins revealed by the elements.

The floating ice had collected about our ship. Our launch took us safely to it about 2:30 a. m. I was loath to leave so beautiful a scene but I went to my cabin at 3, and suspect we sailed shortly after.

Tues., July 30, 1935.

This day is notable for the fact that we reached the

SVALBARD CERTIFICATE

It is hereby certified that:

H C Richardson

on the S.S „STAVANGERFJORD"s summer cruise 1935 has visited SVALBARD and the Ice Barrier at 81° north lat. and 10° east long.

K. S. Irgens
Commander
S.S „STAVANGERFJORD"
Norwegian America Line
OSLO

"never-ending Progress to perfection"

A MIXTURE of steel dust and kerosene now enables engineers to detect flaws in steel castings and machine tools which heretofore went unnoticed. This mixture of hammerscale, which is known as "magnetite," is poured upon a casting or tool which has previously been magnetized. If the presence of a flaw is suspected, the magnetite thus applied will reveal even the smallest cracks, even those invisible ordinarily to the naked eye. Only magnetized steel can be tested by this method as the magnetic poles near the flaws are necessary to attract the dust which will show the imperfection.

Steel dust is used as flaw detector

THE BLACK Ball Ferry, *M. S. Kalakala,* gave Puget Sound, Washington, the first completely streamlined ship operated anywhere on the seven seas. The name of the ship was taken from the Chinook Indian language, meaning "Flying Bird," and that it resembles one can be seen on first sight. The *Kalakala* is 276 feet long, has a beam of 55 feet 8 inches and a draft of 13 feet, with a capacity of 2,000 passengers, and 110 automobiles. Of unusual construction, 97¾ per cent steel, she is completely fireproof. The superstructure is entirely welded by a special electric method which gives great strength and eliminates unsightly rivet heads and overlapping plates. Five tons of welding rod were used in the ship's construction. The *Kalakala* is propelled by a Busch-Sulzer Diesel engine which develops 3,000 horsepower at 230 rpm. The auxiliary generating unit is a 600 horsepower Diesel engine direct connected to a General Electric generator rated 500 kva with a 10 kilowatt, chain-driven exciter. This generator furnishes power for the various engine-room auxiliaries, such as blowers, compressors, pumps, etc., as well as for the galley and lights. The original Black Ball Line was established in 1916 to give regular service between New York and Liverpool. During the famous clipper ship era, some of the fastest ships to fly the American flag flew the house flag of the Black Ball Line.

First stream-lined ferry is all steel

Absolute Zero

The latest attempt to reach the unattainable temperature of absolute zero has resulted in a figure approximately one five-thousandth of a degree above —273.15 degrees centigrade, the accepted value of absolute zero. A magnetic thermometer, together with special salts, were used. The salts were cooled to the temperature of liquid helium, 1.6 degrees above absolute zero. A magnetic field of 30,000 gausses, lowered quickly to 25 gausses, was used to lower the energy of the salt particles, and as their energy decreased, so did the amount of heat contained. The samples became colder and colder, reaching finally their lowest temperature, and then began to warm up to the temperature of the liquid helium bath. The rate of warming was measured by detecting the magnetization of the salt, from which a curve was plotted to show the relationship between temperature and magnetization. By extending the curve negatively, the above calculation was made.

A NEW General Electric laboratory product has again come to the fore in the shape of a new aid for determining the exact number of foot-candles, not only for the specific task but for the specific pair of eyes doing the seeing. Looking somewhat like a pair of opera glasses, and just as convenient to manipulate, the meter is really two instruments in one, as it will also appraise the relative visibility of various objects. It is calibrated for normal vision and takes into account the numerous psychological and physiological factors involved in the complex process of seeing.

Visibility meters fit light to eyes

EQUIPPED with a periscope and a specially-designed 12-lens, motor-operated high speed camera, the only building of its kind in the world has been erected in this country. In this unique structure, lightning research engineers of the company expect to obtain new information on natural lightning. With facts garnered here, they expect to strengthen and improve transmission and distribution equipment and so further safeguard from lightning damage and interruption the far flung networks carrying light and power throughout the nation. Of even more interest than the building, which resembles a window-paned water tank, are the instruments inside. The periscope operates through use of a crystal sphere eight inches in diameter, at the peak of the structure, whose brilliantly silvered area reflects lightning flashes from any direction and sends their images down through a dark walled tube to a mirror set at an angle of 25 degrees. Images, from up to 20 miles away, are visible through an eye-piece. The camera with its 12 lenses is unique in photographic equipment. The 12 eyes cover the entire 360 degrees of the circle and through them may be recorded on a moving strip of film any flash of lightning within range. The film record thus obtained is the basis for laboratory study and from it facts relating to the multiplicity of the strokes and other information are secured.

12 lens camera catches lightning

Faster Yet Safer

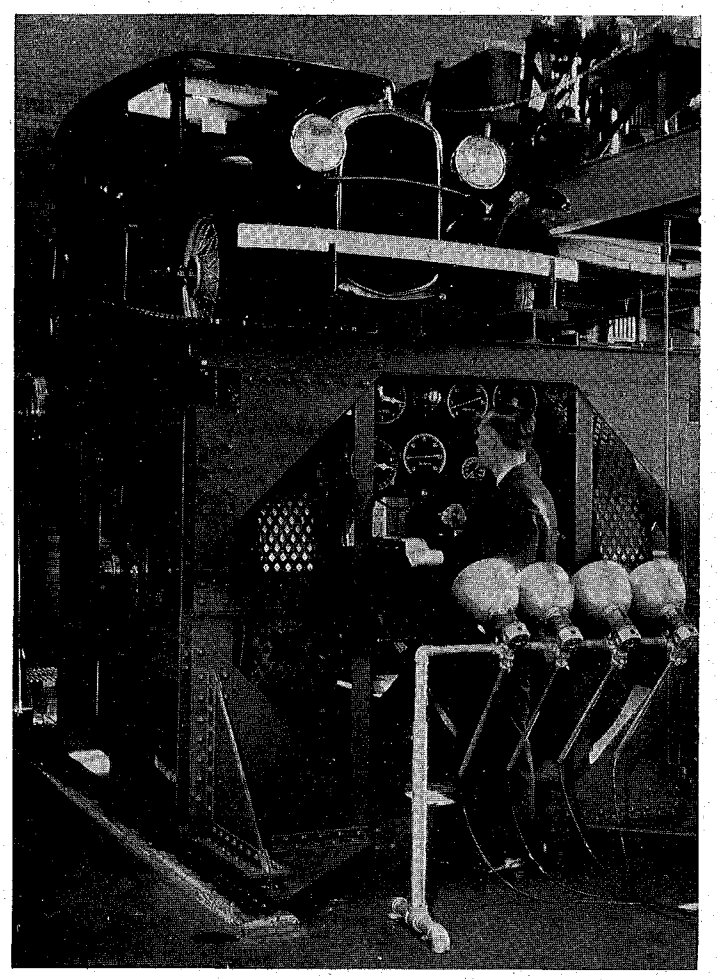
HIGHWAYS

For the Future

By Reino Ranta, M. '39

WHILE great advances have been made in the improvement of automobiles towards greater comfort and safety, relatively little has been accomplished in this respect in the way of the roads themselves. Granite blocks, bricks, and creosoted blocks are commonly used for paving. Cast-iron blocks have been in use for seven years in England, where thousands of tons of such blocks are produced annually. With an increased market such cast-iron paving would be fully as cheap and possibly cheaper than brick and at the same time provide superior wearing qualities.

The blocks used in the short stretch of experimental paving at the entrance of Fifteenth Avenue S.E. onto Washington Avenue are triangular in shape. The upper surface of each block is covered with diamond-shaped studs and the bottom of the block is hollowed. A feature patented by Iron Roads, Ltd., of England is embodied in the three supporting points on the undersurface of each block. This eliminates the rocking present in rectangular blocks. The Inter-Lake Iron Company has already taken over the English patents and is ready to cast this type of paving at Toledo, Ohio. Such paving will provide a use for Minnesota's almost unlimited supply of low-grade iron ore.



It is necessary to determine by experimentation the type of paving that will give the safest and most pleasant riding. In this conjunction, tire manufacturers have conducted experiments to eliminate weaving and noise in tires. It was found that by making the studs on tires irregular, noise and vibration were eliminated. The same principle holds true of the studs on iron paving. It was also discovered that tire wear is almost entirely due to slippage. By producing a surface that will eliminate slipping, wear can be very materially decreased.

To conduct such experiments outside, it would be necessary to build at least a half-mile of paving. Even then difficulty of making measurements in a moving vehicle and the great expense incurred in re-laying the stretch with varying types of blocks is obvious. Thus it was that E. W. Davis, superintendent of the School of Mines Experimental Station, conceived a machine to duplicate road conditions and facilitate the testing of cast-iron paving.

In its essential form the testing is done by simply reversing actual conditions and passing the paving under the wheels of a car. Several months were spent by Professor Davis and his staff in preparing blue prints and ordering the varied parts necessary in an original machine before the work of assembly was begun and the machine finally ready for use.

The machine consists of a Plymouth sedan mounted on a frame of heavy steel beams reenforced at the corners with steel plates. The frame extends slightly beyond the car on each side and is approximately seven feet high. The rear wheels of the car are clamped to the frame, and the rear bumper is attached to the frame by means of a heavy spring. The front wheels rest on two large flywheels within the frame. The flywheels, so constructed

that their inertia is equal to half that of the car, are in the form of steel drums sixty-eight inches in diameter and a foot wide. The two thousand-pound flywheels are set on a large axle and rotated by a belt from an electric motor. The paving blocks to be tested are bolted to the outer surface of the flywheels.

An automatic device makes it possible to turn the front wheels of the car from the outside so that a skidding force can be obtained. The master cylinder of the hydraulic braking system of the car is placed in a convenient position so that control over the braking force applied to the front wheels is possible from the outside. Weights totaling six hundred pounds are placed inside the car to give it an average load.

An instrument board, located in the forward end of the frame, is illuminated by a battery of four floodlights so that readings of the instruments can be taken by a high speed moving-picture camera. As most of the data of the experiments is centered in an interval of from two to three seconds (i.e., from the time the brakes are applied to when the wheels come to rest) such a camera, taking sixty-four readings a second, becomes a necessity.

At the top and running from left to right on the instrument board are a revolution counter for the right wheel, a speedometer, a gage measuring side force, and a revolution counter for the left wheel. Below is a dial recording the time, a gage measuring braking force, a gage showing braking pressure, and a flywheel counter. Below the board are two "vibrographs."

The revolution counters give the revolutions made by the front wheels and fly-wheel respectively. The speedometer is included for popular interest and when the machine is at top speed shows a reading of about sixty-five miles per hour.

The skidding force developed when the front wheels of the car are turned is shown on the side-force gage by means of a hydraulic dynamometer attached to the center of gravity of the car by a cable. This type of dynamometer is more sensitive to a small motion than one of the spring type.

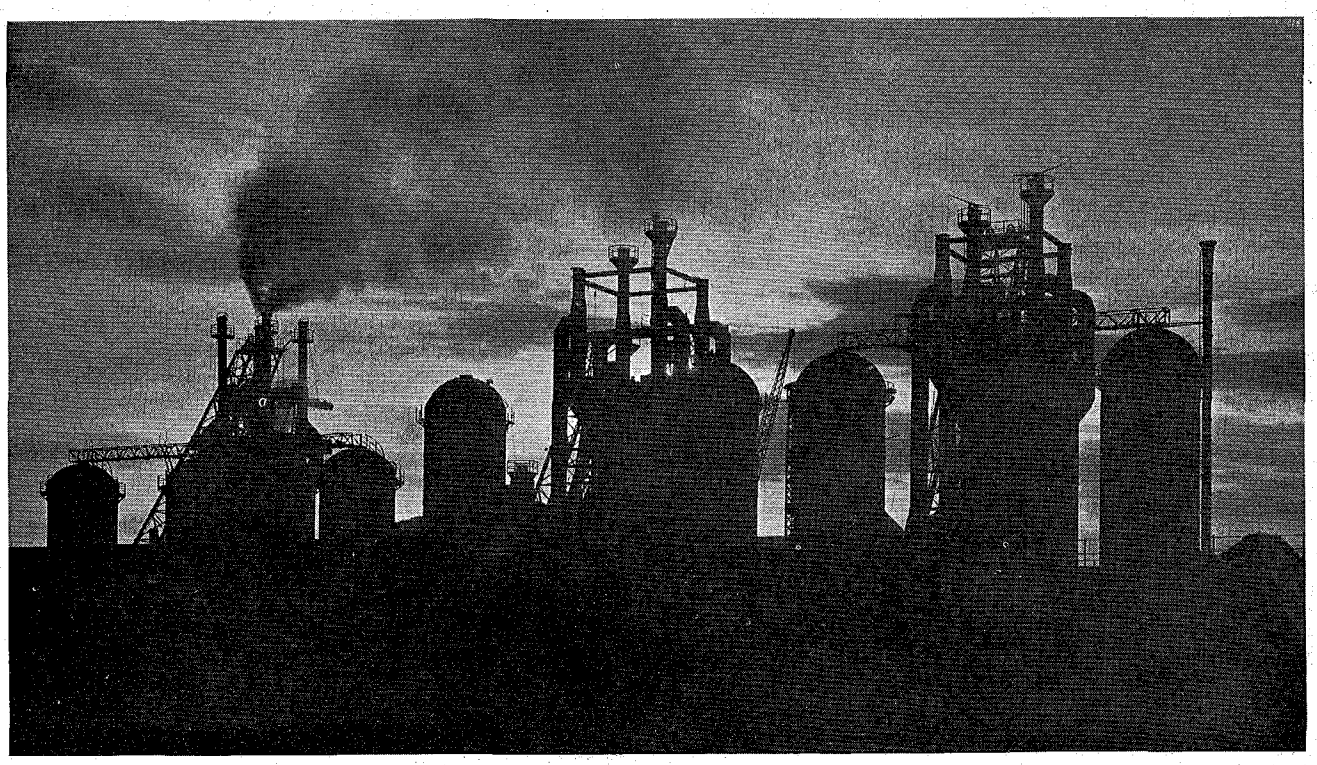
The clock, requiring 2.5 seconds for each revolution of the long hand, is run by a synchronous electric motor. The two remaining gages measure the braking force or "drag" on the car and the oil pressure, respectively. The pressure on the brakes must be known in order to duplicate readings.

The two "vibrographs" are connected with the synchronous motor. The instrument on the left records the forward and back motion of the front axle, and the other the vertical movement. The pens are lowered onto or raised from the paper by means of solenoids. On the graphs, 1.3 inches correspond to a second of time.

It is interesting to note the periodicity present in the recorded graph from the instrument showing vertical vibration as the flywheels reach their maximum velocity. This is due to the fact that the front wheels are not perfectly circular and as they revolve swiftly go in and out of phase so that the car "chatters."

Varying weather conditions can be produced by playing a stream of water over the flywheels. Static tests have shown that the iron surface is no worse than concrete under icy conditions, but the studs melt the ice above very soon to give better traction.

By varying the types of surfaces on the blocks it is hoped that the stopping distances can be reduced to a minimum. This would mean increasing the coefficient of friction to a maximum. The coefficient of friction can be obtained by dividing the braking force by the weight of the front of the car and making corrections for certain other factors.



—Courtesy Mechanical Engineering

The MINNESOTA Techno-Log

JANUARY, 1936

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Cost of Flying

TRAVELING men of the great Northwest have discovered they can have a cocktail over Minneapolis, steak and mashed potatoes while flying over some North Dakota plain; and dessert along with a Montana landscape. Do stratosphere ascensions, trans-Atlantic flights, and round the world jaunts add up to this?

Aviation, led by such projects as that of the China Clipper, has progressed by leaps and "hops." Typical of airplane success, the mail carried in on the Clipper safely reached its destination after riding in the new Pacific airliner, which left Manila December 1 and reached San Francisco five days later on a return leg of its trip.

Though man has made progress with his lithe throbbing monsters, he still has to meet the problem of cost. The China Clipper, a 25-ton airship, cost all of $400,000. Business men don't travel around that way, even during the best of times.

Records and developments as brought about by China Clippers and their partner ships point to the day when there may be an airplane owner in every family. Already the department of commerce has been attempting to create an air flivver to sell at $700, a move which has enmeshed the department in a controversy with many concerns.

Secretary Roper has asked for 87 million dollars for construction and improvement of airports and the federal government has allotted 23 million dollars for this purpose during the last three months.

The China Clipper has already won for itself and its airplane sisters a mail contract on the Pacific. Perhaps its success will stimulate the development of an airplane for the common man.

At the Desk

WHAT do you think of the cover picture this month? It was printed by a rather different process. The cut was printed in black in the usual method then moved over to one side a distance of .0033 inches (one-half the distance between the dots on the plate) and printed again in blue. Result: the black dots peep through between the blue ones and we have a two color process using only one plate. The photograph was loaned to us by the Hamilton Standard Propeller Company.

The magnificence of the new San Francisco Bay bridge is brought before us in an article written by Bob Teeter. Bob was out there this last summer, so he has first hand information.

A year's issue of the Techno-Log would not be complete without a story on the summer travel of Mr. Richardson, our genial English professor. This one meets all of his former high standards in articles.

The inside dope on the Pavement Tester is given us in a short article by a Miner, Reino Ranta.

The shorts this month include articles on Anodized Pistons, the regular Progress page, Alum News, Architects' page, Campus news, the usual Mental Tilts, and Stray Scraps. As an additional treat, the ghost of B. H. T. L. has been resurrected to write "An Engineer Looks At Life." By the way, your editor is one of the very few persons to know just what the T. in B. H. T. L. stands for. With sufficient encouragement he might publish it.

How to Handle Women by Electricity

If she is wrong—Rectifier
If she is too fat—Reducer
If she becomes upset—Reverser
If she wants chocolates—Feeder
If she talks too long—Interrupter
If she is a poor cook—Discharger
If she gets too excited—Controller
If she is out of town—Telegrapher
If she sings inharmoniously—Tuner
If she gossips too much—Regulator
If she goes up in the air—Condenser
If she is picking your pockets—Detector
If she will meet you half way—Receiver
If she wants to be an angel—Transformer.

Now Here's A Book

By Clifford I. Haga

Instructor in English

WITH war in all its forms and with all its implications so much in our minds today, it might be pertinent to call in an expert consultant to straighten out our thought. For that reason I am going to introduce my readers to Captain Liddell Hart, the English staff officer, military historian, and philosopher of war, and the half-dozen books by which he has labored for a dozen years to force us to think of war logically and intelligently. Loving sweeping generalizations as I do, I have learned by bitter experience to resist their temptations; but the one I am about to make is so attractive that I break the pledge again. Boldly and flatly I say this: no person whose reading has been confined to the major war novels and plays, however good, from Barbusse's "Au Feu," through "What Price Glory," "All Quiet on the Western Front," "Journey's End," to "The Road to Glory," or such autobiographical works as Graves' "Goodbye to All That" and Lawrence's "Seven Pillars of Wisdom"—to name only a few—no such person can think or feel maturely about war until he has read Liddell Hart.

Why? Simply because Captain Hart is a soldier whose intellectual processes have been as diligently drilled as the more limited motor-sensory system. Driven by a philosophical and historical hunger, his life has been devoted to a discovery and analysis of first principles. As we read him we learn that war is more than a large-scale football game between two differently uniformed hordes, more than a heart-wearying puppet show jerked through its inconclusive routines by diabolic munitions-makers or international bankers and industrialists, more than that hysterical thing called—by the hysterical—mass-murder. We learn that war is more than a string of hair-raising metaphors. War is—war. It is a means to an end. To say that it is as frequently misused, as it is well-used, is only to say that down through history we have not always refrained from abusing our inventions and institutions.

Of course war is only one of several means to that end: the settlement of political differences. To make war the only or chief scapegoat is careless thinking. If, for the moment, we forget the other alternatives to war and think of it alone as Liddell Hart teaches us to think of it, we find that everything said about war is true—not because war is necessarily any more vicious than some of its substitutes, but largely because those who make war (and that means civilians and politicians rather than the military) are all too likely to be incompetent to employ the technique of war intelligently, profitably, or effectively. In other words, he measures war by the cold standard of the technologist whose categorical imperative *Zwechmässigkeit* ("fitness for the purpose") is quite uncolored by either the sentimental benevolence of the old-fashioned, garden variety liberal or the passionate ardor of the robot-patrioteer geared to a blaring reiteration of "My country, right or wrong, etc." Philosophers still practice Aristotle's precept of the Golden Mean—even when they talk about war.

After reading Liddell Hart's four best books—"The Real War: 1914-1918," "Sherman: Soldier, Realist, American", "Foch: The Man of Orleans," and "Colonel Lawrence: The Man Behind the Legend"—a thoughtful person will be profoundly moved. Each one of them in turn, and particularly "The Real War" and "Foch," portrays a system which might be called institutionalized incompetence. The tragedy and failure of the tremendous effort war entails are rooted in a disregard or ignorance of first principles. In the biographies of Sherman and Lawrence and in the earlier book, "A Greater Than Napoleon: Scipio Africanus," we see that war, within its proper limits and when it most closely adheres to first principles, is not the least desirable means to an end.

The whole problem seems to boil down to this: international rivalries and disputes necessitating settlement by war (as at present) are the result of unintelligent living, and the inconclusive and enervating technique of arbitration called war cannot be expected to be better than its origin. One need not be a geneticist to trace the perverse genealogy.

Hopeless and shocked though one may be, a reading of Captain Hart's books can become a wholesome and sanative discipline. As I have reiterated, first principles must be stated before thought or action can become profitable. He gives us these first principles with a wealth of specific illustrations. I recommend him to my friends in both extreme camps, to both pacifists and militarists. For the first, the rigor of his analysis will canalize the well-meant floods of emotion and sentiment which so often sweep pacifists off their feet. To the latter extremists Liddell Hart's work, in its cool and detailed particularizing, will be a check and a brake as effective as Santayana's apothegm, "To delight in war is a merit in the soldier, a dangerous quality in the captain, and a positive crime in the statesman."

Of Liddell Hart's books these are the ones I find best and in this order: "The Real War," "Colonel Lawrence," "Sherman," "Foch," "The Remaking of Modern Armies," "A Greater Than Napoleon: Scipio Africanus."

ANODIZING PROCESS ON PISTONS

A New Surface on Aluminum

By Gordon Brierly, E.E. '38

ALUMINUM alloy pistons with a hard, long-wearing surface are now being produced by the Buick anodizing process. The latest installation at the Buick plant is completely conveyorized, facilitating automatic operation and accurate control. Anodizing is, in effect, a de-plating process. The current, which is sent through the treating tank, is opposite in direction to that which would be used for ordinary electro-plating. The nature of the bath is such that a hard oxide is formed on the surface of the piston, integral with the metal rather than a plating.

The pistons treated, after being hardened and ground, are clamped on specially designed racks which also serve as one electrode. The overhead conveyor system picks up the racks and carries them to a tank containing a chemical cleaner which removes all foreign material. After remaining in the bath for a short time they are again picked up by a conveyor and transferred to a water rinse tank to remove the cleaner chemical.

Another continuously running chain conveyor removes the racks from the water and lowers them into the anodizing bath. Here the racks and pistons move slowly around a "U" shaped tank, reaching the other end in 15 minutes. Then they are lifted out automatically and rinsed first with cold water and then with hot water in order to remove all traces of the chemicals used in the anodizing bath.

The racks and pistons are then taken out of the water and the pistons are removed from the racks to be finished. The empty racks, however, are not removed from the conveyor but continue on into another bath where the current is the reverse of the anodizing current. This removes any oxide which may have formed on the contact points of the rack, the oxide being a non-conductor of electricity. All parts of the racks except the contact points are coated with a non-conducting surface to prevent electrolytic action.

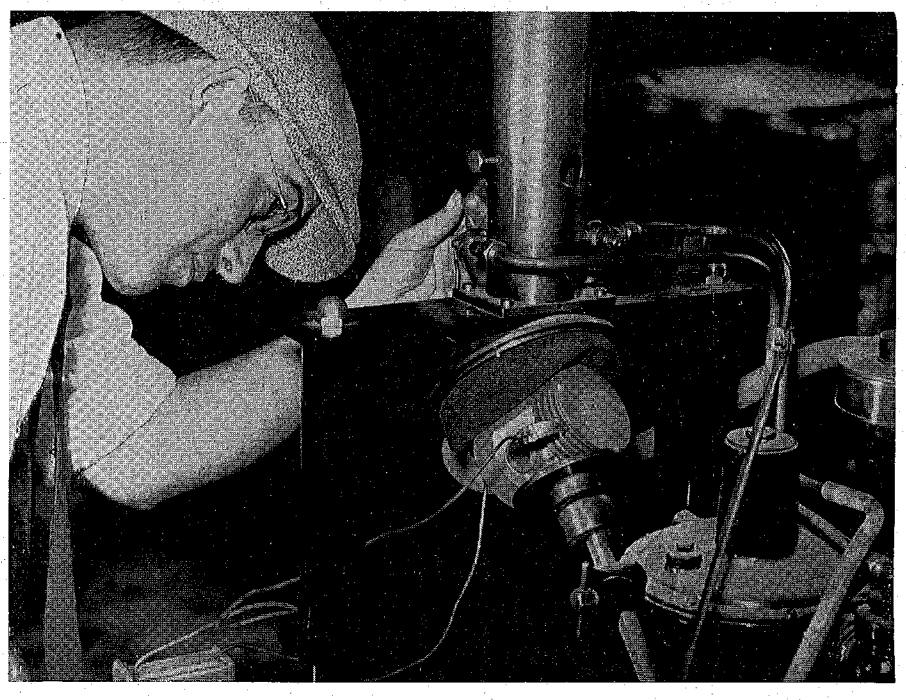
The method of controlling the temperature of the anodizing bath is notable for its accuracy. The bath, which is continuously agitated by the moving racks, is cooled by conduction through the inside walls of the "U" shaped tank to a large tank of cold water. The water supply for this tank is from a well, 354 feet deep, which was sunk to assure sufficient water at an absolutely constant temperature. The water coming from this well is almost ice-cold.

Well water is used because it was found that the temperature of the city water varied too much to provide the close control necessary. The bath chemicals are thus held within one degree Fahrenheit of the specified temperature. Pyrometers in the plating bath, coupled with the control of the rate of flow in the cooling tank help to hold the temperature constant.

The non-conductivity of the oxide makes possible a rather ingenious method of determining the hardness and thickness of the oxide coating on the pistons. A piston to be tested is mounted in a specially designed sand-blast machine (see figure). Contacts are placed across the skirt of the piston in series with a battery and an electric lamp. The time required for the special grit of the sand-blast to cut through the oxide coating is measured. The lamp will light when the coating has been cut through and the circuit completed. The time required is proportional to the combined hardness and thickness of the anodic coating.

The new treatment produces pistons which wear as well as cast iron with the added advantage of a 50 per cent reduction in weight. The load on connecting rod bearings may be thus lowered to such an extent that bearing life is more than doubled.

This ingenious device measures the thickness and hardness of the anodic coating by sand-blasting the piston surface until an electric circuit is established by exposure of bare unoxidized metal. In operation the mechanism is enclosed as a protection to the inspector.



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The 18th Annual

MINERS' SHINDIG

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ALUMNOTES

1936! We wondered the past year just what this year would bring us; or must we go out and get what we want. As time goes on we find that both are true. To you readers, both alums and students, we bring better news this year in these columns. You may wonder what "better news" we have in mind. More employment, better jobs, and more marriages is the "better news" we bring.

E. H. Hovemeyar, '35 Electrical, is working for the General Electric Company at Erie, Pa. Mr. Hovemeyar came back to Minneapolis recently with a ring. That sounds like prosperity, doesn't it?

Carlyle R. Burton, E.E. '35, is with the General Electric Company of Schenectady, New York. Carlyle was married on December 28, 1935.

Leonard T. Ostergren, '35 E.E., former A. I. E. E. president, is now with the Goodyear Tire and Rubber Company at Akron, Ohio. Leonard came back here for the holidays.

George E. Morris, '27 Civil, is with the United States Coast and Geodetic Survey. He has been recently working on hydrographic surveys of the East and Gulf coasts and Alaska. George is married and enjoys golf and photography as hobbies.

"The demand for competent structural engineers exceeds the supply," says **Kenneth Cromsie,** '29 Arch., who is employed as chief engineer by the Paper Calmenson Company. Kenneth went on to say that a great deal of private work in the line of structural engineering was in the offing.

Kenneth Hornung, Arch. Mar. '34, was married on Christmas Day, 1935. Kenneth is working on an engineering project of the WPA in Waterloo, Iowa.

Charles N. Bailey, '31 M.E., is Superintendent and Chief Engineer at 111 South Dearborn Building, Chicago, Ill.

R. E. Samuelson, M.E. '33, is an engineer with the Collins Radio Co. at Cedar Rapids, Iowa. Mr. Samuelson spent six months in South America (Colombia) installing transmitting stations for the Company.

Robert K. Zeese, '30 Civil, is a Junior Highway Engineer in the Division of Management of the United States Bureau of Public Roads at Washington, D. C. Robert has been working in various sections of New York, New Jersey, and Florida. He is not married, so moving around doesn't bother him. He has been working with Ray Hertel, '30 Civil, James Hanson, '29, and Rex Anderson, '30.

Lester J. Rowell, M.E, '29, is test engineer for the Chicago District Electric Generating Corp., Hammond, Ind. Lester says that the world has been very good to him and he is still single.

Bill Reichow, M.E. '30, told us that he has just been transferred from the N. Y. office to the Kansas City office of Brown Instrument Company. Bill said he expected to take on a wife Saturday, Dec. 28, 1935, as he was afraid to go to Kansas alone. We don't blame you, Bill, and we hope you got there O.K.

> Alums! Send us news about your job, your hobbies, your progress, and anything which would be interesting to your former classmates and instructors. They're just itching to hear from you. Write to the Alum Editor, in care of this magazine.

Christmas vacation brought down **Eric Peterson,** '33 Civil, and **L. A. Rodert,** '30 Aero., from Duluth Junior College, where they are employed as instructors.

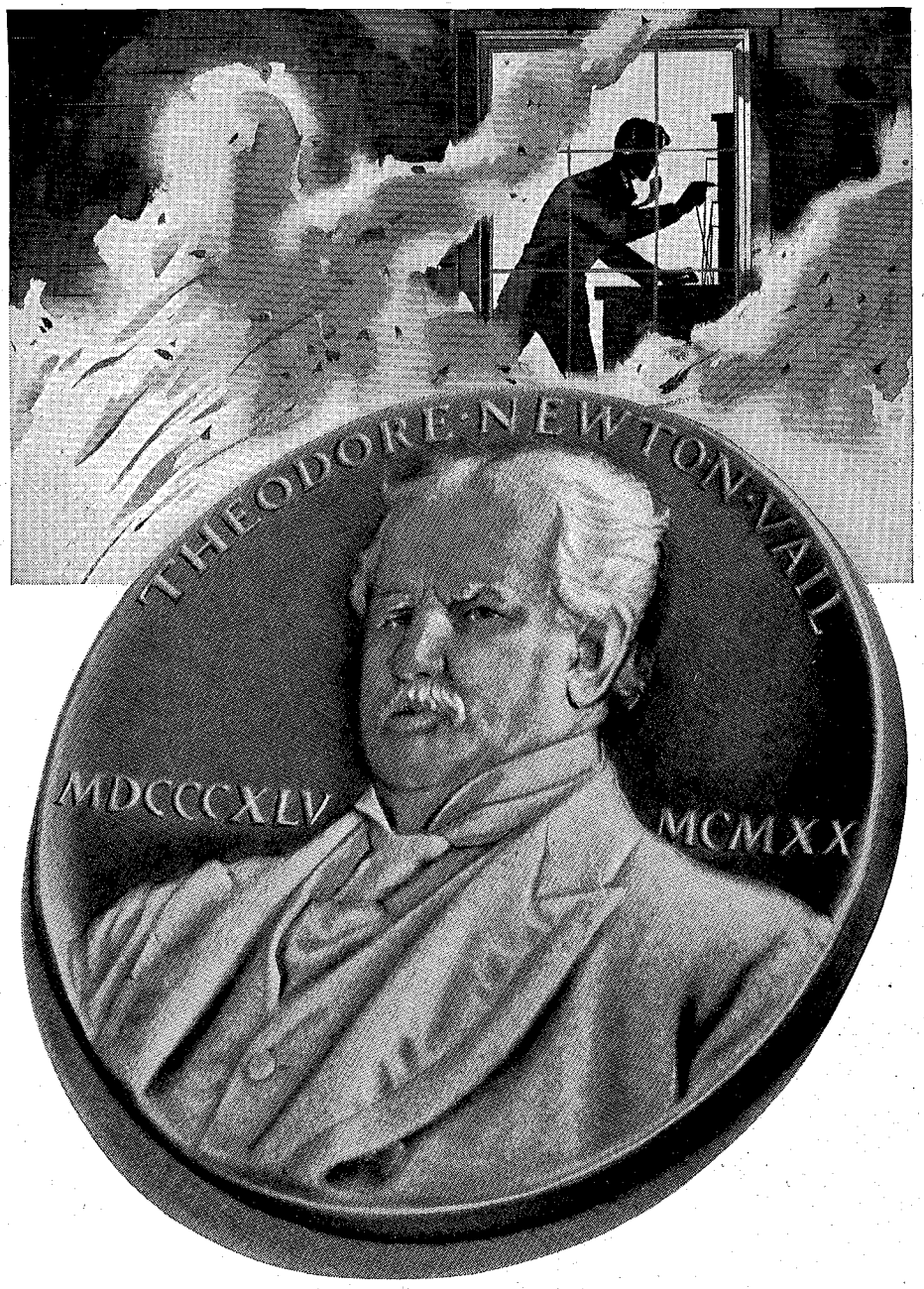
E. L. Kells, M.E. '34, has completed the work for his Master's degree at California Tech., and is now with the Southern Counties Gas Company, Los Angeles, California.

Paul Honey, M.E. '31, is with Procter and Gamble Mfg. Co., Staten Island plant. He is now Edible Process Supervisor and has charge of a division of 58 men.

Here's getting ahead for a '35 Civil! **Leon Hamlet** is in the sales department of the Minnesota Highway Department at Morris, Minn. He is assistant to **W. C. (Bill) Hill,** '32 Civil, who is also with the Department. Leon was married to Charlotte Granges, '32 Minnesota, on September 28, 1935.

L. J. Markus, EE '33, is now an instructor at the National Radio Institute, Washington, D. C., his work includes the writing, editing, and revising of radio lessons. He was married to Miss Jeanette Evans, '35 Ex, last fall; after touring the East for a Month, the couple is now settled in Valley Vista Apartments, Washington, D. C.

Paul Wallfred, M.E. '34, is working for the Tropic Aire Company in Minneapolis, along with Lyle Scott, E.E. '35.



Back of a Medal

FIRE was raging through a Virginia village at midnight. A telephone workman sped there from his home... found the central office in danger.

Relieving the young woman operator, he handled all calls . . . summoned help from nearby towns . . . 'til buildings on both sides collapsed and the telephone building caught fire. Quickly he disconnected the small switchboard . . . moved it to safety . . . improvised a telephone station in a field.

In 20 minutes he re-established communication. Next morning, the rescued switchboard was installed in new quarters . . . telephone service was resumed as usual.

That telephone man received the Vail Medal... one of several awarded each year to Bell System employees for outstanding public service. Devotion to duty... day by day as well as in emergencies... has given America the world's finest telephone system.

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Architecturally Speaking

Architectural Literature

LAST month I made several remarks concerning the use of professional books by architectural students. Today I should like to elaborate on the subject a bit. If you will remember, which you undoubtedly won't, I said something about reading the books as well as looking at the pictures. I said this because you can never evaluate a building fairly without knowing something about the conditions under which it was built. Of course, I'll grant you authors don't always coöperate by giving that information. So if you will bear with me I should like to present a very brief sort of "Readers' Guide" of architectural books, particularly those dealing in ideas.

Works of architectural philosophy of the classical eras are rather rare; most of the discussion of these was by modern writers tending to be frightfully technical, something I would like to avoid in this list if possible. The Roman book on Roman architecture is Vitruvius' "Ten Books on Architecture." These are interesting for an exposition both of Roman ideals and fancies and of some of the ageless architectural clichés. A good general survey of architecture is Charles Whitaker's "From Rameses to Rockefeller," which seeks to correlate the age with the architectural expression. A good work on the early ecclesiastical work is Josef Strzygowski's "Origin of Christian Church Art." An interesting book to read in connection with a study of Renaissance architecture is Ralph Roeder's "Man of the Renaissance." While it is not in any sense an architectural book, it gives excellent background material concerning the life and times. Typical of the works written during the Renaissance is Vignola's treatise on the orders, nothing more than a mathematical treatise on the proportions of the Greek and Roman orders.

In modern times the field really gets thick and exciting and vitally interesting to us because these men are writing about the times in which we live, trying to find an expression in sticks and stones of contemporary ideas.

The forerunner of modern work was Louis Sullivan. His philosophy is really best presented by a reprint of "Kindergarten Chats" in which you find exposition of his famous dictim "Form follows Function," and his plea for an American architecture instead of a mere copying of the dead forms of past ages. Sullivan also wrote "Autobiography of an Idea," telling of his own rise and development. A very recent book by Hugh Morrison on Sullivan gives a good survey of his life and work with excellent pictorial material. The philosophy of his follower, Mr. F. L. Wright, is expounded at great length in his now somewhat scandalously famous "Autobiography" and in the more serious "Modern Archtitecture, the Kahn Lectures for 1930." He has also written his Town Planning ideas in the "Disappearing City," later given concrete form in his studies for Broadacre City. With the exception of Sullivan and Wright, practically all the books on contemporary architectural thinking are foreign. Foremost among these is Le Corbusier with three books to his credit —"Vers Une Architecture," giving his feelings and thought on architecture in general; "The City of Tomorrow," a self-explanatory title; and "Le Ville Radieuse," a further development of his ideas on town planning for more sunlight and air. Andre Lureat has written an interesting book called "Architecture" although it is written in French.

A great many fascinating monographs have been published in Holland, Germany, and France on all of the leaders in contemporary architectural thinking—Gropius, Oud, Van der Rohe, and many more. These are unfortunately not available in our library, a fact which, I feel, impairs its workability greatly. An example of this type of book is the Dutch monograph on Wright, which is the only one in our local library.

The way to get contemporary movements and ideas while they are still somewhat warm is by means of the periodicals. Here again, foreign publications are more interesting and vital. This can easily be seen by comparing the periodicals in our own library. The few foreign ones devote much more space to fresh attempts to solve the present-day problems than do the American ones. Of course, the somewhat inane "housey" publications are not considered at all in this comparison. It is really unfortunate that these dilettante organs can not be replaced with some of the publications published in the centers of contemporary activity.

—G. W. B.

Dope . . .

Advance dope on the only reason for the existence of the Architectural Society, namely, the Architectural Jubilee: The local bigwigs plan to make it the biggest, the best, the most gala occasion since the Architectural Society's inception.

Last year's Jubilee brought better than a smattering of eulogies in as much as it was taken off from the campus and flung in the Curtis Neo-Classic Salon, whose exquisite gilt was relieved by a fittingly peonic brilliance of color conveying the Mehican theme of the "Beaux Arts Ball—a la Cucaracha!"

This year it is hoped that attendance will soar due to the precedent now set, but, nevertheless, it is felt that a more intimate *salle du danse* would better befit the smug indifference which has been known to infest the student body.

We have been advised to suggest that you whet your curiosity, one and all, to a point of dropping in upon the next Society meeting—member or no.

Dr. Halvorsen Will Address A. I. Ch. E.

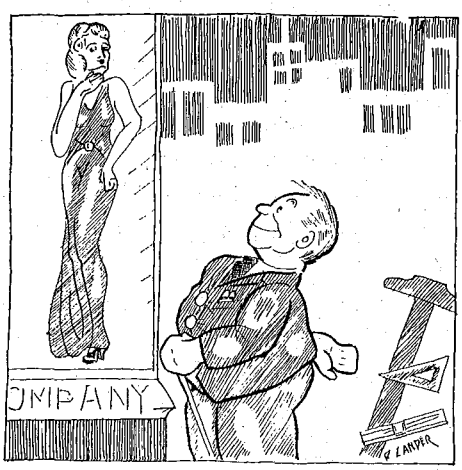
Dr. H. O. Halvorsen will address the students' chapter of the American Institute of Chemical Engineers on Thursday, January 30, at the bi-weekly meeting in the Minnesota Union. His subject will be "Sewage Disposal and the Trickle Filters" and will be supplemented by a motion picture of his recent work on trickle filters. His work, which has increased the capacity of trickle filters several fold, has created quite a panic among the sludge advocates, who long have claimed their method to be the most economical method of disposal. Refreshments will be served after the meeting.

Professor Buchta Addresses A. I. E. E.

The American Institute of Electrical Engineers held their last meeting on December 4 in the Physics building. Professor Buchta lectured on sound and acoustics and performed several experiments in connection with the lecture. An oscillograph built by the physics staff was used to project light rays reflected from a diaphragm on the wall, illustrating the wave forms of words spoken into a microphone. Another instrument filtered out certain sound waves and let the audience listen to the phonograph records with some of the frequencies removed. At the close of the lecture, Professor Buchta filled his lungs with hydrogen and spoke to the group, producing a peculiar voice.

The first meeting this quarter will be a social meeting held the second week of the quarter. The prize paper contest and other business matters will be discussed. Several inspection trips have been planned for this quarter.

An Engineer Looks . . . At Life



By B. H. T. L.

It has often been said that a drink is a curse, but to the venerable city fathers of Keokuk, it is more than a curse—it is an abomination, and particularly so when mixed with a goodly portion of devil-may-care, hilarious, high-riders.

The high-riders are those men men whose hazardous task it is to put in and rivet the beams in the arch of a bridge or in the umpty-umpth story of a skyscraper. To say that their job is hazardous is putting it mildly—in fact, Death walks hand in hand with them every day. Death holds one end of the rivet while the high-rider manicures the other.

When the folks living in Keokuk reached that stage of civilization at which they balked at swimming the river every time they wanted to play croquet on the opposite shore, they floated a bond issue and hired a company to build them a bridge. Along with the beams, bolts, nuts, and other screws, came (curse 'em) the high-riders.

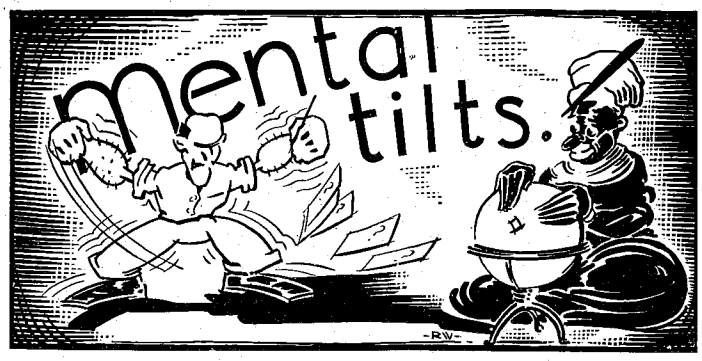
After ye old bridge was about half built, the hell-roaring high-riders got the then original idea to cause a severe drought in the town's liquor supply. After getting the aforementioned drought well rolling, they did a little rolling themselves, as gentlemen will, when in their cups, coast around for something to occupy their spare time. In their hilarious meanderings they came upon a tall concrete shaft or pillar pointing its coarse gray finger at the sky. They also accosted a bronze cigar store Indian and, when they received no reply to their convivial greeting, decided that he was a high-hat and therefore must be dealt with accordingly. They put two and two together and got the usual resultant—nine—so they hied and hicupped themselves back to the bridge and procured a miscellaneous supply of ropes, blocks, and other tackle. They proceeded to put the recalcitrant Indian on top of the high concrete monument with as much alacrity as you would utter the proverbial "Robinson Aloysious Crusoe." Their task finished, the drunken high-riders returned to their bunks well satisfied that the Indian had been chastised sufficiently and had earned his just desserts. Came the dawn, as it always does; the varmints vehemently declared themselves innocent of the whole affair.

It took those venerable city fathers three years to devise a way to get ye old Indian back to *terra firma* by some other means than blowing up or knocking down their concrete monument.

Maestro Carl E. Swanson, the gentleman who dishes out those heart-breaking quizzes, keeps his class doing the old shoulder-to-the-wheel act with little tales when his "ten-minute tests" temporarily lose their efficacy. Here is his latest effort:

A fellow was driving along past a farm and on this farm he noticed pigs running around most bodaciously from tree to tree. A pig would pause momentarily at a tree and then precipitately depart for another one at a dead run—that is, at as much of a dead run as a pig could possibly be capable of achieving. The fellow's curiosity overwhelmed him so he drove into the farmyard to investigate. He found the farmer, and asked, "Why the dementia præcox in yon swine?" The son of the soil answered, "Well, you see, it was this way. Last winter I had a bad attack of laryngitis and could not make a sound. The only way I could call the pigs to feed them was to beat on the pig-sty with a club. And now the woodpeckers have got my pigs going crazy!"

Telephone the girl at the switchboard at the Pantages and ask her to say "Ricardo Cortez" . . . . . She will.



Monkeys

There has been a problem bouncing around the office here for the last couple of years that has intrigued the staff no whit. We have wanted to run it in this column many times but there is one stickler; we don't know the correct answer. So this month we are going to turn you loose on it. One buck to the guy that first brings in a solution to us. Include all of the work so that we might check the method.

A piece of rope weighs 4 ounces per foot. It is passed over a pulley and on one end of it is suspended a weight and on the other end a monkey; the whole system is in equilibrium.

The weight of the monkey in pounds is equal to the age of the monkey's mother in years.

The age of the monkey's mother added to the age of the monkey is 4 years.

The monkey's mother is twice as old as the monkey was when the monkey's mother was one-half as old as the monkey will be when the monkey is three times as old as the monkey's mother was when the monkey's mother was three times as old as the monkey.

The weight of the rope is one-half as much again as the difference in weight between the weight and the weight plus the weight of the monkey.

The length of the rope on the side from which the weight is suspended is equal to one-half the difference between the length of the rope in feet on the side from which the monkey is suspended and the difference between the length of the rope on the side from which the monkey is suspended and twice the age of the monkey's mother when the monkey was born.

What is the weight of the weight?

He Wins

A. W. Haaland wins the simoleon for last month. All correct and turned in at 12:31:46½ p. m., December 11, 1935, just 29 hours, 59 minutes, and 47 seconds after he took his TECHNO-LOG out of the P. O. box.

December Answers

It would require 72 hound-leaps to overtake the fox. The anchor post would be located at a point 166 ft. from the 100 ft. tower, 37 ft. from the 190 ft. tower, and 172 ft. from the 90 ft. tower. In the third problem, ½ of the first ingot, 5/16 of the second, and 3/16 of the third were required to make up the fourth ingot.

A LITTLE STORY: What could be the reason for the appearance of a certain innocent young electrical engineering student at the Nurses' Home at twelve-thirty a.m. one Sunday in December; and what could be the reason for his immediate reappearance outside, empty handed and considerably chagrined? It is also rumored that (not to mention any names) Waldemar Klima, while on the first date of his life, was considerably impressed with the voluptuousness (as Waldy puts it) and cute nose of a certain student nurse. The name furnished upon request. Some claim, although the rumor is unfounded, that Waldy has been the victim of a huge practical joke made possible by a classmate's ability to impersonate a girl's voice. However, let this serve as fair warning in the future to engineers who entertain hopes of dating student nurses. We also wonder just what Mrs. Barnes, the keeper of the nurses, had to say to Mr. Klima upon his untimely appearance at the Nurses' Home . . . **Dean** Ora Miner Leland held the rank of Major in the United States Army during the war. It seems that some of the men under his command knew his full name and would address him as "Major Ora Miner Leland"; it took him quite a while to determine whether or not he was being kidded . . . . . **K.** Wimpy Waller, the maintainer of social standards at the Alpha Rho Chi house, seems to think they grow some rather attractive blondes at the Beth Page, famous for its feminine pulchritude . . . . . **The** teeming metropolis of Brainerd recently declared a holiday, the reason being: Otto William Dahl finally graduated. He is now going to assist a certain young lady from Iowa in making patchwork quilts from necktie ends. . . . . **Robert** Auvinen denies that there is anything to his being seen frequently with Dorothy Towne. . . . . **Don** Sutherland is about to jump off the deep end with Janet Jindrick. Won't some kind engineer give him a word of warning? . . . . . **Jim** Acker's big competition with Rochelle Hudson, the blonde Venus of Hollywood, is Harry Richman, the song and dance man from Broadway . . . . . **Since** our campaign for better hats to adorn the heads of our math department, no less than five new "Gourdcovers" have made their appearance in this division. However, there is still one notable deficiency. We will give him just one month to remedy the situation before making an exposure. . . . . **Are** you aware that we have an Olympic champion in our midst? He is none other than Clem Sculley, small sized sophomore in Civil Engineering, with particularly exceptional ability as a figure skater. He seems to do pretty well also with a certain young blonde and can be found in her company any third hour in the P. O. . . . . **Marshall** Edson, frosh chem whiz, has been running up a large phone bill lately making calls to a charming little girl out at Excelsior . . . . . **Jean** McAuley, Chi Omega queen from the South, is causing Dick Pratt a lot of worry these days. We wonder if the competition is getting a little too tough for him . . . . . **Who** was the young would-be engineer who called Elsa Hoidale at three o'clock in the morning to make a date with her? . . . . . **To** Omar Patterson goes the first prize for the best story of the month. He will receive a fur lined bath tub with his name engraved in gold letters. The prize for next month will be a slightly used Christmas tree. Drop all entries in P. O. 4615 along with the roof off a Terraplane or a reasonable facsimile. And so this department wishes you all a new year filled with every success, scholastically and otherwise.

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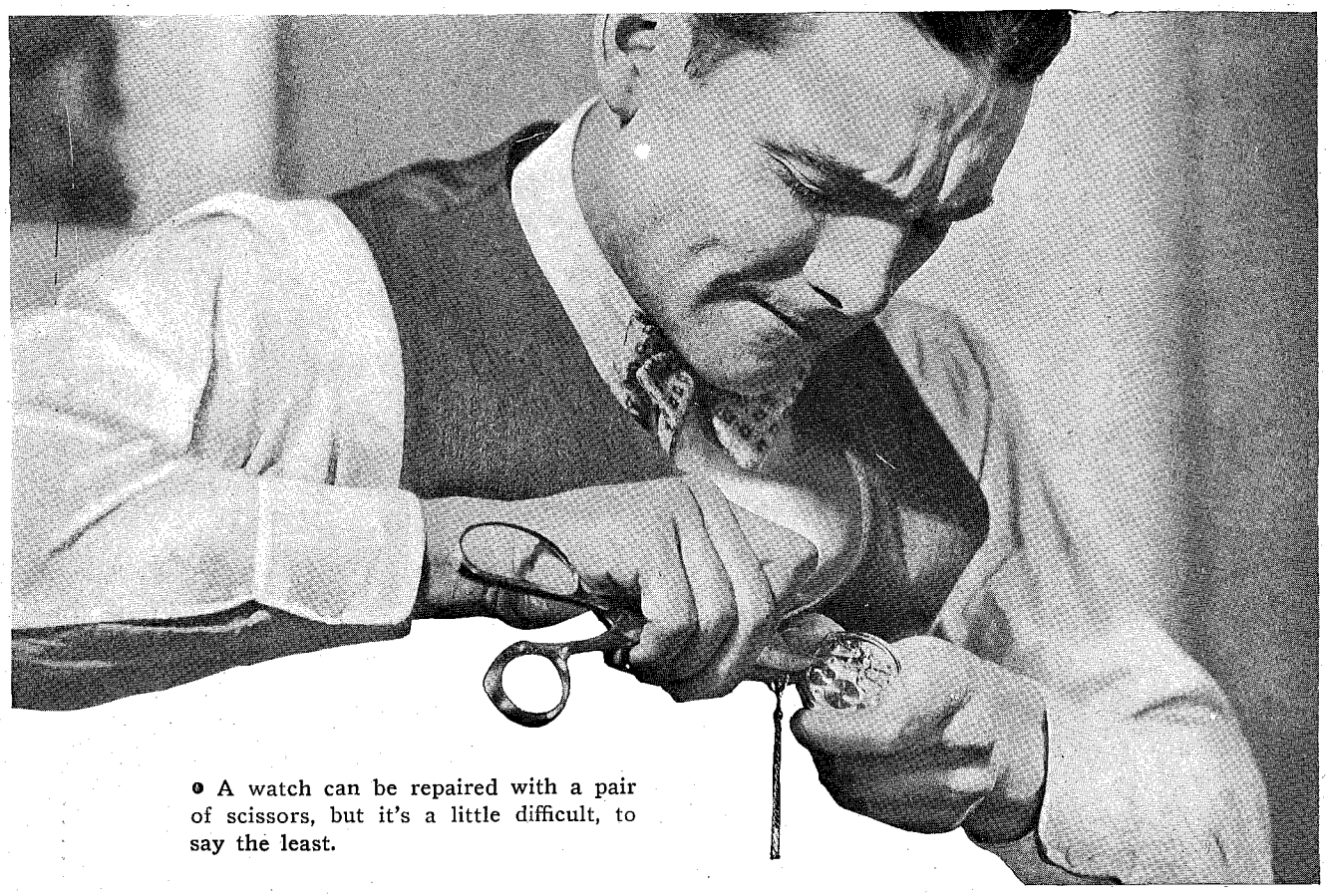

• A watch can be repaired with a pair of scissors, but it's a little difficult, to say the least.

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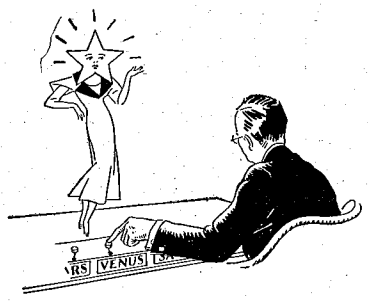
G-E Campus News

EDITORIAL BOUQUET

IT IS very pleasant to have people say nice things about one. The pleasure is curiously heightened, however, when the nice things are said in a roundabout way—never intended directly to reach one's ears. General Electric recently was honored in such a manner on the editorial page of the Spokane, Washington, *Chronicle*, and the Company is still basking in the warmth of the glow generated. The editorial, in part, read as follows:

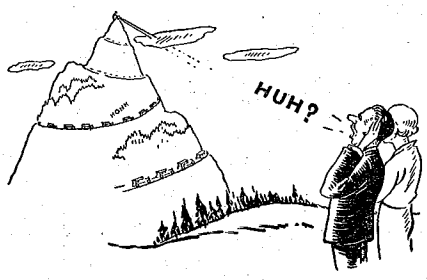
"An exposition at which inventors of the Pacific Northwest will display their work will be held next month in Portland.

"It will probably be a revelation to those who see it. Most persons find it hard to think of great men coming from 'near at home.' When one speaks of inventors or scientists, the Northwest citizen thinks of the General Electric laboratories, or of observatories in California, or clinics in Vienna. . . ."



CELESTIAL PUSH-BUTTON CONTROL

HEAVENLY bodies a million times fainter than the faintest star the eye can see unaided will be brought to the earth for inspection and photography at the touch of an electric push button when the McDonald Observatory on Mt. Locke in western Texas is placed in operation. The observatory building itself is almost completed, but the technicians of the Warner and Swasey Company at Cleveland are "making haste slowly" with the polishing of the 82-inch reflecting mirror. They estimate that another 12 or 18 months will be needed before the mirror is ready for installation. The 45 tons of moving parts of the telescope will be at the command of a single individual, who will be able to take his stand upon an observing bridge and virtually order the stars to parade before him. The motors and complete electrical control to make this possible have been manufactured for the builders of the telescope by General Electric.



VOICES FROM THE SKY

WHEN the Whiteface Memorial Highway—a road leading to the summit of the 5000-foot Whiteface mountain in the heart of the Adirondacks—was dedicated this autumn, voices came down from the sky on a beam of light. There was nothing mystical about this performance, however. The beam of light came from a 24-inch G-E searchlight on the summit of the mountain. The voices were those of President Franklin Roosevelt and New York's Governor Herbert Lehman.

President Roosevelt's words, dedicating the highway, were carried on the light beam seven miles from the mountain to the crowd at the Lake Placid airport. Governor Lehman had spoken over the light beam the night before. He was so interested that, after the dedication ceremonies were finished, he spoke again to demonstrate the equipment to the members of his family. Both night and day demonstrations were successful, although once or twice during the day the words faded to faintness when small clouds floated by the mountain top and partially obscured the light beam.

Two-way communication was carried on by means of short-wave radio equipment located at the airport. G-E engineers, who made this special installation, had to transport a gas-driven power plant and a dozen or more storage batteries to the mountain top to operate the talking light beam.

96-205DH

MINNESOTA TECHNO-LOG

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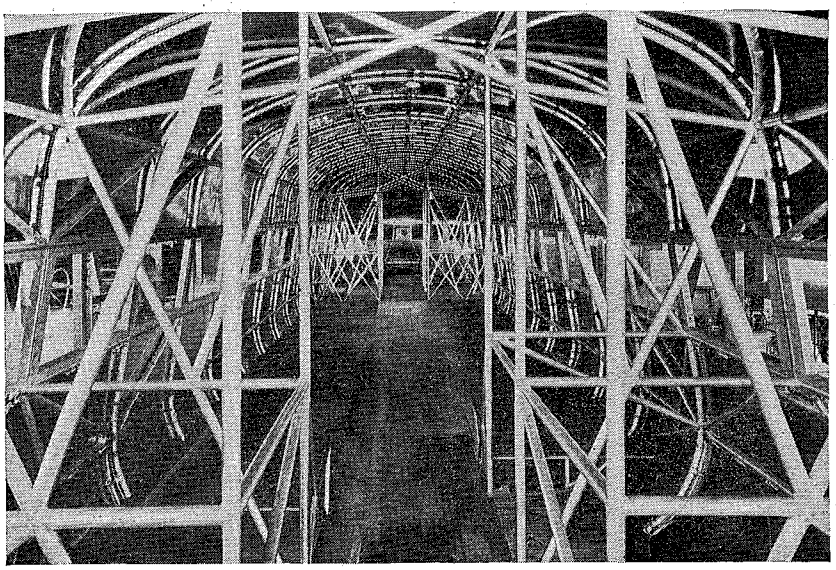
February
1936



HERE'S HOW—the framework of the light weight, streamlined rail cars for high speed is Lindewelded from chrome-molybdenum steel tubing.

Mastery over all Metals

Welding Makes Jointless Structures Possible in Practically All Commercial Metals and Alloys

By A. B. KINZEL*

One great advantage of using welding is that practically every commercially available metal and alloy can be made by this means into a jointless assembly.

Contributes to Home Comforts

Numerous articles fabricated by welding are found in most homes. Familiar ones cover a wide range of metals—kitchen ware and furniture of aluminum, copper and stainless steel; copper tubing in refrigerators, sheet metal in refrigerator boxes; kitchen cabinets and gas ranges; water pipes of copper, brass, iron and steel; furnaces and hot water tanks of strong heat-resisting irons and steels. Even the tiny alloy wire elements in radio tubes are welded.

Simplifies Automobile Maintenance

Automobile manufacturers use welding for innumerable assemblies where your safety and comfort depend on permanent strength and tightness. The modern automobile repair man also uses welding. With welding he quickly restores broken parts to use again. Steel bumpers, fenders, frames are readily made jointless by welding—as strong as or stronger than the original piece. Cracked cylinder blocks and broken aluminum crank cases are welded. Valves and valve seats are made service free by welding a thin coating of Haynes Stellite to the wearing surfaces to give longer life and added thousands of low cost miles.

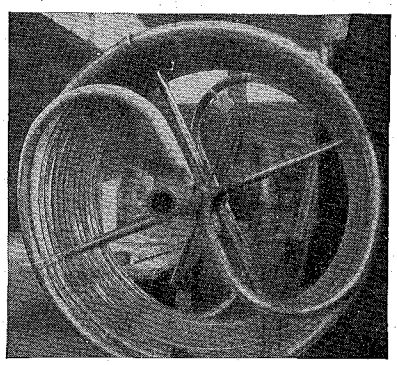
Aids Industrial Users

In industry—for tanks, containers, piping and a wide variety of other machinery and equipment of all sizes, shapes and metals—the use of welding is even more extensive.

Welding Marches Ahead

The wide-spread use of welding for various metals and alloys has been due largely to constant advances in technique and materials. Typical among these is the development of Lindewelding, a procedure for the rapid welding of steel pipe and plate. Speed increases of 50 to 65 per cent and material savings of 25 to 50 per cent over previous methods have been made.

Bronze-welding, welding with a bronze welding rod, is widely used for both repair and production. Smooth joining of metals or alloys of different compositions can be accomplished by bronze-welding. Steel can be bronze-welded to cast iron, bronze and copper can be joined, brass and steel plate can be united.



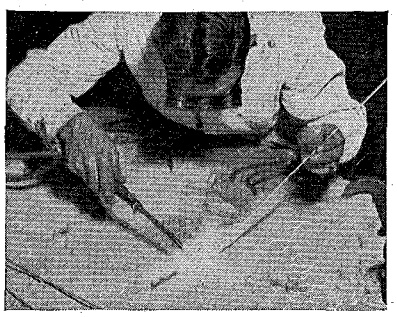
EVERY METAL—responds to the oxy-acetylene blow-pipe. This stainless steel coil for cooling milk has welded joints.

Makes Modern Metal Designs Jointless

Exact procedures for the welding of corrosion-resistant steels and alloys have been developed. Welds so made are sound, strong and ductile. Resistance of the welded joint to corrosion makes it valuable also for use in joining special alloys such as Monel Metal and Everdur. Welded aluminum alloy chairs, tables and other furniture have been made possible through the development of special aluminum welding rods.

At Your Command

Modern welding technique, plus the great variety of metals and alloys on the market today provide many new possibilities for your products. Information and data which will help you use welding to wider advantage may be had from the nearest Sales Office of The Linde Air Products Company, a unit of Union Carbide and Carbon Corporation. These are located at Atlanta—Baltimore, Birmingham, Boston, Buffalo, Butte—Chicago, Cleveland—Dallas, Denver, Detroit—El Paso—Houston—Indianapolis—Kansas City—Los Angeles—Memphis, Milwaukee, Minneapolis—New Orleans, New York—Philadelphia, Phoenix, Pittsburgh, Portland, Ore.—St. Louis, Salt Lake City, San Francisco, Seattle, Spokane and Tulsa.



WELDING ALUMINUM—an architectural plaque, modern in design, is repaired by a modern method.

Everything for oxy-acetylene welding and cutting—including Linde Oxygen, Prest-O-Lite Acetylene, Union Carbide and Oxweld Apparatus and Supplies—is available from Linde through producing plants and warehouse stocks in all industrial centers.

*Chief Metallurgist, Union Carbide and Carbon Research Laboratories, Inc., Unit of Union Carbide and Carbon Corporation—This being a Business News Advertisement.

MINNESOTA Techno-Log

37 ELECTRICAL BUILDING

UNIVERSITY OF MINNESOTA, MINNEAPOLIS

FEBRUARY, 1936

WAYNE STONE
MANAGING EDITOR

ROBERT DIXON
BUSINESS MANAGER

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VOLUME XVI NUMBER 5

	Page
NEW ARMORY	91
OCEAN 'CLIPPING'	92
WHEN IN HAWAII	94
ALUMNOTES	96
PROGRESS	97
EDITORIAL	98
NOW HERE'S A BOOK	99
CAMPUS NEWS	100
STRAY SCRAPS	102
MENTAL TILTS	102

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—*American Architec*

The Big City

the national guard's

New Armory

a serviceable project

By Robert Teeter, M.E. '37

DOWNTOWN Minneapolis has recently seen the addition of another public edifice of magnificent yet practical and serviceable proportions. The new State Armory building, at a cost of $720,000, has arisen in the past year to more completely round out the municipal and state building system of the city. The project was financed by a 30 per cent PWA grant and a private loan to cover the other 70 per cent.

The new Armory, replacing the long condemned and finally demolished Kenwood Armory, will house the local units of the National Guard and will be available for a limited number of civic enterprises. It consists of a large main drill area, 270 feet long and 206 feet wide, and an office structure at one end extended 60 feet beyond the drill area and the same width.

The project was built under the supervision of the State Armory Building Commission, of a combined structural steel and reinforced concrete design. The outside end wall and the roof are of structural steel, and the side walls and balcony are of reinforced concrete. Trusses of the three hinge type, fabricated and erected by the Minneapolis Steel and Machinery division of the Minneapolis Moline Company, support the roof over the drill area.

At one end of the building are four stories of office space in addition to a basement. The ceilings of each story are of concrete poured over plywood panel forms, to leave a surface to be smoothed only by an abrasive, necessitating no further finishing. Flat ceiling construction was used throughout. Besides office space in what is called the "headhouse," there is also a combined ballroom and gymnasium on the third floor.

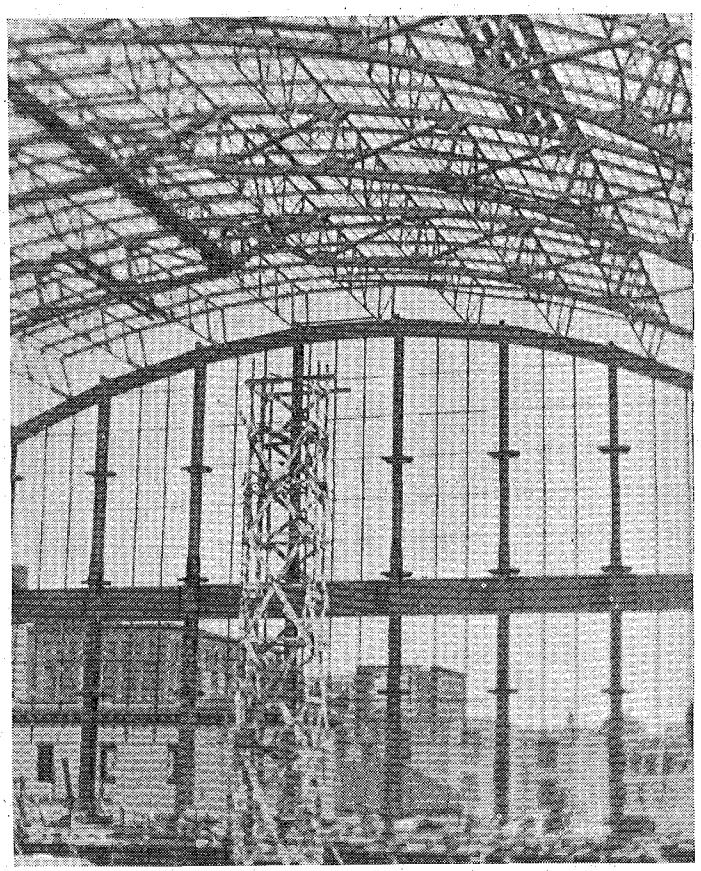
The main body of the structure, the drill hall, was built over a first floor level spanned by eight trusses spaced at 30-foot intervals and supported by reinforced concrete columns set in a firm sand and gravel base. Two rows of reinforced concrete columns, along with interior columns of steel, support the main floor. The basement has a flat ceiling, supported as described by concrete and steel columns. The columns are so placed and the ceiling is at such height as to allow easy maneuvering of motorized equipment using the basement, entrance to which is made by ramps on either side.

In the arched spans, expansion joints are provided between each two pair of rows of roof trusses. Alternate pairs have diagonal bracing. The actual roof, supported by an articulated section free on a steel angle at the wall, is of a burned clay aggregate concrete. Under the roof is a two inch insulating and acoustical fiber-board.

Surrounding the drill area on the two sides and the end opposite the offices is a concrete balcony, built separately from the main superstructure over the main floor level. It is supported by concrete columns and reinforced concrete incorporated in the side wall construction. Contraction is provided for by joints carried through the masonry of the walls, thus masking movement.

Unique in the Armory construction is the use of the fireproof fabric and clay aggregate concrete, wide column spacing, and flat ceiling construction.

The armory, long needed by the National Guard, is up-to-date in structure and complement and will provide effectively for both the Guardsmen's and the public's needs.



Ocean 'Clipping'

By Armon Walters, E.E. '37

China Clipper Dimensions

Gross Weight	51,000 lbs. (25½ tons)
Weight Empty (as standard mail transport)	23,100 lbs.
Wing span	130 ft.
Wing area	2170 sq. ft.
Chord	20½ ft.
Overall length	89½ ft.
Overall height	24 ft.
Power	3200 hp.
	Four-geared and supercharged Pratt and Whitney, double-row 14-cylinder "Wasp," developing 800 hp. each, driving Hamilton three-bladed constant-speed propellers with brakes.
High speed	179 m.p.h.
Cruising speed	157 m.p.h.
Range as mail transport	4000 miles
Maximum range required	2400 miles
Service ceiling	20,000 ft.

SINCE the beginning of time, nations have been searching and striving for shorter and faster trade routes to the Orient. By 1931 four air routes across Europe were reaching out for the ten billion dollar trade of the Orient, but America still was 28 days away by steamer. At this time three men were busily engaged over plans for an aerial trade route across the Pacific Ocean. They were Col. Charles A. Lindbergh, Pan-American Airways technical adviser; Juan Trippe, president of Pan-American Airways; and Andre Priester, chief engineer of Pan-American.

The route was charted from California to China across the islands of Hawaii, Midway, Wake, Guam, and the Philippines, all possessions of the United States. This was a 9,000-mile aerial trade route across the vast Pacific Ocean that bid fair to affect the course of world affairs by changing from 28 days to 60 brief flying hours the interval between the Western World and the far-off Orient; that would give American commerce a high road to the billion-dollar markets of the East, and make neighbors of peoples half the world apart.

Many thought these plans fantastic and impossible because at that time no seaplane had been built that would fly the 2,410 miles between San Francisco and Hawaii with even a safe reserve, let alone a paying commercial load.

Five out of six airplane manufacturers queried on the project of building such aircraft said it was impossible to build a seaplane that would carry enough fuel for 3,000 miles at a cruising speed of 150 m.p.h. in addition to a payload of mail, passengers, and express. But Igor Sikorsky, who had been building larger and larger planes for the company's Latin-American routes, agreed to tackle a 19-ton flying boat which would be of immediate use in the Brazilian division and fulfill all of the trans-oceanic conditions.

By the summer of 1932 Sikorsky had accepted a contract to build three such ships at his Bridgeport, Conn., factory, at a price of $1,000,000. Glen Martin, who had built scores of great airplanes for the United States, also undertook to build three 25½-ton ships to meet all the company's specifications for a contract price of $1,200,000.

Both Sikorsky and Martin knew they had taken on the most difficult problems they had faced in 20 years' experience. But they also knew they would have engines more powerful per unit weight than any previous flying-boat designers had had available, and more efficient propellers. Many of the materials they would use were lighter and stronger, too, than those that had gone into earlier planes. All of these things would help.

The designing and building of the great ships to be used on this route was only half the battle, radio equipment to keep the flying-boats in constant contact with their bases and navigation instruments to keep them on their courses had to be designed.

Shore or ship radios that spanned all the distance desired have, of course, been commonplace for some years. But to develop light-weight, low-powered, ultra-reliable equipment to cover the whole Pacific from an airplane has been one of the major tasks faced in this whole project. Radios for straight communication were comparatively simple. Most of this equipment had been developed for the service in the Caribbean under almost identical conditions.

Each of the big "clipper" boats carried two sending sets, two receivers, and a dual antenna system. Even when on the water, with engines still, batteries insured that all sets could be used for days on end to send position reports, get weather data, dispatch instructions to and from almost any spot in the entire Pacific. In the air their range is even greater. From far beyond Wake, for example, the China Clipper's radio operator has kept in constant touch with Pan-American's Miami station, half a world away.

The project's real radio triumph has been its extension of aircraft radio direction-finding devices to unprecedented ranges. The normal type of radio beacons serve well

enough for overland lines, but their short ranges of a hundred miles or so make them obviously impossible for trans-oceanic use. Pan-American early standardized on the international routes a telegraph-signal type, then extended it in power. On each of its flights, the Pan-American Clipper was able to keep a constant running-fix of its position to the fraction of a mile by radio bearings it could take on ocean vessels and a half dozen short stations. It can then check those readings with bearings taken by its base stations on its own signals. Gone forever is the great hazard that once faced fliers crossing great expanses of ocean.

Gone, too, are the hazards that once existed when unexpected fog obscured objective harbors. A well tried, perfectly proven procedure of using the radio direction-finders in conjunction with the plane's flying instruments enables the big ships to land smoothly and accurately in any of its base harbors.

Interior of Cabin —*Sperry Gyroscope Co.*

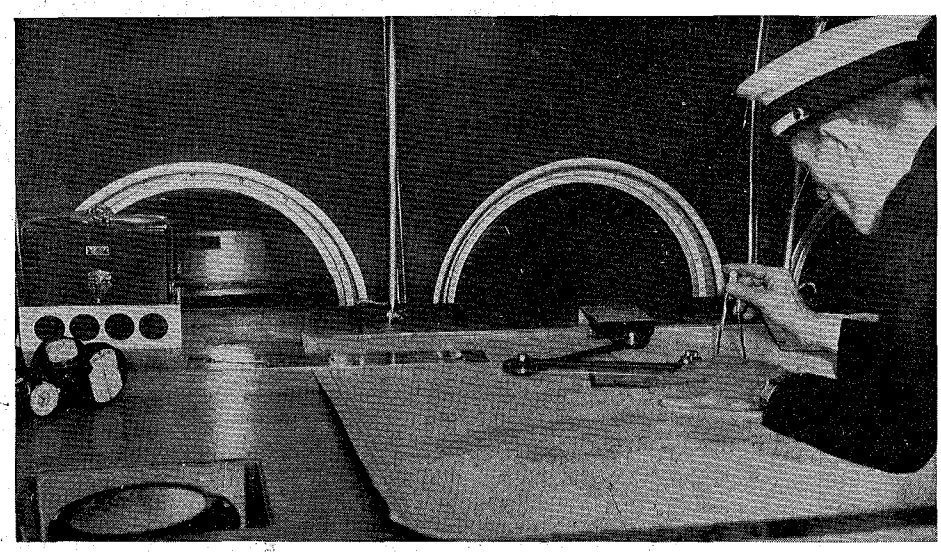
The navigation of the great ships over the Pacific includes all of the problems of navigating a great steamship with a few extra fancy ones thrown in for good measure. The Pioneer bubble octant and Longines chronometers are in the first line of defense in primary navigation on the Pacific. The octant especially has proven highly efficient in complicated navigation problems by allowing more rapid and simplified computations. This instrument is adaptable without a horizon as well as with one.

The most interesting of the new navigation instruments developed for this project is the Kollsman drift indicator. This instrument consists of a telescope with cross-hairs fitted with horizontal and vertical bearing plates, graduated in degrees. The instrument may be used as a drift or ground speed indicator or as a pelorous for reading azimuths of celestial bodies, for navigating purposes. It is used as a drift or ground speed indicator by taking sightings on fixed points on the ground.

To provide a fixed point for reference on the surface of the ocean, a number of bomb devices have been tried out. The most common of these is the smoke bomb. This bomb is designed to give off a column of dense smoke upon impact with the water. This type of smoke bomb has been used on all of the Pacific flights but has been found to have somewhat limited visibility. Even in good weather they are visible for only five or six miles.

Pan-American has recently developed a new bomb which is proving very satisfactory. It consists of a glass shell containing about a pound of aluminum bronze powder. The container bursts upon impact with the water and the finely divided particles of aluminum spread rapidly on the surface of the ocean. This produces a bright spot that may be seen for 10 or 12 miles under reasonably good conditions. Flares have proven quite satisfactory for night work in good weather.

Navigation Room —*Aero Digest*



All of these developments along with the bases and their trained men are necessary to keep the "clippers" on schedule. And what a schedule it will be! A take-off in late afternoon from San Francisco Bay, a landing at Honolulu seventeen hours later in the early morning sunshine, then only four daylight flights to Manila with nights spent on the tiny base islands now sprung into new world prominence. A final half-day flight from Manila into Macao, near Canton, on the China coast, will complete the trip.

At last the Orient is reached in less than a week, making it possible to fly around the world on commercial airlines.

When In Hawaii . . .

By Russell C. Brinker, M.S.C.E. '33

LAST year when the TECHNO-LOG carried Professor Harlow Richardson's interesting account of his trip to Hawaii and the Orient, I little dreamed I would soon be in Hawaii myself. But here I am, and anxious to enlarge upon Professor Richardson's glowing description of nature's paradise.

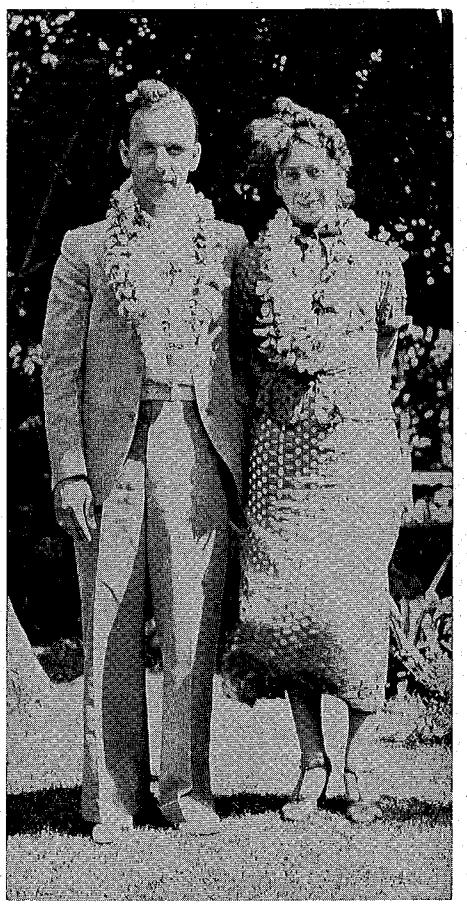
Sailing from San Francisco September 7 on the S. S. President Coolidge, Mrs. Brinker and I arrived at Honolulu 7:30 a. m. September 12. The vaunted hospitality of the Island's residents was immediately demonstrated, for Dean and Mrs. Keller and other faculty members met us at the pier, placed sweet smelling leis about our necks, and whisked us off to Dean Keller's home. For the next nine days which were occupied with house-hunting and sight-seeing, Dean Keller's guest cottage served as our headquarters and home, as it has done for many new faculty members in the past.

House-hunting disclosed two interesting points. First, that glass windows are commonly dispensed with on the rain-free ocean-facing side and only screens used. Secondly, because of termites, which attack all wood except koa and the dense teakwood, wicker furniture predominates. Termites will literally eat a house. They have been known to bore a hole straight through a book to attack the wood below. Book worms—not students—are a menace in themselves for they find the bindings a delicious morsel. At any rate, we soon found a satisfactory small home which is without the traditional palm tree, but does have a banana and a papai tree in the yard.

Mr. and Mrs. Brinker on their arrival in Honolulu September twelfth

Seemingly it is beyond the scope of an engineer to try to describe the beauties of the mountains with their ever-present clouds, the many different palm trees and gorgeous flowers, and the deep blue of the ocean where it pounds on the rugged shore line. However, the publicity department of the tourist bureau ably takes care of that anyway, so leaving such luring descriptions in more capable hands I can confine myself to an account of the University, its students and activities, and general features of possible interest.

Gastronomically speaking, there can be be no question about Hawaii being Paradise Island. And gastronomically speaking, I am doing my share for the farmer. But then the Minnesota C. E. classes of 1932, 1933, and 1934 who saw me work on Albert's cooking at Cass Lake can readily understand that. I have over-stuffed myself at a 10 course Chinese dinner where the menu included birds' nest soup (made of seaweed), shark fins, chicken and duck prepared several different ways, pork, stuffed oysters, fish, rice, vegetables, water chestnuts, Chinese bread, and the customary soup which both starts and finishes a meal; at a Japanese dinner of *sukayaki* which is a mixture of meat and many vegetables including bamboo shoots (which my imagination insisted came from tender fish poles); and a Hawaiian *luau* (feast) where pork, yams, cooked and raw fish, raw squid (octopus to me), chicken, poi, vegetables, and a sort of cocoanut jello were served. For the common daily menu, fresh pineapple and tree ripened bananas, papaia, cocoanuts, avocados, etc. provide a local background for the usual mainland foods.



The courses of the Chinese dinner are eaten successively from the same dish, a one-half saucer size bowl, using a miniature gravy ladle or chop sticks. After watching a piece of meat slither from my uncontrollable chop sticks and slice like a golf ball onto my neighbor's lap, I gave up chop sticks. Anything uneaten from one course becomes the base for the next. In the past, it was considered impolite for a guest to leave anything uneaten in the

bowl. In some sections of China it therefore became customary for each guest to bring a bag into which was dumped the remains of his bowl for later disposal, probably on the way home. Since anything less than a 22 course dinner originally was considered inadequate, and indulgence in each course was expected, the bag carrying custom appears logical.

Knives, forks, and spoons were unessentials omitted at the Hawaiian *luau,* but no one appeared handicapped. Personally, the food being extremely greasy, I'd take two napkins or an old shirt any day in preference to a knife and fork. The poi was "two-finger"—meaning the consistency was such that rolling two fingers in the bowl would provide a mouthful. One-finger poi is thicker, three-finger poi thinner, but all of it has the appearance and delicate flavor of well seasoned wall paper paste. After living in Minnesota, raw fish didn't cause the nose to curl upward, but raw squid or octopus was something else. It is reminiscent of chewing a rubber eraser or ball, and just as profitable. I'm told, however, that baked squid is better—the toughness factor being reduced to the order of that found in a tough clam. One thing missing was live shrimp. Served alive in a bowl, they are eaten by the practical method of biting off the head and spitting it back into the bowl. Had they been served, my interest would have been biological only—centering on whether or not the severed head would swim convulsively away.

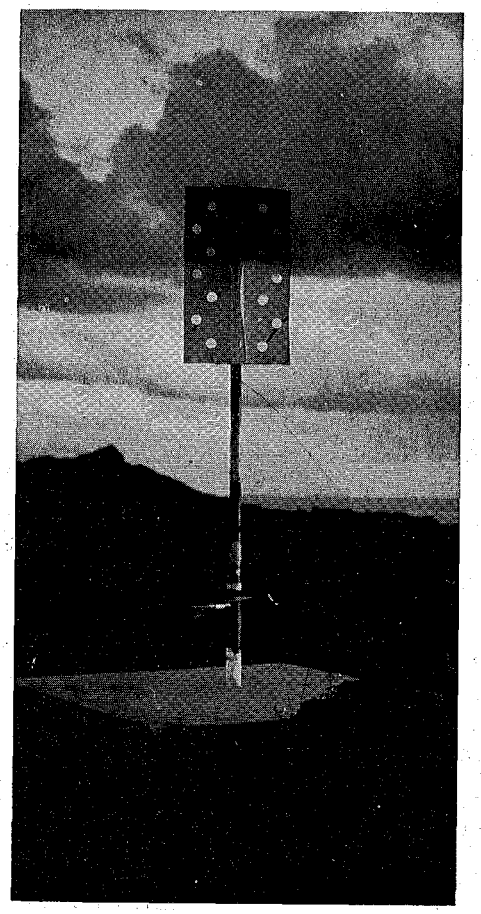
Triangular mark, background mountain King's Head, to right is Waikiki Beach

The method used by Hawaiian fishermen in catching squid is unique to say the least. A squid is located by probing with a spear in holes and pockets of the coral reef which nearly surrounds the Island. When jabbed with the spear, the squid grabs it with a couple arms, meanwhile holding onto the coral with the others. After more jabbing, the angry squid is induced to let go its hold on the coral and is drawn up toward the fisherman. When close enough it winds its legs about the fisherman, often pinning both his arms tightly against his body. Undaunted, the fisherman makes his kill by biting out the eye which is the nerve center of the unlucky squid. The squid is considered a delicacy, and can be seen for sale fresh or dried at fish markets about town, the 30 to 36 inch legs being most desirable. It might also be mentioned that many years ago visitors were taken out by the natives at $1 a head to see swimmers kill sharks with only knives as weapons—or so the story goes. Sharks are seldom found inside the reefs, but infest the water beyond.

Permanent signals are kept on the Territorial triangulation stations located on tops of the various ridges. The signals, as shown in the picture, consist of two red and white plates set at right angles on top of an iron pipe. The pipe fits into a larger one concreted into the foundation permitting removal of the signal. By means of a key through both pipes the signal may be padlocked in place to prevent disturbance. From the campus four are visible and afford excellent check sights, though for campus maps of ordinary scale they usually fall beyond the limits of the sheet. I know Professor Zelner's face would light up with pleasure if he could put his Junior triangulators to work on the network here. A direction instrument is included in the department equipment, and the students are given some practice in using it.

The city of Honolulu might be called a contradiction to the verse, "East is East, West is West, and never the twain shall meet." Here East and West do meet, intermingle, and inter-marry without degradation. Combinations such as Portuguese-Hawaiian-Chinese descendants are common, but strangely enough the Chinese-Japanese mixture is relatively rare.

Walking along the downtown streets one hears torrid music from the many taxi dance halls mingling with the weird oriental tunes emanating from radios and phonographs. Open front buildings show a predominance of oriental girls employed as barbers, bar maids, and clerks. Western in outward appearance, the silk, china, and curio stores are yet Eastern in content and internal style.



My introduction to the University of Hawaii the first day when I had to call roll in a class composed of Chinese, Japanese, Hawaiians, and *haoles* (whites), will long be remembered. Chinese names usually consist of one syllable, with Chang, Ching, and Chong, and some Bings, and Bungs, replacing the Andersons, Johnsons, and Olsons of Minnesota. Japanese names ordinarily have more than one syllable, which gives the best clue for determination of nationality or descent. The procedure is to ask the name, and if of one syllable, the owner is probably Chinese. Height also may be a clue, since some Chinese are fairly tall, while the Japanese are invariably short. Centuries of kneeling for meals, etc., caused constriction of the leg muscles resulting in the race of short legged people with bodies of normal length. (While on a picnic I saw a party of Japanese eating off a blanket spread upon the ground, while the benches and table, provided for such outings, were scorned except for hats, coats, etc.) The Hawaiian names may be long or short, and while formidable looking at first sight, become easy to pronounce after the sounds of the 13-letter Hawaiian alphabet are known.

Regardless of racial descent, the different groups are proud to be Americans, and the engineers at least, know their college slang.

ALUMNOTES

'25 **Frank A. Morris,** M.S. (M.E.) has come up in the world. After receiving his Master's degree, he served three years as Assistant Director of Experimental Engineering Laboratories. He then went with the Insulite Company of Minneapolis, and served as follows: two years, research engineer for the company; two years, Manager of the Insulite Company's plant at Kymi, Finland; two years, Mill Superintendent of the Insulite Company's plant at International Falls; one year, Production Engineer of the Minnesota and Ontario Paper Company at International Falls.

On February 1, 1936, he assumed the position as Resident Manager for the Minnesota and Ontario Paper Company and subsidiary companies at International Falls, Minnesota, and Fort Francis, Ontario.

'27 **Lawrence B. Anderson,** Arch., has recently returned to M. I. T., where he is a member of the teaching staff. He has been trading positions with R. C. Jones of the teaching staff here.

'29 **Elo C. Tanner,** M.E., is working as refrigeration engineer with the Westinghouse Company.

'30 The present address of **Russel S. Cheney,** C.E., is Box 217, McCone City, Montana. He writes, "Expect to be located on the Fort Peck project for another year. Our home consists of a 16x32 foot shack with the plumbing 100 feet north. The water supply comes to town on an old Model "T" and costs 1 cent per gallon. The lawn is sage brown and cactus but come on out. We would like to see you."

Helen Thian, Int. Arch., formerly of Powers' personnel department in Minneapolis, is now enrolled at Columbia University for graduate work in Fine Arts.

'31 **Milton Bergstedt,** Arch., formerly with Lundy of St. Paul, is now with Magney and Tusler of Minneapolis.

'33 **Forton Christoffer,** M.E., completed the two-year graduate course in the Harvard Business School in June, 1935. He is now employed by the Cincinnati Milling Machine Company.

Gayle B. Priester, M.E., is with the Carrier Corporation of New York City.

'34 **Gordon Bina,** C.E., is in charge, and is chief engineer on the Epping Irrigation Dam at Epping, North Dakota. This is the largest dam of its kind in North Dakota. The area of the reservoir is about 250 acres and has been stocked with fish. Gordon says that the region about the dam is becoming a center for migratory birds. Gordon is working for the WPA of North Dakota and is directly under the War Department. In a recent note to us, Gordon said, "Not married—yet!"

P. M. Riede, M.E., is doing design and development work for Marquette Manufacturing Company of Minneapolis.

Clifford N. Sonnesyn, M.E., is an assistant engineer with the Federal Cartridge Company of Anoka, Minn.

Dean Lundholm, Arch. E., is working on the addition to the Women's Gymnasium for the Standard Construction Company of Minneapolis.

'35 **J. H. Willox,** E.E., is employed by the Rural Electrification Commission at Washington, D. C.

Paul A. Westlund, E.E., is with the John Deere Company of Waterloo, Iowa.

Frank Govze, Ch.E., is employed by the Solvay Products Company of Syracuse, N. Y.

David C. Grahame, Ch.E., is an assistant at the University of California.

Carl Holvick, Arch. E., is doing estimating for the Ring Construction Company of Minneapolis.

Axel Hyttinen, Ch.E., is working for the North West Paper Company at Cloquet, Minn.

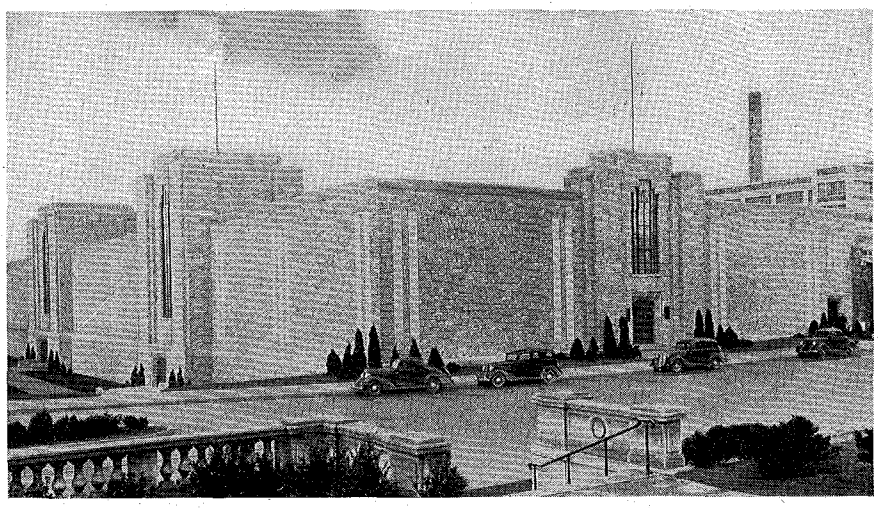
Harold J. Lewis, Ch.E., was recently employed at the Shell Petroleum Corporation refinery at Wood River, Illinois. Harold says more power to the new Institute of Technology here at Minnesota.

Caron Carlberg, Arch., of Anderson Frane Corporation, Stillwater, Minn., has been sent to New York as a salesman. Caron is being furnished with a car, and living and traveling expenses—just for business purposes, of course.

Armin Rohde, Arch., is doing Gothic details for an architect in Milwaukee, who is a specialist on churches.

George Thompson, Arch., is at M. I. T., doing graduate work on a scholarship. George won the Boston Society of Architects Competition recently. The prize was one hundred dollars and was competed for by M. I. T., Harvard, and the Boston Society of Architects.

"never-ending Progress to perfection"



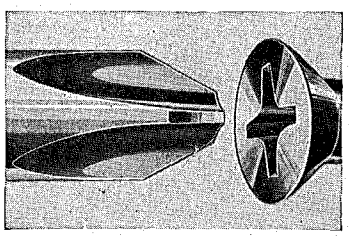
New windowless building improves lighting

Windowless Building

Glass is a minor part of this completely air-conditioned, windowless three story office building of the Hershey Chocolate Company, in Hershey, Pennsylvania. Scientific control will produce artificial working conditions, much improved over former surroundings. Temperature, humidity, and indirect lighting control are some of the major improvements. Other advantages claimed are the elimination of distracting noises from outside the building, an estimated 25 per cent reduction in operating costs of winter heating and cooling systems, and more floor space available. The artificial lighting system gives the effect of actual daylight with none of the accompanying eyestrain.

Recessed Screw Heads

A new type of recessed head for use in machine screws, stove bolts, wood screws, and sheet metal screws, in all sizes and shapes, is now offered by the American Screw Company. A tapered driver is employed to fit into the tapered recess in the head. Some of the advantages are one handed operation, greater strength, faster driving with less effort, reduced spoilage, fewer accidents, and tighter setting of screws.



New Screw and Driver

High Strength Welds

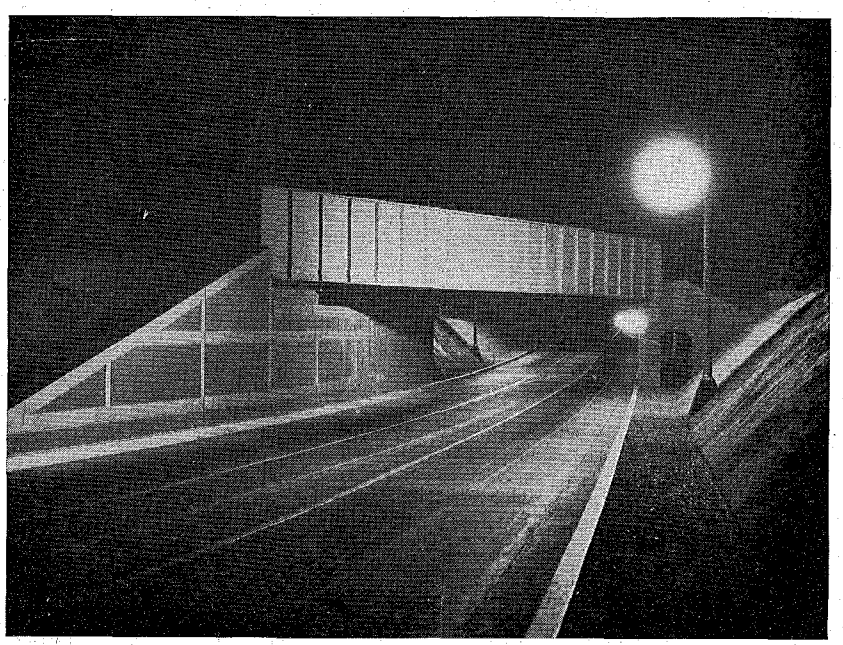
A different type of coated arc welding electrode is now being put on the market for welding the group of stainless steels belonging to the 25-12 variety. It is known as "Stainweld B" and provides weld metal of the same high corrosion-resistance, high tensile strength and ductility as steel containing 25 per cent chromium and 12 per cent nickel. Tensile strength tests show that a weld with this metal will resist a stress of 95,000 pounds per square inch.

Improved Slide Rule

A new slide rule is now provided for electrical and mechanical engineers. In addition to all the scales of the standard log log rule it has a reciprocal scale, and a cube scale. Multiplication of three factors or division with two divisors requires only one movement of the slide.

Highway Lighting

The commercial use of sodium vapor lamps for lighting is being tried out on several highways in California. In the specific instance pictured here, glare at a spot like this where the highway dips under a railway might produce a blind spot in the motorists' vision which would be worse than no light at all. So two 1,000 candle power lamps, on 23 foot standards, are used and are working very satisfactorily.



Sodium lamps increase underpass visibility

The MINNESOTA Techno-Log

FEBRUARY, 1936

An Engineers' Show

SOME two weeks ago several engineers decided that some sort of an Engineers' Show, such as the Arabs used to stage, would be well received. A meeting of the presidents of the honor societies with the members of the Technical Commission was held to consider the proposal. It was suggested that the best time to hold such a show would be during the Engineers' Day celebration. After giving the idea a perfunctory study, it was tossed aside as being too huge an undertaking, that student interest would not be sufficient to assure its success.

Is this too huge an undertaking for this school? Why are Dartmouth and Wisconsin able to stage shows that even go on the road to play in nearby towns? The reason is lack of student interest. The Institute of Technology is large enough to furnish an audience for it. The talent must surely be here in a school of this size, and with a group of about 100 students who were really interested, who would give time and effort to such a show, and if the student body would come instead of scoff at it, the show would be a grand success. If you think a show should be given, if you would support it, if only to the extent of buying a ticket, will you please mention it to someone in the Techno-Log office, or to some member of the Technical Commission.

At the Desk

THE China Clipper. Clipping the days required by ships to hours.

"Clipping" from United States to China in 60 flying hours. A fairy story a few years ago; a reality today. The story of the work behind it is told in one of our feature articles this month, "Ocean Clipping," by Armon Walters. You'll find it on page 92. The cover picture was loaned to us by the Pan-American Co.

The picture of New York, on the frontispiece, has nothing to do with anything in the magazine this month but your editor thought it was an interesting picture and here it is. If you have been or lived in New York, can you pick out your house, or the window of your room in the hotel you stayed at? The cut was loaned to us by *American Architect.*

"When in Hawaii—" When in Hawaii, what? Mr. Russell (Hans) Brinker, former Civil Engineering Instructor here, now teaching at the University of Hawaii, explains to us the proper method of eating raw squid, biting the eyes out of an octopus, and eating with chop sticks. Also some nice notes on Hawaiian surveying. All on page 94.

Alumnotes, the regular Progress page, the book review, some news, Stray Scraps, and some new Mental Tilts to puzzle over, complete the issue.

The Miracle Man

There was a desert of alkali
When the Miracle Man came 'round
And cast a sort of hasty eye
On the barren and parching ground:
Then he made some lines and some figures strange
And summoned his slaves—and, lo,
The water came down from the mountain range
And the desert began to grow!

He plants the sod
With his magic rod
Which he squints through a tube to scan
With a gleaming chain
Over hill and plain
Goes the modern Miracle Man.

There was a river that rose in flood
With terrible rage each Spring,
Drowning its hundreds and spreading mud
And ruin on everything,
Till the Miracle Man with pencil made
Some figures hieroglyphic,
And now the river is calm and staid,
A pattern of streams pacific!

For the floods that rave
Must all behave
And peacefully wear their gyves,
They must cease to rage
And earn a living wage
When the Miracle Man arrives!

There was a pass too steep to scale,
An Isthmus to tough to cut,
A swamp too boggy to hold a rail;
Said the Miracle Man, "Tut! Tut!"
He made some jottings, he called his crew—
There's a highway through the pass,
And ships are sailing the Isthmus through,
And trains ride the soft morass!

Through the wizard art
Of a pale blue chart
These miracles did appear,
For the Miracle Man
On the Modern Plan
Is known as the Engineer!

—*Anonymous*

Now Here's A Book

By Clifford I. Haga

Instructor in English

I FIND that lately I have got into the bad habit of attempting to crowd into a single review a digest of many books. Last month's Liddel-Hart omnibus I had expected would be the last of such ambitious efforts—but behold, I do it again this month. Although I am speaking of only one novel, "Men of Good Will," by Jules Romains, it will be necessary for me to list four volumes: "Men of Good Will," "Passions' Pilgrims," "The Proud and the Meek," and "The World from Below," volumes one to four, respectively, of the English translation of what will someday be a practically endless novel. Ten volumes have already come out in French and those so far translated contain the first eight in four double volumes.

So much for preliminary statistics. You can easily see why it is now or never if I am to tell you about Romains' novel. Should I wait much longer, I would need perhaps an entire issue of the TECHNOLOG. But now that the novel is well under way, we may make our first, superficial survey.

The first volume begins in Paris on October 6, 1908—at dawn to be precise—and the tenth concludes with the end of August, 1911. In that time, not quite three years, the reader has made the acquaintance (how extraordinarily intimate I will leave you to find out for yourselves) of some two hundred fifty characters. (I am not counting dogs and horses.) These two hundred fifty persons come from every part of Paris and of France, from every trade, profession, vocation, and class—and in some way or other, directly or indirectly as the narrative flows on, they all get woven into a complex and realistic web of life, each one contributing his share, large or small, to the tensions and impulses by which the others are held in the pattern, and give to the whole a gradually and irresistibly progressing sense of completeness. In a way, this huge novel is sheer virtuosity. Seldom has an author attained Romains' finesse whereby both the astronomically huge and the microscopically minute are presented with a marvelous brilliance of focus.

When will the novel end? All we know is that Romains calls it his last important work. He is, I believe, in his forties, and, since French authors are notoriously long-lived, we may perhaps receive the concluding volumes in another twenty or thirty years.

Now that I have given a purely statistical evaluation of "Men of Good Will," you may feel like a person wanting to take a stroll before dinner whose host says, "Fine—let's make it a Marathon!" And some of my more practical-minded readers will ask why they should be urged to make such a detailed study-tour of the Grandeurs and Miseries of the French. Good—what has "Men of Good Will" to offer a Technology undergraduate in the year 1936? A great deal, is my answer. For one thing Romains manages to demonstrate with realistic precision the interdependence of human lives. No man is a simple, discrete entity in thought or feeling or action. He works upon others and others react upon him—and not always do the more powerful influences in his life come from his intimates, nor does he fail to extend his influence to others many links removed in the social chain. In other words, the reading of this novel cannot fail to be for many a significantly maturing experience of a high order.

My advice is that you begin reading "Men of Good Will" at once before the accumulation of volumes becomes unmanageable. Then in 1985, when your grandchildren ask, "What did you do in the 30's, grandfather?" you can answer, "I did my duty and kept even with Romains, volume by volume." Your grandchildren will bless you for that. They of course expect to inherit the national debt we are building up, but to ask them to assume in addition the whole burden of "Men of Good Will" is to ask too much.

Miners Create Underground Atmosphere at Annual Shindig

One hundred and seventy-five couples rode the "cage" down to the Miners' Shindig in the Minnesota Union, February 7. The "cage" was a replica of an actual cage used to lower miners down into the mines. It was set up in the hall leading to the ball room. Shindiggers entered a door into the cage, rang a gong, the floor jiggled and the side of the mine shaft could be seen going past through a window in the cage. At the bottom of the "shaft" another door was opened that entered on the ball room.

Michael Tenenbaum was the General Arrangements chairman. John Mahle, tickets; Charles Danckertson, music; Jack Melvin, decoration; William Mather, programs; Roger Lynn, publicity; and Richard Krumm, chaperones, were the other committee chairmen. Chaperones were Dean and Mrs. Elting H. Comstock, Drs. and Mmes. R. L. Dowdell, Stanley A. Trengove, and John W. Gruner. Ken DeVilliers furnished the music.

Halvorson Talks On Trickle Filters

The trickle filter and its advantages over other processes as used in sewage disposal was the subject discussed on January 30 by Dr. H. O. Halvorson, former chemical engineer, now associate professor of bacteriology here, at the meeting of the American Institute of Chemical Engineers held in the Minnesota Union.

Dr. Halvorson is a recognized authority in this field, having done much work in the laboratory as well as in actual plant design and construction. The lecture was supplemented by slides and motion pictures taken of his own research studies. The meeting was well attended, in spite of the cold weather, by many water-works men from Wisconsin, Iowa and Minnesota.

Wednesday, Feb. 12, the local chapter took a field trip through Hamm's brewery. Many students, as might be expected, joyfully attended. The trip was arranged, according to Harry Cottingham, president of the chapter, "because of popular request."

A. M. A. Has Meeting Members Take Trip

"Some problems in the Manufacturing and Marketing of Wood Products" was the topic discussed at the first meeting of the American Management Association in keeping with the club's new quarterly program. The speaker, Mr. M. H. Otto, presented this subject Thursday, January 20, after a dinner served in the Minnesota Union. On the following Wednesday, the members of the association were guests of Mr. Otto and the Wabash Screen Door Company for an enlightening inspection trip of the plant with which the latter has been connected for several years.

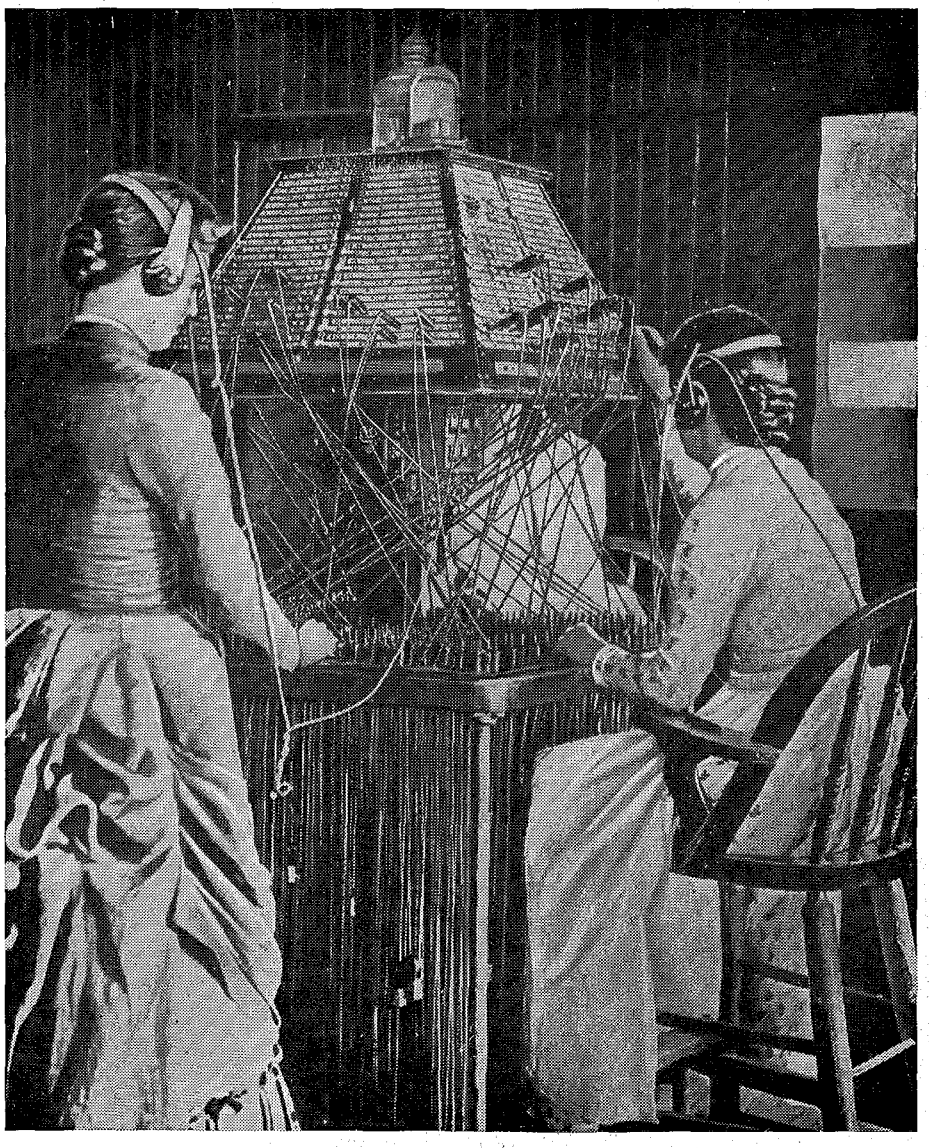
The student branch of the national organization, with Mr. George Filipetti of the School of Business as faculty advisor, is organized for students taking one of the Engineering-Business sequences. The national office provides literature on current manufacturing and management problems, and the regular Monday afternoon discussions are usually based on this data. The present program includes two dinner meetings each quarter with speakers from local industries. Inspection trips usually follow during which the problems discussed may be observed first hand. Recently elected officers of the club include Eugene Kindler, president, and Maurice Squire, vice president, from the School of Business, and Marvin Lee, secretary, from the College of Engineering and Architecture.

Phi Lambda Upsilon Holds Initiation

Officers and members of the Zeta Chapter of Phi Lambda Upsilon, honorary chemical fraternity, initiated thirteen seniors and graduate students at a banquet given January 21 at the Francis Drake hotel. The speaker for the evening was Dr. Dunham Jackson, professor of mathematics; the toastmaster, Dr. Henry N. Stephens, assistant professor of chemistry.

The initiates were: William Cain, Philip Palmquist, Marvin Formo, Leon Grozovsky, Harrison Anthes, Donald Chamberlain, Vernon Nilson, Clinton Walman, Frank Allen, William Nelson, Cyrus Barnum, Jr., Charles Sage, and Eugene Hess.

The Phi Lambda Upsilon organization, which meets once a month, is devoted to the purpose of acquainting its members with men in the chemical profession and with the science of chemistry itself. Membership is limited to seniors and graduate students. Election to the fraternity is on the basis of scholarship and personality.



"Newfangled invention" makes good

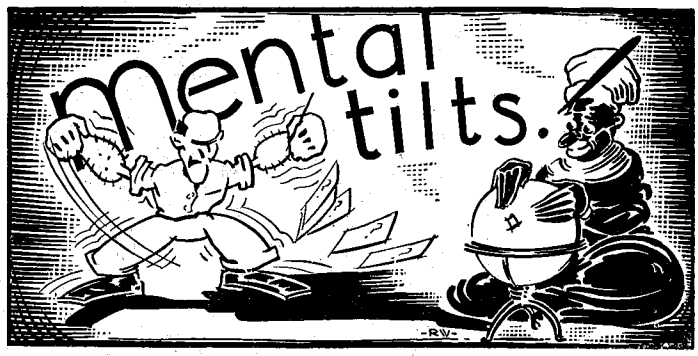
"Can you really talk through a wire?" people still asked when this early telephone switchboard went into service in 1881. ¶ Apparatus was crude—service limited—but the *idea* was right. It took hold in spite of ridicule. Today there are more than 13,000,000 telephones in the Bell System—telephone conversations average 60,000,000 daily—the service is faster and clearer than ever. ¶ Telephone growth and improvement will go on. For Bell System men and women work constantly toward one goal: enabling you to talk to anyone, anywhere, anytime.

Why not call Mother and Dad tonight? For lowest rates, call by number after 7 P. M.

BELL TELEPHONE SYSTEM

ALTHOUGH it is a long time since the Civils came back from their last summer camp, some of the stories of their extra-curricular activities are still going the rounds. One of the best we think is the one concerning the barber pole that disappeared quite mysteriously from the front of the local barber's establishment. The same pole as mysteriously appearing in one of the outbuildings of the Civil camp bearing the name of a certain faculty man and in a manner most embarrassing to him. . . . Maybe this incident could account for certain suspects receiving D's while supposedly guilty parties were more fortunate. . . . And then there is the little incident which happened at the Triangle house a little while ago. It seems that they received an urgent request, via the telephone from the druggist across the street, to shut off their water heater as the druggist wanted to make a soda and all that he could get from the faucet was steam. What happened was that one of the preoccupied engineers in his rush to be on his way had forgotten to turn off the water heater and as a consequence the steam found its way across the street through the water pipe. We suppose that Mr. Torrens, the druggist, had a special that day on steam heated sodas.

We have just received word from the Foresters' camp that the boys were quite disappointed not to have been paid a visit by the Engineers on their Foresters' Day. They are beginning to think that the Engineers have forgiven them for using rotten eggs instead of fresh ones last Engineers' Day. . . . Our nominations for last quarter's scholastic hall of fame are the following boys, the only ones who received all A grades in the Engineering College: Millard La Joy, Russell Nielson, Seniors; Orville Becklund, Lloyd English, Juniors; Howard Daniels, Sophomore; Leslie Anderson, Donald Duncanson, Freshmen.



We're ready to admit that for the past two months we have put you through some rather stiff mental calisthenics so this month forget about your slipstick and work these in your head. Oh, yes—you've got to present good sound arguments as to how you arrived at the results. Here they are, go to it. And a buck to the first brainstormer whose solutions are all correct.

A cage enclosing 3⅞ cubic feet of air having an opening 1½ inches in diameter near the top, is suspended from a spring scale which reads 5 pounds. One day a canary, having a volume of 2 cubic inches and weighing 4 ounces, flew through the opening in search of something or other. Once inside, he became bewildered and could not find his way out, but flew continuously about in search of an exit. As soon as the canary flew into the cage the scales went through a drunken sailors dance. At what point did they finally come to rest?

This'll be a cinch for all youse sailors. The staff, being very nautical minded and wishing to pick up a few extra dollars racing next summer, want to know just how it is possible to make their boat travel faster than the wind. No, Joe College, we can't use an auxiliary motor. We're just a bit skeptical about your ability to prove to us that it is possible.

The answer to the monkey problem, last month, 5¾ pounds for the weight. If you're curious as to the solution, we have it in the office. Rodney Magner turned in the first correct solution at 8:40 a. m., January 16.

MINNESOTA

The North ★ State

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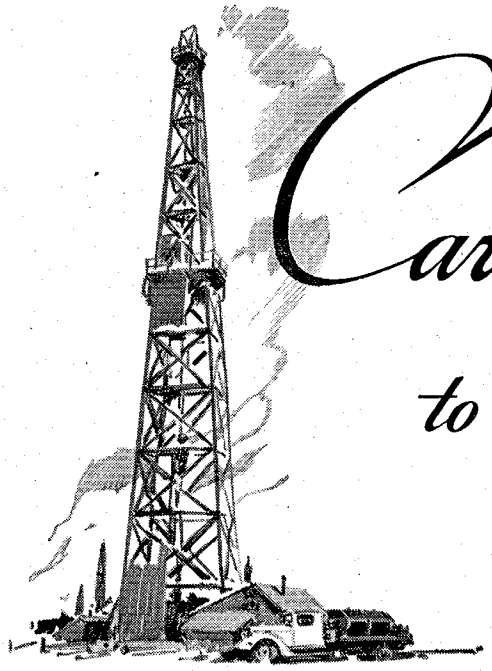

Carrying CHEMISTRY *to* OIL PRODUCTION

ANY development that materializes from a laboratory problem to a million dollar business in the short space of three years is, to be sure, of widespread importance.

That, in essence, is the history of Dowell Incorporated, through which as a subsidiary of The Dow Chemical Company, Dow is bringing chemistry to the aid of oil production.

Ever since old "Colonel" Drake sank the first oil well of commercial importance in 1859, oil producers have faced two basic obstacles in their efforts to drain nature's vast underground reservoirs of petroleum.

First, in many instances, greater production was possible if the producing formation could be opened up—creating fissures and channels from which oil could feed in to the "hole" and be pumped to the surface.

For years the only means of accomplishing this was to "shoot" the well—to lower a charge of explosives and blast. While reasonably effective, this method was hazardous to both life and the well itself. Frequently, in shattering the rock, subterranean water rushed in to ruin the oil. Often, the great heat glazed the surface of the rock, sealing its pores and defeating the purpose.

The second obstacle came with time. As the oil filtered through the porous rock it deposited gums, paraffin and resinous substances until the pores became clogged. The rich flow of oil dropped off until finally the well had to be abandoned.

Operating one hundred and thirty brine wells as the source of basic chemicals, The Dow Chemical Company faced similar problems. It turned its technicians' attention to finding the answers.

Starting with previous attempts to use hydrochloric acid as a dissolver of limestone—attempts that largely failed because the acid attacked metal tubing and equipment as well as the rock—they found the answer in an inhibitor. This ingredient added to the acid allowed it to be pumped down to the rock where it performed the necessary service of enlarging pores and opening channels or, in different dilution, to free clogged pores, thus reviving production.

To this basic development, Dowell Incorporated has added many other chemical applications that are overcoming specific difficulties in oil production.

Today Dowell Incorporated is a national organization. It has treated more than 6000 wells and has put more than 20,000,000 extra dollars into the pockets of oil producers in only three years.

Last year it applied over 3,350,000 gallons of its special inhibited acid to oil wells. Its trucks and cars traveled over 1,275,000 miles rendering this great service.

But, important as is this part Dow is playing in serving oil producers, it is only a segment of its contribution to American industry. As one of the world's foremost chemical companies, Dow produces over 250 products that literally find their way into practically every phase of industrial manufacturing, many pharmaceutical products, farming and fruit growing as well.

DOW

THE DOW CHEMICAL COMPANY, MIDLAND, MICHIGAN

Branch Sales Offices:

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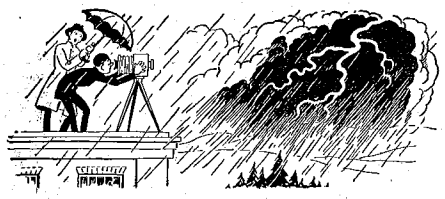
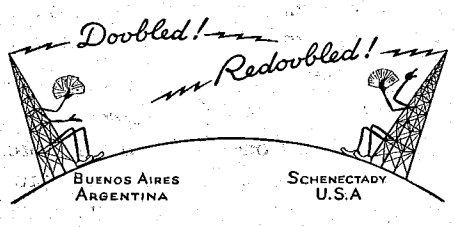
G-E *Campus News*



CRASH!

IT'S a thunderstorm sweeping over Pittsfield, Massachusetts. But G-E engineers, instead of hiding under the bed, go up on the roof to be nearer the lightning. On one of the buildings of the Pittsfield Works they have built and equipped a lightning observatory. By means of an ingenious periscope and a high-speed, motor-driven camera, any lightning flash occurring within many miles—north, south, east, or west—can be automatically photographed. Its characteristics, as recorded on the film, can then be compared with those of the artificial flashes produced by the 10,000,000-volt lightning generator in the laboratory.

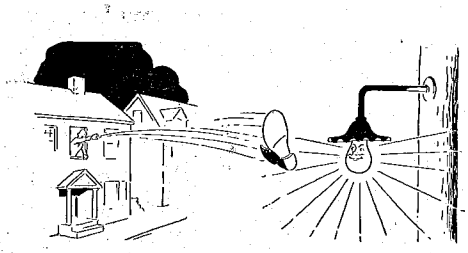
An observatory has to have a hole in the roof. This causes astronomers no embarrassment, because they can work only in clear weather. But with lightning observers it is different—when there is lightning there is also rain. So, to keep the rain from falling on the 12 lenses of the new camera—and from running down the engineers' necks—compressed air is blown upward through the aperture. When next the thunder rolls over the Berkshires, and timid citizens are cowering under the bedclothes, these General Electric engineers will be up on the roof taking elaborate notes on Jove's own brand of lightning.



GAME BID

DOUBLED! Redoubled! North led, but the dummy was 6000 miles away. Psychic bids flew thick and fast when a North American contract-bridge team, including Mr. and Mrs. Ely Culbertson, played a "bridgecast" tournament with a high-ranking team from Argentina. The North Americans were seated on the stage of Rice Hall in the General Electric Company, at Schenectady, N. Y., while the Argentine team played at the Casabal Club in Buenos Aires. The plays were carried by the short-wave stations W2XAF and LSX, of North and South America, respectively.

W2XAF, in Schenectady, used a feed-back circuit so that short-wave listeners all over the world, tuned to the one station, could follow the playing with as great ease as the 500 kibitzers who jammed Rice Hall. This was the first international bridge broadcast in which the principals were all recognized experts. The North American team, captained by Culbertson, won by a margin of 1030 points.



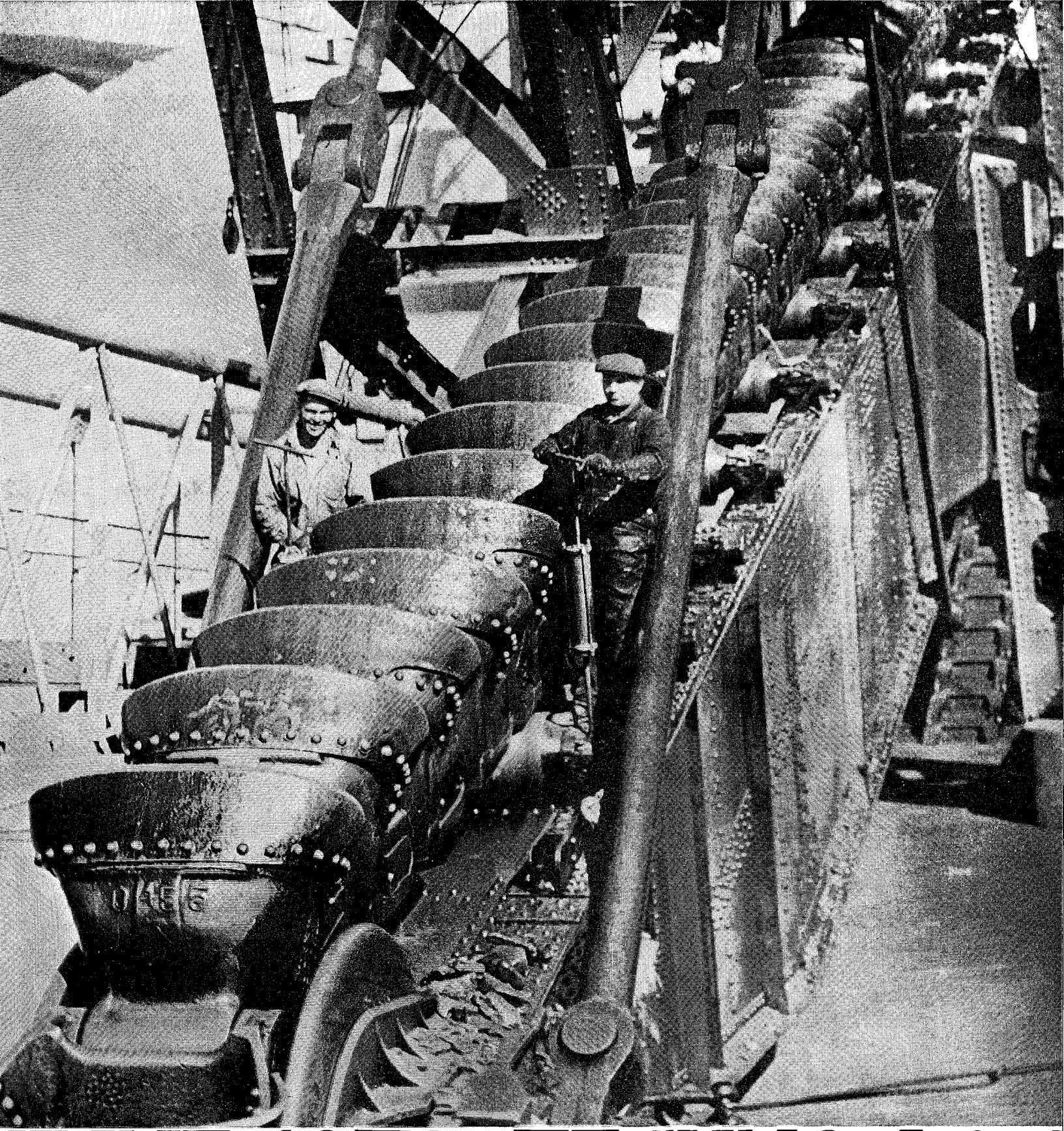
BEDROOM PRIVACY

MANY a man has shinned up a lamppost to daub paint on a street lamp that shone in his bedroom window. Many another light sleeper, of lesser climbing prowess, has tried throwing shoes and hair brushes at the offending light. Now there is hope that this war will soon be over.

Adequate street lighting is, of course, a necessity. G-E illumination engineers have perfected a new fixture that directs the light where it is needed—on the street—and keeps it from trespassing on the pillow. A concealed light source and a reflector designed along new optical lines have removed street lamps from the list of public enemies of sleep. Motorists, too, will welcome these new luminaires. Because the reflector extends below the incandescent source, the driver's eyes are protected from direct glare—he can see the road better.

96-227DH

GENERAL ELECTRIC



MINNESOTA TECHNO-LOG

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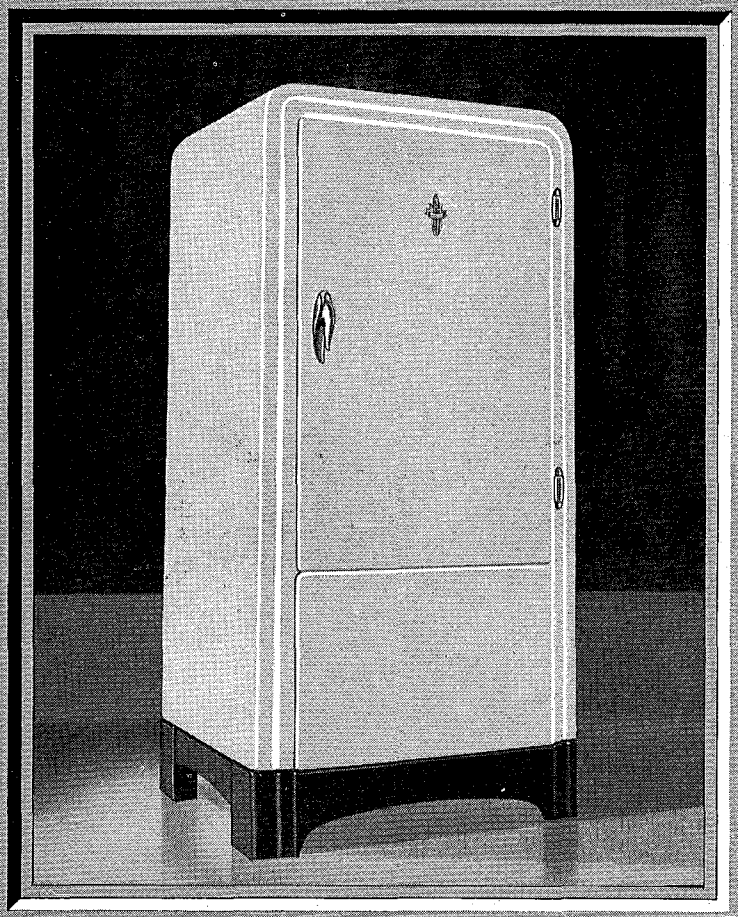
Better . . because IT'S WELDED

● The modern automatic refrigerator is *better because it's welded!* Welding insures smooth, permanent units in which there is nothing to work loose—no place for germs to gather—no joints to develop leaks.

Welding has made many good products better—refrigerators, automobiles, radios, streamlined locomotives, metal furniture, and a thousand other things. You, too, may find it profitable to consider the advantages in both production and sales which can be gained for your product by jointless design-for-welding.

Linde engineers will gladly cooperate with you in the design or redesign of your products for welding. The benefit of their broad experience is available from Linde Offices located in principal cities throughout the country and at 30 East 42nd Street, New York, N. Y.



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LINDE OXYGEN — UNION CARBIDE
PREST-O-LITE DISSOLVED ACETYLENE
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MINNESOTA Techno-Log

37 ELECTRICAL BUILDING

UNIVERSITY OF MINNESOTA, MINNEAPOLIS

MARCH, 1936

WAYNE STONE
MANAGING EDITOR

ROBERT DIXON
BUSINESS MANAGER

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VOLUME XVI NUMBER 6

	Page
MINING GOLD	107
ELECTRIC POWER	110
ST. PAT SPEAKS	113
PROGRESS	114
TECHNICAL JOURNALISM	115
NOW HERE'S A BOOK	117
FIREMEN VOLUNTEERS	118
CAMPUS NEWS	120
UNIVERSITY FASHIONS	123
MENTAL TILTS	125
STRAY SCRAPS	126

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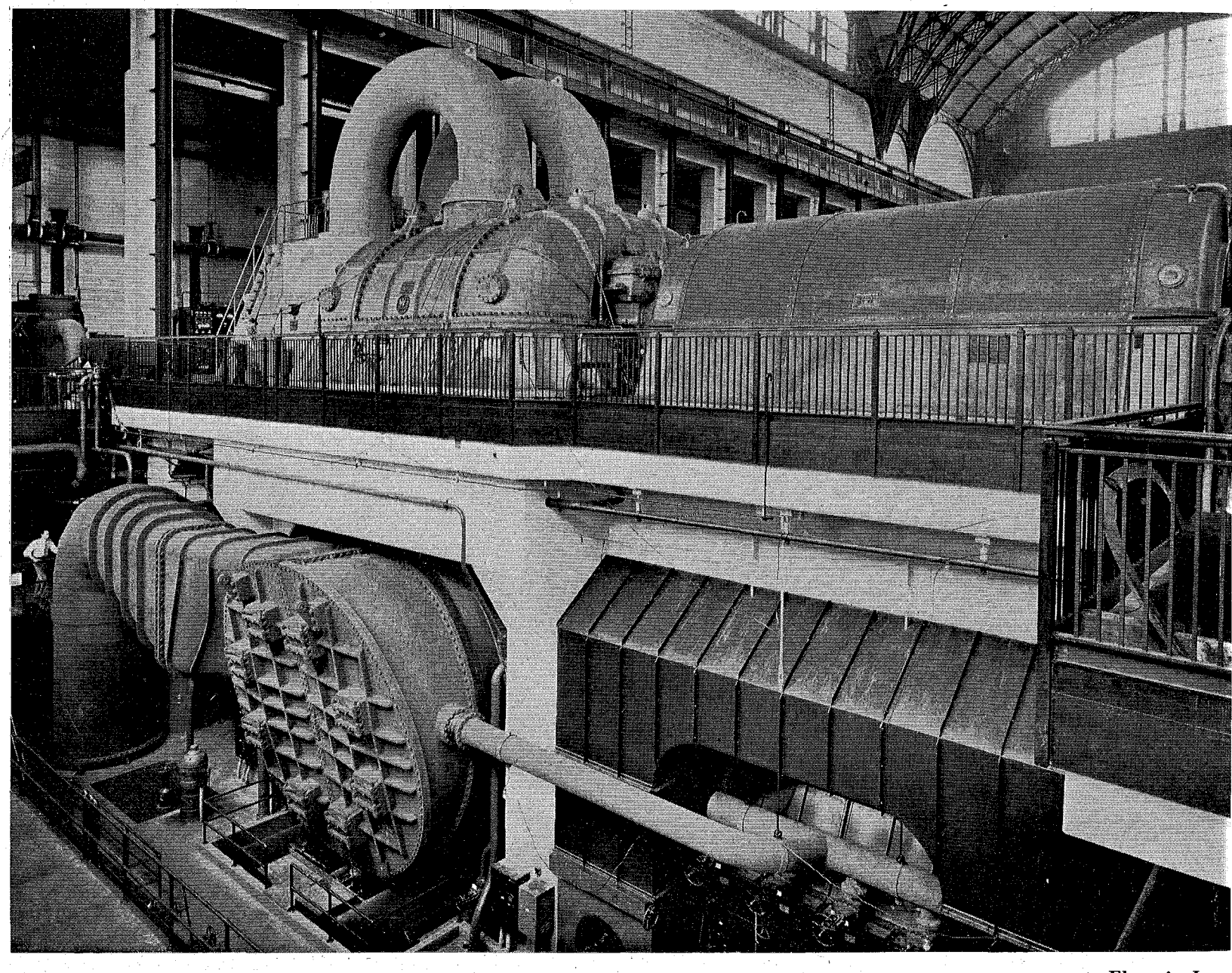


—*Electric Jour*

165,000 Kilowatts

Mining Gold With a Dredge

By Warren Woodward, M.'35

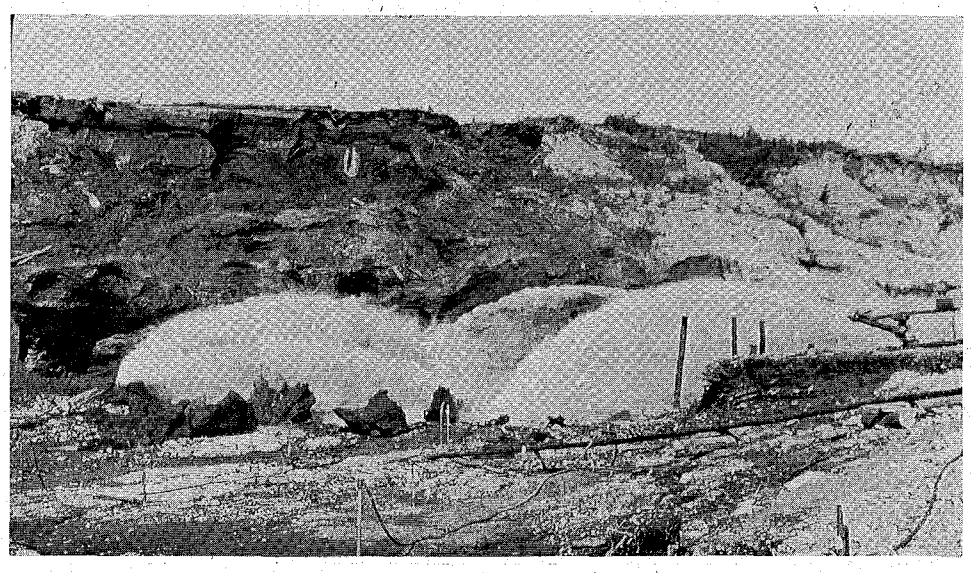
ABOUT the time the bonanza placer of the Klondike region, in Canada, two hundred miles or so east of Fairbanks, began to yield low grade ore, several rich strikes were made in the Fairbanks district. This was in 1905. Immediately all the disappointed and tired-of-working prospectors and miners along with the successful made a "gold-rush" for the camp in hopes of finding a quick, easy "stake." But it soon developed that hard work was just as necessary a requisite here as any place if one were to be a successful miner. It is never difficult to work hard and long when the gold comes pouring in, but when it does not come quite so easily many lose heart and move on. This is the experience of all "strike" camps.

When this first influx of transients had been weeded out, leaving only the earnest persevering workers, Fairbanks and vicinity had a population reported to be over 15,000. Everything which the miner used, from smoking tobacco for himself, to hay for his horses, had to be hauled in by sled for 500 miles, or by boat for more than 1,000 miles during the short summer. Naturally the cost of mining and of living was extremely high. Soon the gravels of profitable grade began to give out and the population to dwindle. This was about 1910. Several years later things had become very quiet. In 1915 a small revival was experienced due to some new discoveries, but it was short-lived and mining activity continued to decline.

In 1924 the 470-mile Alaskan railroad from the ice-free seaport, Seward, to Fairbanks was completed. This meant just one thing to Fairbanks—*gold dredges!* There had been no method of transporting such heavy machinery before, but now it could be done. Prosperity would return. The U. S. Smelting, Refining, and Mining Co. immediately started development work and by 1928 had three dredges operating and two more a short time later.

A gold dredge is a device for digging and extracting the gold from placer gravels. The fact that they can dig gravels simultaneously and continuously deep under water, wash them, and then pile the waste behind, makes their cost of operation per unit of material handled very cheap. Consequently not only much ground too low grade to have been economically worked before,

Hydraulic mining of gold in Fairbanks, Alaska



but also much of the ground worked over by the old-timers could now be profitably handled.

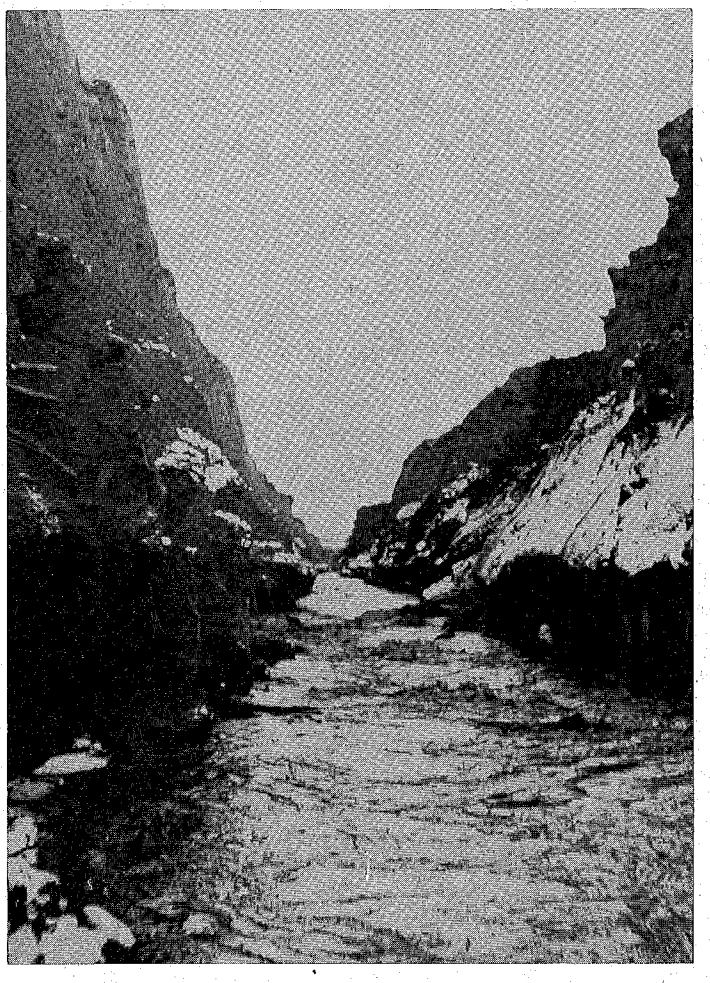
Due to climatic and topographic conditions, the preparatory work to dredging the gravels is quite extensive and furnishes work for many times the number of men used in the actual dredge operation. This preparatory work is probably as interesting and unique as any in contemporary mining practice.

The first process is the prospect drilling. This is done by ordinary water well drills, but all the cuttings from the bit are saved and panned. The holes always go into bed rock a short distance, which means they are from 30 or 40 feet to as much as 300 feet deep. The holes are laid out in a definite pattern so that after the total values derived from each hole have been found, the probable value of the area between all holes can be very closely approximated. In practice it has been found that these approximations invariably indicate smaller values than are actually recovered. After a block of ground is found to contain commercial gravel, the actual limits of "pay dirt" are determined.

Next, the prospective area of development is cleared. This in itself is some job, as blisters on many a husky hand can testify. The implement used is a brush hook, which to the uninitiated looks like a battle-axe from King Arthur's time. The handle is like that on an ordinary axe, but the motion used in its operation rather suggests that used with King Arthur's implement. There is the consolation, however, that in the use of it man-making exercise is gained. The usual type of ground cleared has an undergrowth of willow and small cottonwood with a few larger trees as spruce and birch scattered through it. A patch 100 feet by 300 feet is considered a good 10-hour job to clear.

When the ground is cleared to the satisfaction of the "boss," whose ideas on the subject seldom coincide with those of the "hookers," the bulldozers start in. A bulldozer is a "sixty cat" (60 hp. Caterpillar tractor) equipped with a blade ten feet long and six feet high which, instead of being set at an angle to the machine as on a snowplow, is set at right angles to it. The thick layer of reindeer moss and tree stubs which covers the ground is cut simultaneously and pushed like long jelly rolls in front of the machines to the edges of the cleared space. This is rather a lengthy operation, since the "cats" not only get stuck in the mud occasionally, but also are stopped by large stumps which then have to be blasted. The purpose of this de-mossing is to give the hydraulic nozzles, which are next put in position, something to dig into. The covering of moss, unless removed, turns the water, perhaps not as smoothly but just as effectively as a brick wall.

Drain showing deep cut due to rapid erosion



The nozzles are so placed that the effective washing radius of adjacent ones overlap. Naturally a complicated but temporary system of surface pipe lines, built to carry high pressures (up to 120 pounds per square inch) must be laid to feed all these nozzles. One of the best known but least liked jobs in the district is that of carrying sections of these pipe lines to positions where they are to be used. After the bulldozers are done, the ground is often so mushy and torn up that this can only be done by several men taking one of the heavy sections on their shoulders and wading, usually several hundred yards, through knee deep mud to the desired spot. It would be hard to find heavier labor, and the nice part is that about the time a poor fellow has both hands full trying to keep from dropping the pipe, three thousand mosquitoes decide it is lunch time. Yes, being on a "bull gang," as it is called, is a man's job. And remember, all over the North the working day is ten hours and the working week seven days. This, of course, is because of the shortness of the season, necessitating that as much be done in as short a time as possible. One is well paid for his work, however, since there is always that long winter "vacation without pay."

When the nozzles are in place they immediately cut a drain which goes either clear to the river or to some little valley which leads to the river. The stripping from then on consists of merely washing the cleared muck into the drain. At the outset this drain is merely a ditch, but as the ground in the bottom gradually thaws out and washes away it cuts down until there is just the necessary difference in elevation between the river and the point where the muck is being washed to keep it running fast enough so the material held in suspension will not settle.

Stripping is carried on until the whole surface of the

gold-carrying gravel underneath has been completely cleared of muck. This over-burden of muck varies in thickness from 10 feet to 160 feet in some of the present projects. One of the most interesting things that greets the newcomer or sightseer on his arrival at one of these stripping operations is the odor which arises therefrom. It is both new and different, but hardly appetizing. The nearest one can approach a description of it is to say that it might suggest the aroma on the leeward side of the world's largest meat packing plant. It is caused, of course, by the thawing out of the age old organic material, both plant and animal, held by the Pleistocene muck. Mastodon and other bones still carrying remnants of flesh are often found, not only in the muck but also in the gravels beneath, which are just as thoroughly and completely frozen, though it should be mentioned that an occasional unexplainable small patch of thawed ground is sometimes encountered.

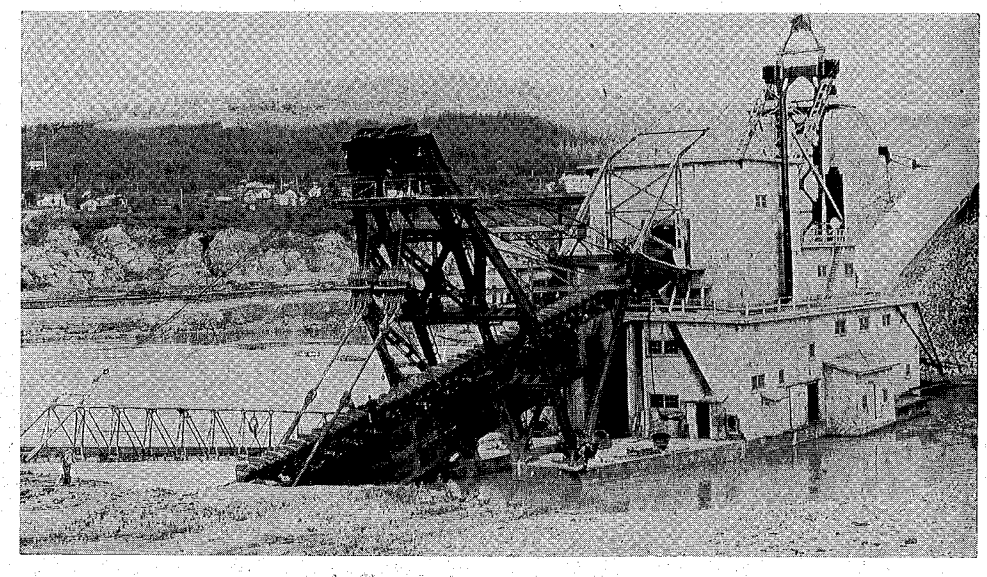
Before the dredge can start its digging operations, this gravel must be thawed. It has been the problem of thawing these ancient placer gravels that has impeded mining progress in all the far northern districts from the beginning. First thawing was done by forcing steam through long hollow rods into points, then by using hot water, and now by using cold water. Naturally with the change from steam to hot water, and from hot water to cold water, changes were also made in the points through which the thawing medium was injected. At the present time the point used is nothing but a ¾-inch pipe pointed with an ordinary chisel bit containing a ¼-inch hole through the center. This point is driven vertically down through the gravel to bedrock, cold water at all times passing through. This driving process employs a greater number of men during the middle of the summer than all the other operations together. A 16-pound hammer which slides on the pipe, a clamp for it to strike upon, and a pipe wrench are the point driver's tools. Ten feet per hour per man is the usual amount required to be driven. Ten-foot sections of pipe are added on the top as the point goes down. They are driven to bedrock, which is usually from 15 feet to 80 feet deep. Point driving is not a boy's game, either.

The pipes are set at about 10 foot intervals in two directions and the pipe lines supply the thawing water at about 15 pounds pressure. It takes about six weeks, as a rule, for the ground to thaw. The points are then pulled, the pipe lines removed and the dredge begins.

This final operation, the dredging, is really very simple. The long elevating bucket and digging line, or "digging ladder" as it is called, is the principal unit. The dredge itself sits on a pond while the digging ladder digs out the gravel just over the bedrock. Naturally as this is dug out, the gravel above is left unsupported and caves down, to be dug out again. The digging ladder dumps its burden into a large revolving trommel screen where all fine material is washed from cobbles and larger rocks. These go to the "stacker," a long endless belt, which piles them in the dredge pond behind the dredge. Thus, the dredge gradually moves forward, digging out the gravel in front and piling it behind, the whole dredge pond moving with it.

The fine material separated from the rocks in the trommel goes through a series of sluice boxes whose bottoms contain riffles and amalgamation plates. These catch all or nearly all the gold and the remainder of the fine material goes into the rear of the dredge pond with the rocks from the stacker. The only gold lost by present dredges is so finely divided as to remain suspended in water, consequently these are very efficient machines.

A view of gold dredge showing the dredging pond



In spite of the higher cost, not only of dredging, but of all types of mining in the interior of Alaska, the mining field there has only begun to give up the wealth which it contains. The easily accessible places, of which there are few, have been well prospected. There is, however, an almost unbelievable amount of country, particularly in the interior mountain ranges, which has been passed over only by airplane, if at all. To the fellow with a little mining knowledge, a small amount of capital, and an unlimited fund of adventuresome courage, this country holds an open challenging invitation.

Government Electric Power Steps in

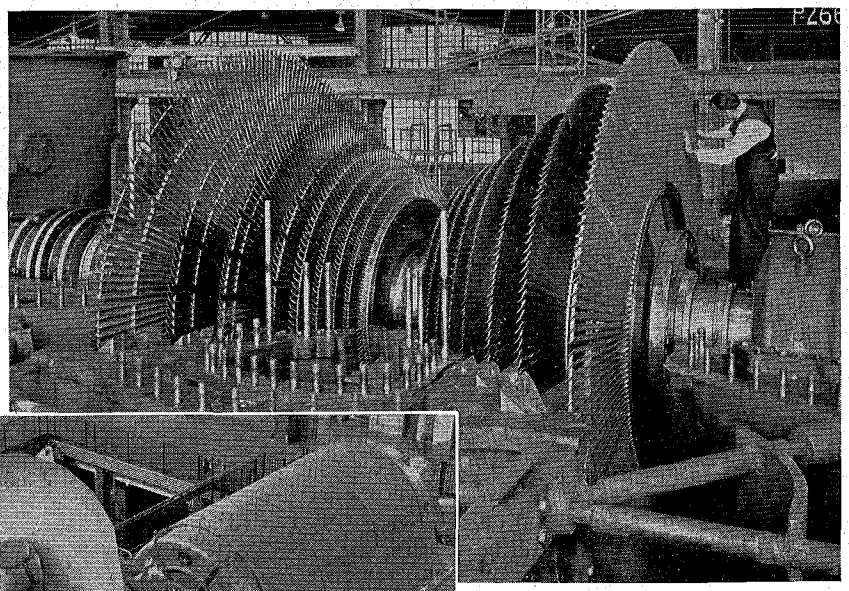
By William T. Ryan,
Professor of Electrical Engineering

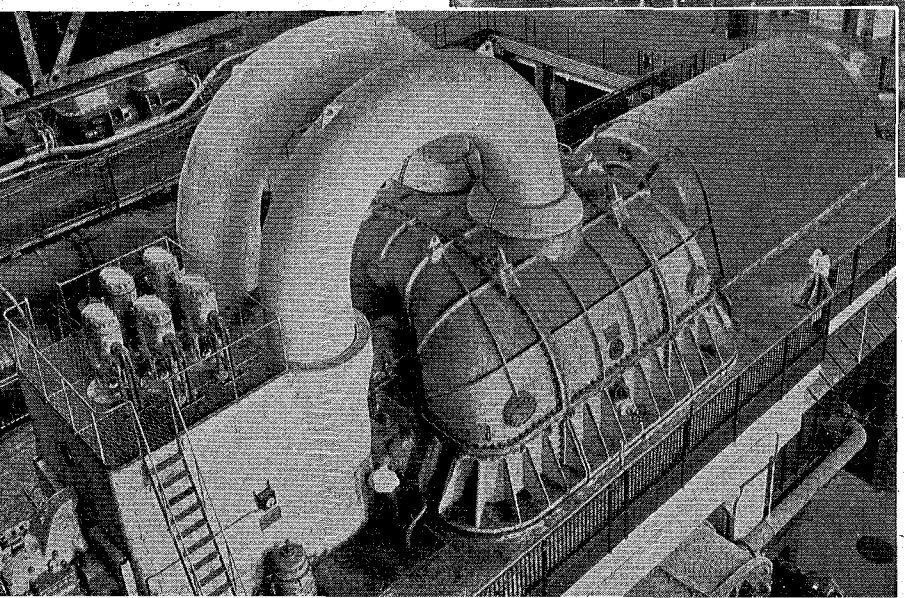
CHEAP electricity for everyone is so important at our present stage of industrial civilization that it is on the verge of becoming an accepted slogan in many of our political and community groups.

Our private power companies and a number of our municipalities have invested about 13 billions of dollars in the electric light and power business. This is an investment of $100 per capita. The gross yearly income is about $2,600,000,000 or about $20 per capita. The plant capacity is about 30,000,000 kw. or ⅓ of a horsepower per capita. Two-thirds of this power is produced by steam and internal combustion engines. One-third is produced by water power. A dependable supply of electricity has been brought to all the inhabitants of our cities and towns. Only a small percentage of our rural communities have been provided for. The campaign heading up in Washington for a cheaper and more universal supply of electricity has resulted in the creation of the rural electrification authority, and has led to outstanding hydro-electric developments in four sections of the country.

I

The Tennessee Valley Association is a corporation formed by act of congress, and administered by a board of three directors, which is planning the water-power development of the entire 40,600 sq. miles of drainage area of the Tennessee River under a single unified ownership and control. The base plant of the system is at Wilson Dam. The primary power at Wilson Dam is estimated at 66,000 kw. with 48,000 kw. of secondary power available for 80% of the average year, and 100,000 kw. for 65% of the time. Eight generating units are installed representing a capacity of 184,000 kw. It is proposed to later install 10 additional units, then the final total capacity will be 450,000 kw.





There are 15,000 blades in this turbine of the Richmond Station of the Philadelphia Electric Company. Below is the 165,000 kw. turbine-generator. Cuts from Electric Journal.

Supplementing Muscle Shoals, TVA is building Norris Dam 300 miles up the river from Wilson Dam, to be completed in 1936.

The authority has also undertaken the construction of Joe Wheeler Dam 15 miles upstream from Wilson Dam. This project will materially increase the primary power available at Wilson Dam and will add 173,000 kw. This development will cost about $20,000,000.

A fourth dam has been authorized about 70 miles downstream from the Wilson Dam. This will

be for navigation and flood control initially and will cost about $22,000,000. Later 6 units for 30,000 kw. each may be installed for power.

In addition to the foregoing plants, the authority has 4 additional dams projected, and a $7,000,000 transmission line underway to link together the various power sources.

The authority sells wholesale to communities at an average rate of about 7 mills per kilowatt hour. It has suggested the following residence rates: first 50 kw.-hrs., 3 cents each; next 150 kw.-hrs., 2 cents; next 200, 1 cent; all over 400 kw.-hrs., 0.4 cent. This is about ⅓ less than the rates for residence consumption in those parts of the country, including our own, which enjoy comparatively low rates. However, low rates alone will not do the job.

If TVA is to succeed, a load must be developed. A wonderful load building program is being worked out to popularize electric service on a scale never before attempted. The government, the utilities, and the manufacturers have agreed to undertake the development of the market with an advertising, demonstrating, and selling campaign set up for the long pull. We are all watching this effort with keen interest and wish it well.

Those of us who have traveled through the Tennessee Valley feel that the lack of purchasing power of the people in this area may prove to be a very difficult obstacle to overcome.

II

The next most talked about project is the Boulder Canyon project, now nearing completion. Although the installed capacity will be 1,835,000 hp. this project is primarily a water project. The cities and towns in the Los Angeles metropolitan district are using each day approximately 200 million gallons of water in excess of the amount replaced in its underground supply. This area in Southern California, which for some time has been going 240 miles for 60% of its water supply, had to have more water. Boulder Dam, which will store enough water to cover the state of Connecticut with water one foot deep, will make it possible for Los Angeles to go to the Colorado River for its additional water.

The 275-mile aqueduct which includes twenty-nine 16-foot tunnels totalling 91 miles is the biggest construction job of its kind in the world and will cost approximately $250,000,000.

III

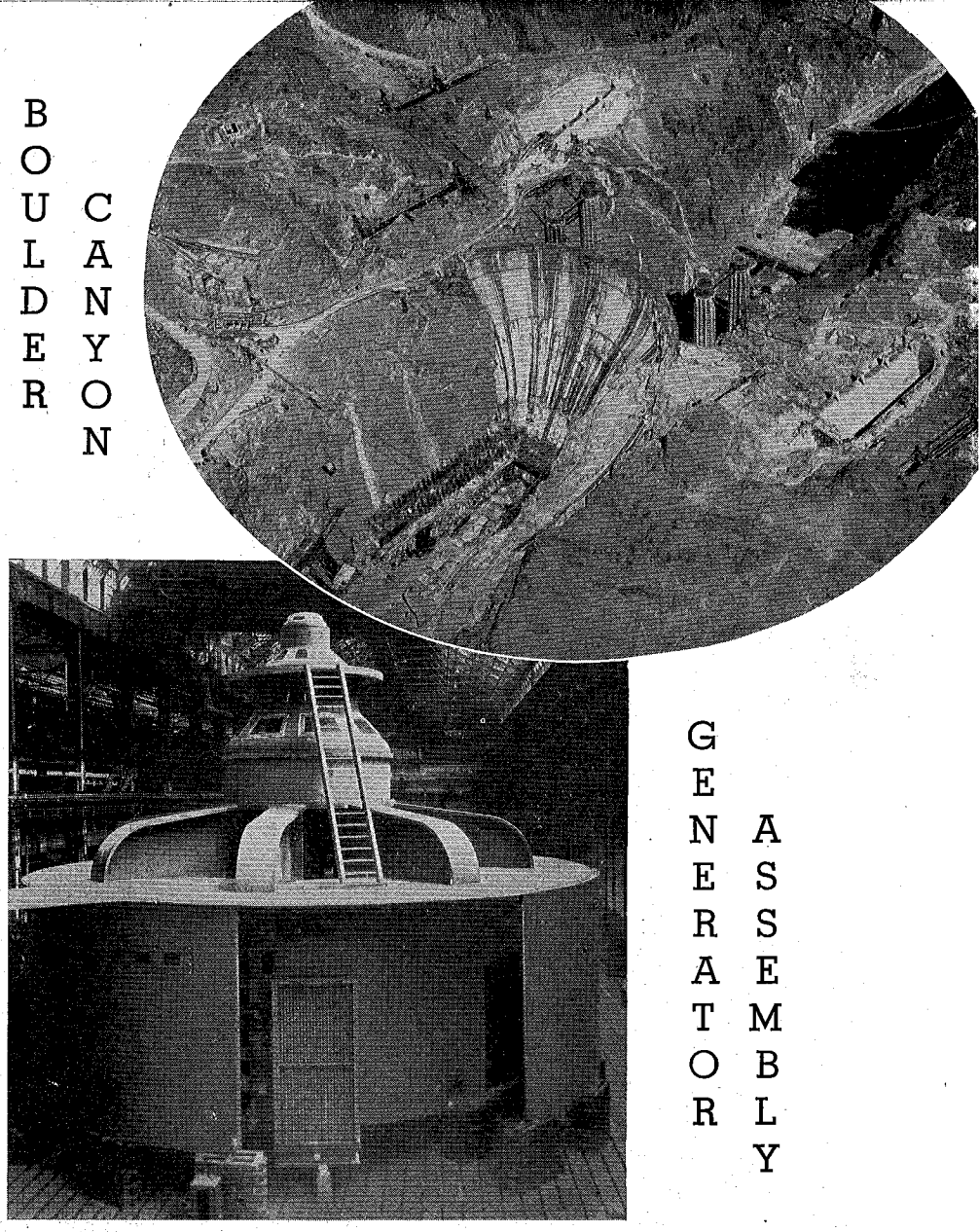
On the Columbia River 75 miles west of Spokane, the U. S. Bureau of Reclamation is building the Grand Coulee Dam and power plant. When this is finally completed it will have a total capacity of 2,000,000 hp. At the same time the chief of engineers of the War Department is supervising the construction of Bonneville Dam about 42 miles east of Portland. This dam is essentially a river and harbor project, although there will be an initial installation of two 4,500 kw. generating units.

The War Department has also under construction the Fort Peck Dam in Montana. The primary object of this dam is to improve navigation in the upper regions of the Missouri River. The ultimate power capacity is estimated at 500,000 hp.

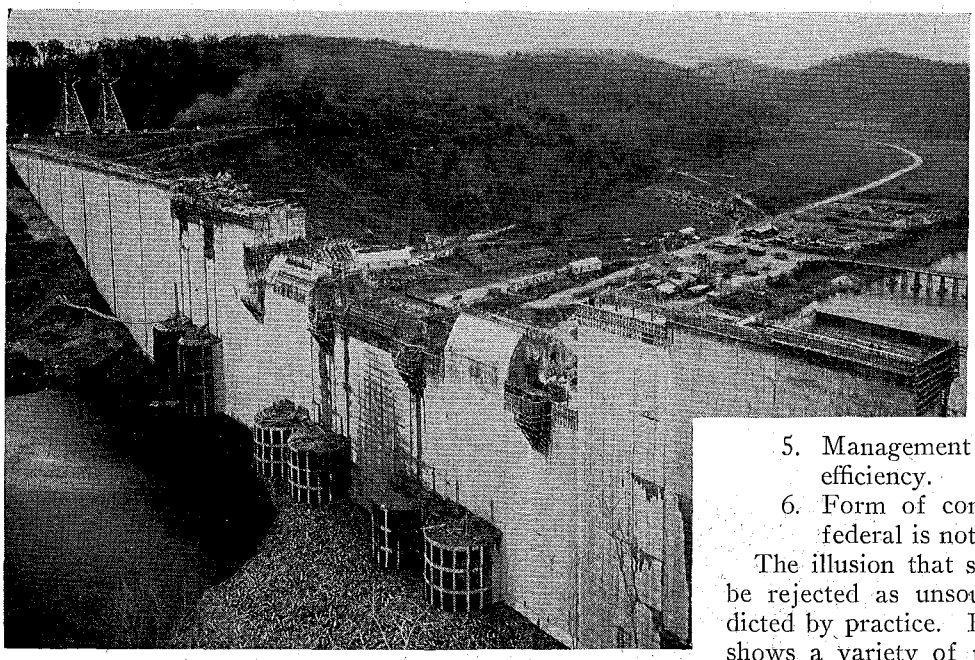
IV

Everyone is familiar with the attacks made upon the power trust during recent political campaigns. If private and municipal ownership supplemented by such major federal projects as have just been described is to continue, some sort of a national power policy and program, together with adequate federal regulation to supplement and coördinate our present method of state regulation must be worked out.

Radical proposals started on the assumption that the industry as a whole is inefficient and needs radical alterations, are just as bad as the hostile criticism of those in



The Boulder Dam, greatest of federal power projects, is now complete. Above is an illustration of generating equipment to be installed. From Electric Journal.



Work in progress on the Norris Dam, a TVA project, is shown here. Water of the Clinch River is rising against the upper face of the dam while the finishing touches are being made at the top. Two generators are now being installed and will be "on the line" this summer at this Tennessee plant. From Electric Journal.

the industry who support the status quo both from the promptings of their own experience and the fear of sweeping criticisms and reforms.

Those who see the necessity for a middle path between extremes are not being heard in this campaign. We are interested in the two fundamental aspects, lower rates and improved service. We are willing to give reasonable rewards to those who earn them, and appreciate fully what the electric power industry has achieved. We see defects, omissions and irregularities in existing setups. We see, as stumbling-blocks of about equal magnitude, the attitude of those who would maintain status quo at any cost and those who proceed on the assumption that the industry as a whole is inefficient and needs radical treatment.

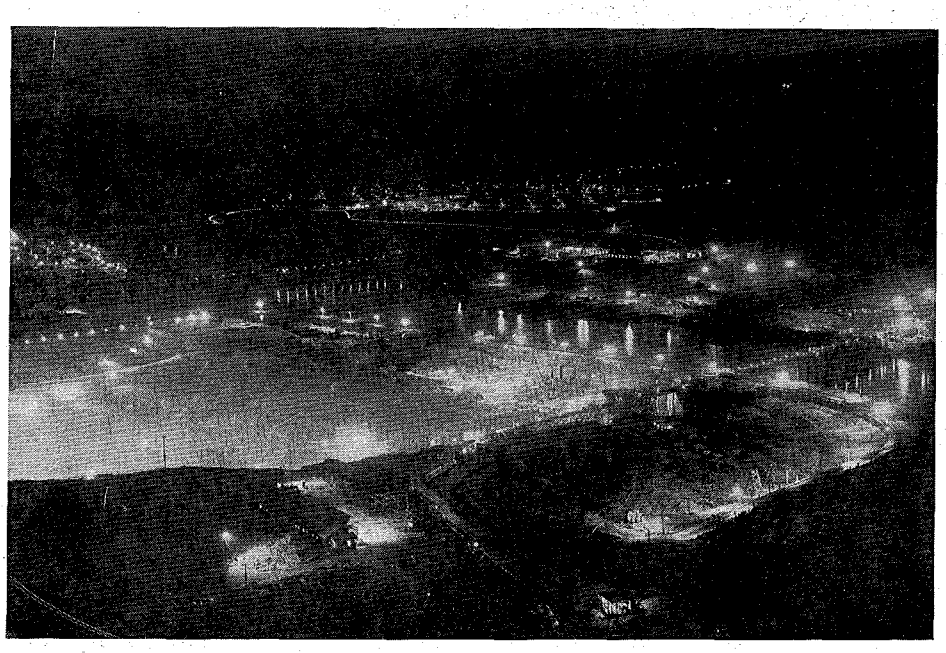
We need a neutral body that will recognize such guiding principles as:

1. Before reorganization can be carried out intelligently, an accurate appraisal of the efficiencies of the individual companies must be made.
2. Efficiency and size are not directly related.
3. Consolidations of undertakings are no guarantee of efficiency.
4. Areas may be either too large or too small for efficient operation.
5. Management may of itself create or destroy efficiency.
6. Form of control as between local, state, or federal is not a major factor in efficiency.

The illusion that size and efficiency go together should be rejected as unsound in theory and as being contradicted by practice. First-hand knowledge of the industry shows a variety of undertakings, some privately owned, some municipal, some large, some small which are efficient.

This leads to the all-important consideration: What are efficient undertakings? Low rates do not necessarily mean efficient electric service. Quality and reliability of service are more important than low rates. If the people of Minneapolis and St. Paul would be satisfied with just a few hours of outages each year, rates could be materially reduced. Just imagine the electricity supply as being discontinued for a portion of the day in January when it was 34 degrees below zero. Remembering that all your oil-burners and hundreds of other appliances would not be functioning, think what it would mean to your community.

It is the author's conviction that the eventual solution as to control should be a type of regulation that will place private and publicly owned systems on a fair, competitive basis. Both should be subject to exactly the same requirements as to quality of service, extending their lines, taxes paid, rate regulation, and even the same accounting system. Then let the most efficient win.



The Grand Coulee at night. This panoramic picture shows the efforts being made to bring this project to completion. Work is carried on night and day. The cut is from Electrical West.

Hear Ye! Hear Ye!

ST. PAT SPEAKS

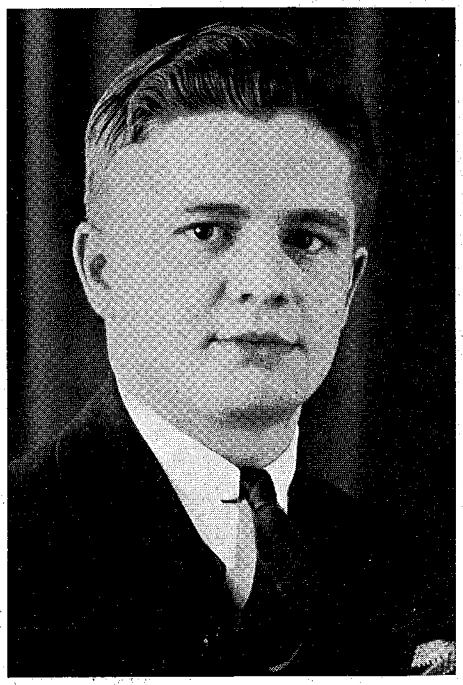
Melvin (Pete to you) Lohmann who is a mechanic who hopes to graduate a year from June had his name drawn out of St. Pat's Hat by the Tech Commish and thereby was declared to set the scene for St. Pat's Annual visit to this campus which is due to happen on April 17 next.

PETE dug into the famous Green Hat for three more names to be on his Grand Council of St. Pat's Day General Arrangers. The names that popped to the surface first were those of three loyal followers, an electrician, a chemist, and a surveyor, Tom West, Fred Meyers, and Elwood McGee, all being in their third year as sons of St. Pat.

Pete tells me that any of you people that think maybe that if you had a chance that you might like to do a little work and spend a little time working on one of his committees that if you see him or drop a note in his P.O. he will talk it over with you.

Pete also said that he would kinda like to have all the loyal tech students lend a hand in welcoming St. Pat by starting thinking about maybe some float ideas so that you won't be rushing home to swipe the kid brother's toy wagon because on account of you didn't arrange for a truck in time and then you gotta have signs and stuf and if you don't arrange for the signs and stuf early you may be surprised to find that there won't be any signs and stuf and yooooou'll be sooooory and then you will be wanting to save your pennies on accounta you'll wanta go to the big dance and sellebrashun which Pete has promised all good tech stooges which is going to be held this year at the St. Paul Hotel, Ohboyoboy. (Are we Institute of Technology guys gettin' Ritzy?)

Pete is pretty happy on accounta because of the Miners ain't agoin' to be throwin' dead eggs at us this year, they'll be on our side of the fence and helping us catch them. You see they moved St. Pat's Day up to Apr. this year so the Miners could wear the Green Hats and Capes and splutter on the Blarney Stone. The Miners are goin' to invite us over peacefullike (without the firehose) to their abode to show us what a Miner does in his spare moments. And too, they're going to have some floats



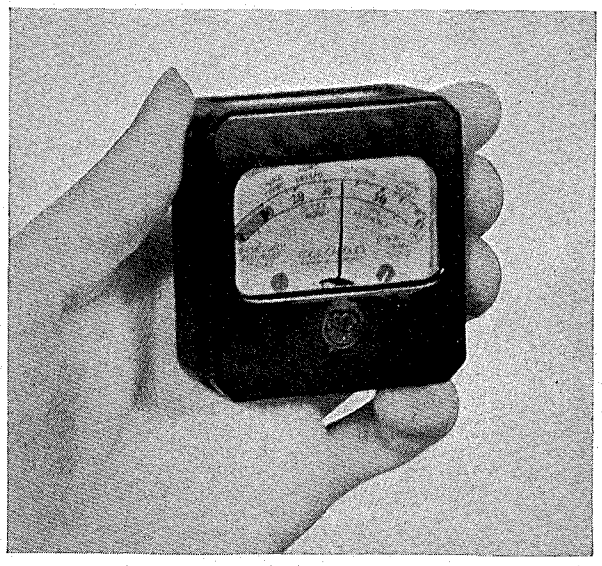
Melvin Lohmann

Pete says the Open House will be going full tilt in all the buildings from 9 a. m. to 5 p. m. and all the machines and equipment and experiments and displays and everything will be running so you can see the wheels go around. And then at 11 a. m. there's going to come the big Parade which everybody will be looking forward to anxiouslike because they will have all their signs and trucks if they do like we said and start thinking now about it. At High Noon the Honorable and Righteous Royal St. Patrick and his Lady will bestow their blessings on the loyal tech seniors.

All you guys will get a chance to practice your fanciest wiggles on thus when you come to the Green Tea and Dansant at 3 p. m. in the engineering auditorium and then if you find out that your date is kind of a Goongirl you can get another one quicklike for the big dance in the evening. And besides maybe you might like the looks of one of them wonderful, beautiful, glamorous, glorious, gorgeous, dazzling, enchanting, deceptive, bewitching, fascinating, charming, lovely, elegant, graceful, comely, sylph-like, captivating, enrapturing, alluring, delightful, and attractive little gazelles from the school of Interior Architecture and decide that maybe you might like to take her to the big evening dance,

So you better figger on a good time with lots doing and put a red mark around Apr. 17 on your calendar because of accounta this is going to be one swell St. Pat's Day. Pete said so.

"never-ending Progress to perfection"



—*Cuts from General Electric Co.*

New compact light meter

Alloy Steel

And yet another surprising feature of the China Clipper is the fact that each of the two 2,380 pound engines are supported by a tubular mounting that weighs only 74 pounds. Chromium-molybdenum steel tubes, heat treated to give a tensile strength of 95,000 pounds per square inch, are welded together to make up this mounting. This light weight, yet strong, steel is also used in many other parts of the plane. Many are of tubing, but machined forgings are also used, as well as sheets and bars, welded together. The handling truck which moves the Clipper around, in and out of water, is fabricated from 16 gage chromium-molybdenum tubing, and will carry a load of 35,000 pounds.

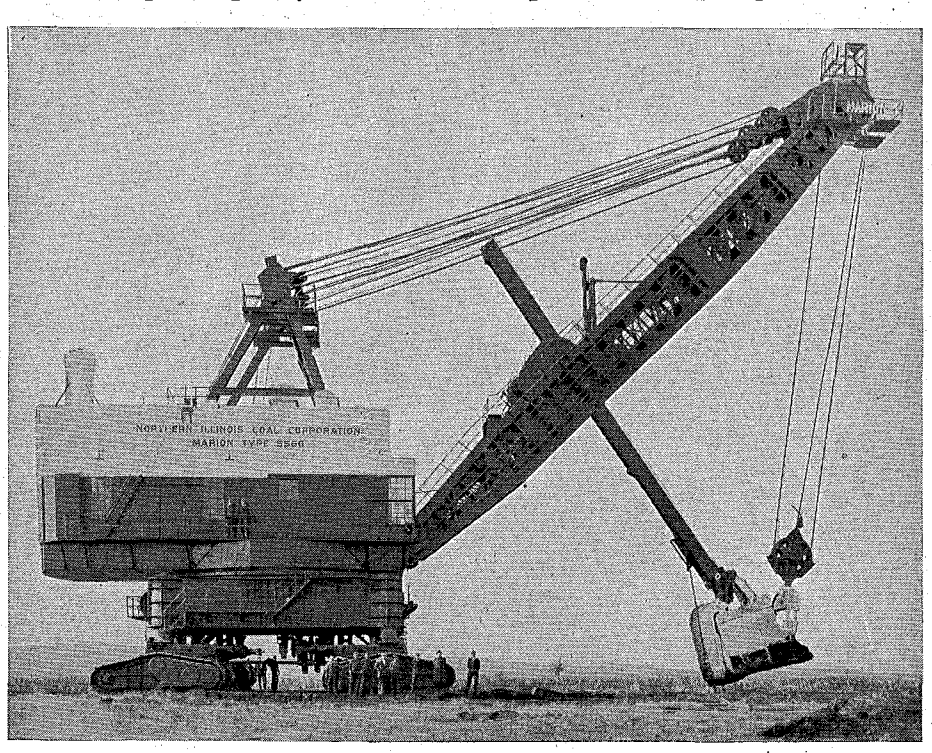
Electric Scoop

With a normal load of 48 tons, the world's largest capacity shovel, rated at 32 cubic yards, went into service last November. The electrical equipment of the machine eliminates several undesirable features of former shovels of this size, one of them being the removal of the mechanical counter-balance arrangement generally used on large coal stripping shovels. A pressure of one or two pounds on one of the master switch handles brings into operation forces resulting in pressures of several hundred thousand pounds at the dipper teeth. The net working weight of the shovel is 1,300 tons, with a boom over 100 feet long, and a dipper handle more than 65 feet long. Especially adapted to open pit mining, its maximum radius of operation is 110 feet, and the height at which material may be placed is approximately 70 feet.

Light Meter

A compact vest-pocket size light meter, resembling a small desk clock, is another new product of G. E. laboratories. On the top of the meter is a light sensitive cell, connected directly to an ammeter, the scale of which is calibrated to read in foot candles. Multipliers are provided so that the range of the meter is from 0 to 750 foot candles. Directly on the scale are marked minimum values of light intensity for different types of ordinary work.

World's largest capacity electric shovel operating in open-pit coal mine



Rambling Thoughts

On Technical Journalism

And the Engineer

Adapted by Wayne Stone, M. E. '36, from a talk

By Philip Swain, Editor of POWER

Editor's note: As the title suggests, the following is an informal dissertation on problems of the young engineer. The article has been adapted from a speech given before the convention of Engineering College Magazines Associated, last fall, and is here presented as valuable not only to your editor, who had the privilege of hearing it, but also as of value to other students.

ALTHOUGH the majority of you may never seek a connection with the technical press, you probably wonder, as many others do, how editors "get that way."

Men enter editorial work by devious paths—hardly two alike. Let me sketch my own. Starting as a boy interested in mechanics and scientific abstractions, and little concerned with social contacts, I dreamed my way through an A.B. course, concentrating at the end on physics and mathematics, with the idea that I would become a research physicist. But this thought was not fully satisfying, because several summers of machine-shop experience, and my natural interest in mechanical things, made me feel that I would be still happier as an engineer. So I went to Yale for four years to study in mechanical engineering, and two more degrees.

I credit Yale with pulling me out of my shell a little, with convincing me that men are as important and interesting as machines, and that the engineer must gain equal facility with both.

Still no thoughts of being an editor. After getting my M.E. I accepted an offer to teach mechanical engineering at Yale. Practical engineering was still in my mind as an ultimate goal, but here was a job in hand in an environment I had learned to love.

In 1916—I never quite figured why—I had trained for a month at Plattsburgh and acquired some highly interesting military experience; learned that even endless hoofing has its thrill, if somebody else does the thinking for you. My leanings were mildly pacifistic, but the New England conscience was on the job. That is probably why I re-enlisted for three months in Plattsburgh the day after President Wilson declared war in the spring of 1917. This was followed by a shavetail commission, then by a 1st lieutenancy at Camp Devons, Mass. There followed drilling of recruits and work as an artillery orientation officer with 10 months in France.

War was a bad experience for many soldiers, but I was lucky—mixed with a lot of fine men, saw England and a quiet front in France, came home with a rich experience and not a scratch. (But please don't take this front-parlor report as a good word for war, which, on the whole, is a thoroughly rotten and inhuman performance.)

By now I was gaining a zest for constantly new experiences. Each seemed to give me something I had lacked before. Teaching might be all right again some day, I thought, but I had to see more of the world of affairs first. So I plunged into a job of engineering salesmanship. I was fairly successful in selling, which is rather surprising in view of my early aversion to social contacts. As a result of this and other experiences, I am now convinced that salesmanship, like a lot of other things, can be learned if you set your mind to it. And you'd better plan to draw a little blood in the rough and tumble of selling if you want to make the maximum progress in any line of work.

Nothing will give you greater self-confidence—and you've got to have it if you expect to get anywhere. The elimination of needless fear is probably the single most important job any young man can do for himself. He should make it a point to list those things that frighten him needlessly, and then go do them all. If he is afraid to meet big men he should seek them out in their lairs and stick his chin out for them to swing at (they generally won't). If he is afraid to address a gathering he should seek an opportunity to do so, and then go through with it even if his knees knock. If he is afraid to take decisive action even though it be in line with sound reasoning, he should force himself to do so in several cases of not too much moment, just to see what happens. The laboratory method!

If you will do those things you will discover that nine-tenths of the bugaboos of life are nothing but thin air. You will learn to stand up to them without a whimper. And you will learn how to avoid that one out of ten which is real, and no kidding.

Study the men who get ahead and see what a large percentage of them have "nerve," plus salesmanship. Some have nothing else. Don't envy the man who gets along on "front" alone. Add a little "front" to your own presumably superior intellect and ability and show him your dust.

Lack of front is the peculiar vice of engineers. After years of observing them, I am convinced that engineers as a class are altogether too damn modest. The time to start acting modest is after other people begin to think you are somebody. Then it pays, because people like to think their heroes are unassuming men. Before that it may be an expensive luxury.

In looking for a job—whether it be engineering, editorial, or otherwise—don't emulate some of the young graduates of today. Don't tell your prospective boss you are not sure you will be of much use to him, but would like a job. He isn't running an orphans' home. It's wise, of course, to admit that you don't know the details of his business—that you've got to learn. But make it clear that

(Please Turn to Page 124)

The MINNESOTA Techno-Log

MARCH, 1936

Power, as an Enterprise

IT IS seldom that the TECHNO-LOG has so appropriate a subject to present editorially as it has in this issue. Professor Ryan, discussing government power, has just turned the tables on certain of his critics.

Both Mr. Ryan and the TECHNO-LOG take pride in reviewing the works of the federal government in electrifying areas of the country by its magnificent power projects. Whether private or public enterprise is the better does not enter here. These are projects well within the scope of the government. But the problem is again before us as to just where to draw the line between private and governmental enterprise.

Oftentimes our public utilities have been held up as tyrannic, unscrupulous, and wasteful. Yet Mr. Ryan points out that in the electric power field, for instance, service is almost never interrupted for any length of time and that rates are a fairly close measure of the cost of product. He goes so far as to say that the best way of settling the problem of which is more efficient, private or public, is to give them the same standards, the same accounting system, same requirements as to service, rate-regulation, and taxes. Then let the most efficient win. Of course this is the ideal solution. Maybe it would be wasteful for a period, but it might lead to a valuable result.

It's little more than a year since Mr. Ryan was accused, along with other faculty members, of promulgating power propaganda. The recrimination was made in a hasty Washington investigation. When Mr. Ryan says let the most efficient win, that's propaganda for neither side of the case. In other words we have a problem before us; our university faculty is active in presenting it; and it's up to us to keep it in mind and act upon it when the opportunity comes.

It is true, on their own admission, that power companies are making an effort to disprove the government's ability to efficiently take part in power projects. They admit their propagandizing, yet we must not be too quick to condemn or condone. Commercialized propaganda, especially in our schools, should be condemned. Yet who can judge whether much of the propaganda is more than social?

At the Desk

DREDGING is one of the latest processes for extracting gold from its natural deposits. Warren Woodward describes it, having spent several summers in Alaska at a gold dredging mine. The type of dredge shown on the cover has made these poorer Alaskan deposits workable. We think the cover presents an interesting study in massiveness and proportion.

Receiving many requests for copies of a WLB talk he gave recently, Professor Ryan found the TECHNO-LOG an answer to his problem. His talk is presented here, with illustrations of many phases of the government power activity he analyzes. While on the subject of power, we've included in our frontispiece a real generator. It's the same one described in cutlines on page 110.

Need we speak of Engineers' Day? We all have to make it what it is, of course.

When your editor heard Philip Swain's talk in Philadelphia last fall, he was very much inspired. The transcript printed this issue may give many of us pointers.

The usual columns and news material appear, and Professor Siler returns this month with a little story about firemen.

The cut run last month of New York City was incorrectly credited; we were indebted for its use to *American Architect* and to *Aerial Explorations, Inc.*

Slips . . .

A story of Winston S. Churchill—told by Gertrude Atherton:

"Shortly after he left the Conservative side of the House (of Commons) for the Liberal, he was taking a certain young woman down to dinner, when she looked up at him coquettishly and remarked with the audacity of her kind:

" 'There are two things I don't like about you, Mr. Churchill.'

" 'And what are they?'

" 'Your new politics and mustache.'

" 'My dear madam,' he replied suavely, 'pray do not disturb yourself. You are not likely to come in contact with either.' "

—*Atlanta Journal.*

It seems that a fair size bridge, which had been under construction for quite a while, was nearing completion. One evening after the men had quit for the night, the entire structure collapsed. On the following morning, the "big shots" went down to the scene of the accident to determine what could be done. When they arrived they saw a lone figure sitting atop one of the girders which jutted out from the water. He was furiously pushing a slide rule back and forth, and seemed to be muttering, "Damn that decimal point."

—*Michigan Technic.*

Now Here's A Book

By Clifford I. Haga

Instructor in English

SOMEHOW the book I have this month, "The Sociology of Invention" by S. C. Gilfillan, tempts me to introduce it in the same way as those sensational display advertisements announce a certain type of general reference work—"Do you know this—that—or the other? Then see pages so-and-so and such-and-such." Here are a few such breath-taking "do you knows?"—Do you know that the Industrial Revolution was not caused by the invention of the steam engine nor did it require the general use of steam power to revolutionize industry and society? Do you know that the introduction of gunpowder and firearms into western Europe in the 14th century had singularly little to do with the downfall of chivalry and feudalism? Do you know that in Colonial times more transoceanic freight was carried in tiny sailing ships than today in our steam freighters (in proportion to population) and that we could do as much today without steam transport? Do you know that gas-light manufacturers never invent or introduce electric lighting devices? Do you know that engineers as a class produce inventions of only trifling importance and that the truly epoch-making devices originate with outsiders? Do you know that scarcely any inventors grow rich on their own inventions—that all of Edison's inventions, for example, were a net loss?

Enough, enough—it is quite clear that we don't know anything about inventions and that our grade-school couplets—steam engine-Watt, steam boat-Fulton, electric lamp-Edison, wireless telegraph-Marconi—are only the rawest and most naive moonshine with but very little truth in them. To find out what inventing and inventions are, let us ask Gilfillan—sociologists know everything. To begin with, he gives us a list of thirty-eight "Social Principles of Invention" as a basis for the determination of the essential qualities of that which we vaguely call invention. Each one of those questions I just asked can be answered by citing one or more of these principles—the first three questions by a reference to Principles 35 (No single invention revolutionizes civilization) and 34 (Equivalent invention), the next two by Principle 32 (Outsiders revolutionize; insiders perfect), and the last by Principle 33 (Enterprisers as important as inventors). As for the folly of those grade-school couplets on which we have all been brought up—steam engine-Watt, etc.—Principles 26 (The progress of invention is impersonal) and 30 (Popular notions of great inventors essentially mythology) are only two of the chief points controverting the popular superstitions.

Now it is of course true that Mr. Gilfillan is a sociologist and what he thinks or knows about invention may be only folly and moonshine to an engineer. But I wonder. As far as first-hand knowledge and original work have any value, Mr. Gilfillan has established himself as an authority. His great book, "Inventing the Ship," is so thoroughly technical as to please any engineer, landlubber though its author may be. His curatorship of several collections in the Chicago Museum of Science and Industry would almost alone qualify him as a useful and profitable source of information. But it is not these qualifications that most recommend him to me—nor is it his talent for exploding balloons of myth or his quick and lively style. It is rather that he is a sociologist, an expert in one of the most fruitful sciences studying human development. Since invention is the primary influence promoting civilization, that outward evidence of human development, the sociologist's approach to the mysterious and exciting problems of How, Why, When can yield a rich harvest for the thoughtful engineer. In the future, even more than in the recent past, the engineer will be found tucked away somewhere in the How, the Why, and the When.

To read Gilfillan's "The Sociology of Invention" should be sheer delight for engineers—as it was for me, the innocent bystander. If "The Sociology of Invention" proves nothing else, it will show the engineer that what he is barking his shins on is not a few trees but—a forest.

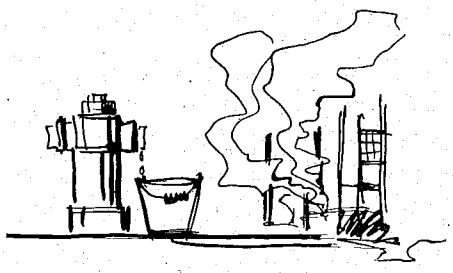
When Firemen were Volunteers

By Roderick William Siler
Assistant Professor of Mathematics

EVERYONE has noble ambitions, when young, which he is seldom able to realize later. I ascribe my success in getting through grammar school to an ambition of this kind. In grammar school I dreamed of being a fireman. Not a locomotive fireman nor a stoker on a steamboat, but a city fireman, the kind that puts out fires rather than starts them. This is one of my ambitions frustrated by going to college. Yet the effect of it was such that up to fifteen years ago, when they speeded up the fire departments by replacing horses by gas, I always ran after an engine going to a fire. Now I never do. In the first place, the engine is out of sight before I can get started. Secondly, I feel pretty sure there won't be any fire, anyway.

Yet I must admit that the golden age of firemen was achieved and passed before my time. I refer to the old volunteer fire departments that went out of business in the larger cities in about the year 1860. Not only were firemen then volunteers but they served without pay. And this in a period when fires were far more difficult to cope with than now. Water supply systems were inadequate; chemical fire extinguishers unknown; modern fire alarm systems not yet invented; but, greatest handicap of all, the engines which pumped water onto the fire had to be pumped by hand.

The usual procedure in case of fire, say around the year 1840 in larger cities such as New York, was this: Someone having discovered a fire would run with the news to the nearest fire station. About the city were scattered towers in which were hung bells, and these with the church bells would begin tolling, picking up the alarm from the first tower and passing it from one to another over the city, the number of strokes of the bells indicating the locality of the blaze. In the meantime the proper fire companies, engines, hosecarts and hook and ladder trucks would be on their way. If it happened to be night, the firemen, who either lived at the firehouse or at their own homes near by, would hop out of bed and start for the engine, pulling on their helmets, shirts, pants, boots, coats as they ran. The important thing was to get on the helmets; the rest could wait until after the fire. Fire apparatus then was drawn by the firemen, all getting hold of the long drag rope, and running with the machine as they bellowed for right of way. Arrived at the fire, the engines were coupled up with the fireplugs and the hose run out. Then began the real work.

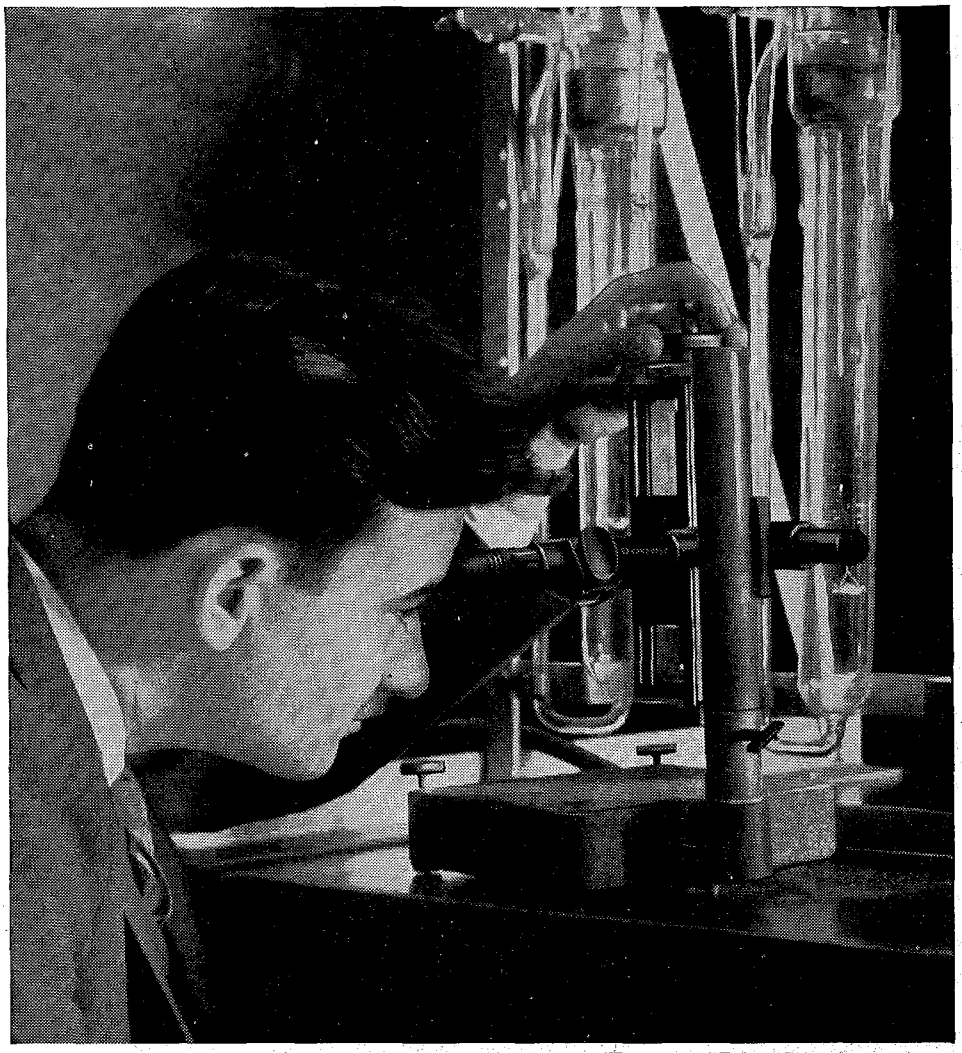


Pumping the engines was back breaking. Throwing water on the fire was doubly dangerous because the force projecting the water was comparatively weak, it taking a good engine and crew to throw an effective stream more than a hundred feet. The difficulty was increased in cold weather, because the small city water pipes and fireplugs froze up. The worst fire New York city has ever had, which broke out on the night of December 16, 1835, happened under these conditions.

It was bitterly cold, between fifteen and twenty below zero, and a raging gale blowing from the North. The city was buried under a heavy fall of snow. Reaching the fire the firemen found the water supply so poor that engines had to be run over to the river for water, obtained by chopping through the ice and relayed from engine to engine, and thus to the fire. Due to the cold and wind, water from the hose pipes could not be thrown more than thirty feet, a pretty small distance to lie between a man and a blazing building or shaky wall. This fire burned almost three days, destroyed over 20 million dollars' worth of property and nearly seven hundred buildings, and injured many firemen. A dramatic incident of this occasion was that when the Dutch Reformed Church of the district caught fire someone entered the building and began playing the organ, and continued doing so until the roof crashed in. Who the organist was remains a mystery to this day.

The great reputation which the old fire companies seem to have passed on is for brawling among themselves. There certainly was a great rivalry between them. Any man who belongs to an organization which demands that at the ringing of a bell he climb out of bed on a winter night and gallop to a fire is bound to take a lot of interest in that organization. Naturally, when anyone spoke slightingly of the company a man ran with he grew pugnacious, and some companies, being unduly sensitive, engaged in more than their share of brawls. But others, the majority, confined their fighting to fire. The astonishing fact to this day and age is that eighty years ago in a city the size of New York —the New York population in 1850 was over half a million—men from all walks of life could be found willing to volunteer their services in such hard and haz-

(Please Turn to Page 124)



"Assets in the making"

THE work of Bell Telephone Laboratories might well be called "assets in the making." It deals with many problems whose solution will be of great future value to telephone users. ¶ The truth of this statement is indicated by improvements already developed and now in daily use. The convenient handset telephone, the dial system, new magnetic alloys, overseas and ship-to-shore radio telephony are just a few examples. ¶ Today more than 4000 men and women are carrying on this work to make tomorrow's telephone service still better.

Why not telephone home at least once each week? For lowest rates to most points, call station-to-station after 7 P.M. daily, or any time Sunday

BELL TELEPHONE SYSTEM

Aeros Hold Sixth 'Take-Off' In Union With Strato Theme

In a setting rivaling that of the best-equipped airport, with a stratosphere theme, aeronautical engineers held their sixth "Take-Off" in the Minnesota Union, February 21.

Sponsored by the Institute of Aeronautical Sciences and the University Flying Club, the Aero's dance featured many entertainments. Gene Hayden's band provided the music.

Leonard Starlof and Vincent Spoor, co-chairmen, managed to provide a ground airplane to test guests' air sense. Souvenir miniature planes on tiny ash trays were given as door prizes.

Contrary to accepted tradition, Joseph Wickstrom, an Arts freshman, won the prize for being the best ground pilot. He received two tickets for free airplane rides as the result of his prowess.

Minn. Alum Analyzes Atmosphere by Light

Dr. M. A. Tuve, E.E. '22, and Dr. A. E. Johnson, both with the Department of Terrestrial Magnetism in the Carnegie Institute, together with Dr. A. O. Wulf of the Department of Chemistry of Soils in the U. S. Department of Agriculture, have developed a new method of exploring the rare atmosphere high above the earth's surface. Dr. Tuve, together with Dr. Wulf and Dr. Johnson, has worked for some time on a method of exploring the upper stratosphere. He hopes to accomplish this with the Tuve, Wulf, Johnson "fingerprinted light."

"Fingerprinted light" is light that has been marked by a light chopper operating at a known frequency. The light is shot into the air with a large army searchlight. A mirror picks up the "fingerprinted light," which is identified by tuned instruments. The instruments also help to analyze the light rays. By means of the "fingerprinted light" the three scientists hope to determine the chemical analysis of the earth's unexplored "ozonosphere" and "altotroposphere." Other conditions that will be studied are the varying density of the air at the high altitudes and the possible effects of wind velocity, dust, water vapor, and turbulence of the weather near the earth.

The use of light as a probable method of explaining the upper atmosphere was suggested some time ago by an English scientist, Dr. H. E. Synge. His plan was to assemble several hundred army and navy searchlights and to shine them all on one spot. The fingerprinted light rays developed by Dr. Tuve and his associates should make possible the securing of even greater volumes of information concerning the rare atmospheres above the earth.

Electricals to Hold Prize Paper Contest

The deadline on papers presented in the annual A. I. E. E. prize paper contest will be the second Monday of the spring quarter. Papers may be presented by any member of the local A. I. E. E. A list of subjects to write on may be had from Professor Kuhlman. The papers will not be confined to these subjects and students will be able to write on anything they may be interested in. Some graduate engineers in the Minnesota section have sent in problems that they have encountered, in the hope that some student will investigate the problem and supply them with additional information. The results of the investigations could be presented in some very interesting papers.

The student papers will compete for a total of $40 in cash prizes. The papers are to be presented in triplicate to the judges, who will select the four best papers. These papers will be read before a joint meeting of the Minnesota section and the student section by the authors. Members of the Minnesota section present at the meeting will vote for the best paper. Four prizes will be awarded instead of the usual one prize.

London Phone Call Part of Bell Lecture

Minneapolis talked to London February 22. The connection was made during the talk "Voices Across the Sea" given by Dr. J. O. Perrine, Editor of the Bell System of Technical Journals, at the 14th annual convention of the Minnesota Federation of Architectural and Engineering Societies held at the Nicollet Hotel, to demonstrate the improvements that have been made in trans-atlantic wire communication.

In order that the audience might receive the full benefit of the demonstration, loud speakers were installed that amplified the conversations from both ends of the wire. Dr. Lind, head of the Institute of Technology, participated in the fifteen minute conversation with a London representative of the company.

"The messages were very clear," said Dr. Lind, "and could be very favorably compared with telephone conversations held within the city."

The present rate for telephone communication with London is $11 per minute before 5 p. m. C. S. T. and $8 per minute after 5 p. m. with a minimum time limit of three minutes.

New Hydraulic Lab is in Final Plans---Construction Will Start

Final revised plans for the University's new hydraulics laboratory on the Mississippi river are now on the drafting board. Actual work on the project, to be located on Hennepin island, will begin within the month.

Under the direction of Lorenz Straub, professor of hydraulics, ground breaking and preliminary soundings on the site will be made shortly. The first structure will be a 250 by 60 foot one story concrete building; others will be added when funds are available.

The present project will cost $95,000, $80,000 of which will be provided by WPA. An important feature of the laboratory will be a 6 foot testing flume, 8 feet wide, which will run the entire length of the laboratory. Water will flow by gravity from above to below St. Anthony falls, a drop of 48 feet.

Natural features in placing the laboratory below the falls will permit a better study of hydraulic flow, without the trouble of pumping. Water will be diverted through the laboratory at the rate of from 50 to 300 cubic feet per second, and will make its exit into two large measuring tanks.

An existing penstock of the old city pumping station, formerly located on the site, will be used as a turbine testing apparatus.

It is Mr. Straub's conviction that the new laboratory will provide University students with the most complete and ideally located research plant in the country, that it will be a long step from the present inadequate facilities, consisting of miniature "glass rivers."

Turner Seeks Plans Here for New Racer

Colonel Roscoe Turner, former holder of the transcontinental speed record and winner of the Bendix and Thompson trophies of 1934, paid a one-day visit to John D. Ackerman, head of the aeronautical department, on February 25, to discuss plans for a new type of plane.

The aeronautical department, under the direction of Ackerman, has previously supplied Colonel Turner with designs. Turner visited the University once before, in June, 1934. He will return again when plans for the new plane are completed.

Dean Leland Honored at Alumni Banquet

A dinner in honor of Dean O. M. Leland was held at Washington, D. C., by a group of Minnesota engineering alumni on Wednesday evening, January 22. Those present included C. M. Jansky, Jr., of the firm Jansky & Bailey, formerly Professor of Radio Engineering at Minnesota; from the U. S. Patent Office, Messrs. Nathan A. Conn, '06 E.E.; Karl J. Albrecht, '25 E.E.; J. Edwin Coates, '27 M.E.; Gordon Reed, '29 M.E.; E. B. Saxhaug, '29 E.E.; Otto B. Roepke, '06 E.E.; E. S. Dybvig, '29 E.E.; A. E. Lyden, '29 Ch.E.; I. L. Wolk, '29 Ch.; M. A. Juten, '32 M.E.; Alfred S. Trask, '23 E.E.; from the U. S. Bureau of Standards, Messrs. Robert Darnielle, '35 E.E.; Sam Levy, '33 E.E.; B. M. Axilrod, '33 E.E.; from the U. S. Bureau of Public Roads, Mr. O. K. Normann, '28 C.E.; from the Carnegie Institution, Messrs. L. V. Beckner, '27 E.E.; L. R. Hafstad, '26 E.E.

Committees Study Plans of New Institute for Set-Up in Fall

The Institute of Technology, organized last fall, will go into effect as a unit next fall. The committees appointed January 16 have been working on the plans of the Institute, and presented their recommendations to the first general faculty meeting held on Tuesday, January 25.

Among the recommendations were arrangements for facilitating entrance registration in the fall by extending the period to two weeks. The beginning students will be given more individual attention in selecting their courses.

Continuation courses will be graded at the end of the year and registration for such courses need not be repeated after the fall quarter. Changes in courses may be made without petitions, merely requiring the permission of the instructors and the head of the department under which the course falls. Students ranking in the upper 60 per cent of their high school class will be admitted without further entrance requirements. Higher algebra, solid geometry, and chemistry will not be considered necessary high school courses for entrance, but as a foundation for study in the Institute the student is urged to take them. Arrangements will be made for taking these subjects without credit in the Institute of Technology.

A committee is working on a plan whereby a first year course common to all schools within the Institute may be established. If this is accomplished new students will not have to decide which school to enter until their second year.

The faculty of the School of Mines and Metallurgy met Wednesday, March 4, and completed organization of that part of the Institute of Technology.

Dr. Lind left last week on a tour of 12 major universities seeking new faculty members for the institute. Both Dean Appleby and Professor Christianson are leaving at the end of this year. Their posts and others must be filled.

A. M. A. Hears Talk On Plant Problems

The Student Branch of the American Management Association held its second dinner meeting of the quarter Thursday, February 27, at the Sigma Phi Epsilon house. Louis J. Giefer, assistant superintendent of the Seeger Refrigerator Company of St. Paul, was the guest speaker.

Mr. Giefer gave an enlightening talk detailing the manufacturing problems and their solutions his company encounters in aligning raw materials, production in the plant, and, finally, the distribution of the refrigerators.

A. I. E. E. Inspects Western Union Co.

"What happens to a telegram after it is taken by the telegraph company?" None of the local members of the American Institute of Electrical Engineers could answer this question completely, so early in February the group braved the cold weather and visited the Minneapolis Western Union Telegraph station to find the answer to the question. Employes of the station escorted the electricals through the plant and explained the apparatus to them, including automatic sending and receiving instruments.

Pictures of the 1935 gopher football team were shown at the student meeting, February 26. After the pictures, O. Morzenti presented a student paper. This was the first paper to be presented at the student meetings this year. A short discussion was held concerning the prize paper contest, followed by cider and "sinkers" before the meeting broke up.

An inspection trip will be held either the last week of this quarter or the first week of the spring quarter.

University Fashions---

By Bob Dixon

TEMPERATURES above freezing and window displays of clothiers remind us that college men will soon be appearing in the latest spring fashions. Consequently, we would like to take a few inches of space to jot down our observations as to spring styles.

The general trend in men's clothes for spring is toward plainer clothes, more color, and bolder figures. The double breasted drape coat, either with the lapel rolled to the lower button or with the top button buttoned, is steadily increasing in popularity. Another coat which is coming into its own is the single breasted jacket with gusset sleeves and two side vents. Checks continue to be prominent with shadow and hound's tooth among the most prominent. The most recent pattern, and one of the best, is the Glen Urquhart plaid which is expected to be very well received by college men. The single breasted belted jacket, full in back, and having notched lapels and patch pockets will be "tops" for sports wear.

Topcoat fashions have changed but little this season. The topcoat will have a shorter skirt and will be fuller. Raglan sleeves are still preferred.

Shirts with button-down collars will continue to be first choice with the university man, although the soft widespread and the new slotted collar will advance in popularity. The latter is the newest creation in collars. The tie, slipping between the whalebone stay and collar, holds the latter down, giving an appearance of neatness and comfort that is sure to find favor with men. Again color plays an important rôle with colored checks and stripes.

Ties for spring will be brightly colored with checks, stripes, and overplaids. Buck shoes, having established themselves last fall, will be seen again this spring in white, brown, green, and blue. Snap brim hats with a welt edge, in shades of green, brown, and dark blue, complete the ensemble.

Technical Journalism . . .

(Continued from Page 115)

you learn fast, have a habit of making good at everything you tackle, and have, in general, a lot on the ball. And, in particular, try to think of some definite way in which you can save him time and trouble and help him make more money. Don't misunderstand me. I'm not suggesting that you play the smart Aleck, but merely that you display a manly self-confidence.

Every job application is a piece of salesmanship and should have preparation in proportion to the importance of the contact. If you get an appointment with a key man on a job you really like, train for it as you would train for a championship boxing bout. Study his outfit—his product, catalogs, or maybe magazines—figure out some definite way you could fit into the picture. Then build up your own morale with a good, long sleep, a haircut, a shine, a new tie (quiet, but somewhat more costly than you would ordinarily buy). Keep treating yourself in this kingly fashion until you are convinced that you are the sort of person that goes places. Then make your call with a veneer of deference, but not so thick that the prospect can't see your own belief in yourself shining through it. I speak with some confidence in this matter because I have tried it in getting jobs, and it works.

Without being more specific, I will say that the company I was with, as an engineering salesman, folded up back in 1921, and I went to New York in the minor depression of that year, perfectly confident that I could land a satisfactory job in the big and strange city. At the end of a single week I held options on three satisfactory jobs, using the technique I have outlined. The chance to go on POWER as assistant editor seemed the most promising of the three, so I took it and have never regretted the step.

Since then I have not wandered farther, because editorial work proved uniquely interesting—a job of infinite variety, utilizing everything I had learned in my life, from the elements of thermodynamics to selling heat insulation to an oil refinery, from the Greek alphabet to running an engine lathe. In fact, it took a whole lot of things that I had never learned, so that I have been forced, during the past 15 years, to study as hard as I ever did in school.

That's more than enough of the personal stuff, so let's have something about business journalism, a term that includes all periodicals devoted to the vocational needs of the reader, whether he be an engineer, a business man, or what not. The successful editor of such a publication must run a three-ring circus. He must have at least three professions. First, he must know the field and its men. He must contact them constantly to discover their practical needs and to gather the material to supply it. He must learn how to talk their own language in his paper.

Then he must be an "editor" in the narrower sense of the word, a man who knows the showmanship of paper, type, ink, photographs, and drawings—of writing, layout, and news. Finally, to go far, he must become a publisher, a man who understands the relations of editorial, advertising, and circulation, who can evaluate their inter-actions and balance the cost of projected changes against their effect on the net profit of the enterprise.

However you may define success, you will need for it these things: salesmanship, fearlessness, and probably also industry and competence. If you desire great power or wealth, you may find it necessary to add ruthlessness (this is a price too few have been unwilling to pay).

If you can be happy with moderate power and earnings, but require interesting and creative work for your picture of success, add these:

1. Be an expert in something, but don't be a narrow specialist. Learn something about everything that touches your job, even remotely.
2. Have hobbies.
3. Keep in good physical and mental trim.
4. Learn to write, to speak, and to do many things with your hands.
5. Seek richness and breadth in life. Don't get stuck in a narrow mental niche.

I have just turned 46, and have apparently reached the age when one exhibits the first faint traces of senility by giving advice to "young men." In self-defense, I should explain that this need not imply any feeling of superior endowment. The facts in this case could not justify any such feeling. This is merely my attempt to describe and evaluate some of the psychological and business scenery I have looked at for the benefit of those of you who may be passing that way ten years hence.

When Firemen . . .

(Continued from Page 118)

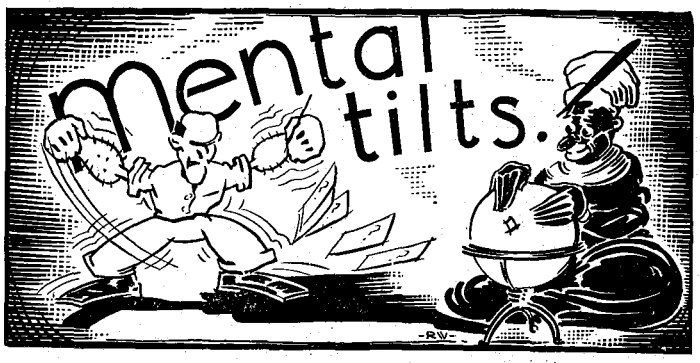
ardous exercise as the ancient fire fighting called for. It recalls the query often made today: Machines and fire engines have improved tremendously, but have men?

An English traveler in this country in 1854 gives a poem written by a member of a Philadelphia fire company, and much enjoyed by his comrades. Besides being distinguished by numbers the old fire companies were even more distinguished by nicknames, as the poem indicates. The Hyenas seem to have been a bit quarrelsome.

"We're the saucy Hyena boys of George's street, as all knows;
We can whip the Penn and Globe, likewise the Carroll Hose;
We'll whip the three together, the Bed-bugs and South Penn thrown in for ease;
We do run our carriage among our foes, and run her where we please.

You'd better hush your blowing, Globe, if you know when you are well;
For if we take your engine again we'll smash her all to hell;
Here is luck to the Bluffers, and all honest boys of that name;
Here is to the Hyenas and Red-devils, that no one can tame."

This chant is about all that remains of the Hyenas, Penns, Globes, Bed-bugs, Bluffers and Red-devils. It is easy to see that a man who wrote poetry like that wouldn't be afraid of anything.



SINCE this column got rather few replies to its rather easy problems of last month, we're taking a new tack this issue by presenting the solution to one or two problems, or at least starts on them.

First the answers to last month's teasers: The scale read 5 pounds before and after, since the bird was buoyed up by the air, whether within or without the cage; the sailboard can travel faster than the wind by taking advantage of the water's reacting component.

For the quickest, most elegant, and correct solution of the following problems the usual one dollar prize will be awarded.

During the dark ages in China, cities had to be well fortified. One city had been built in a circular outline with a wall 62.832 miles long surrounding it. There were four gates located at north, east, south and west positions. Five miles north of the north gate there was a watch tower. A foot traveler set out from the south gate in an easterly direction, trying to escape the city. How far from the city was he when he entered the range of the watch tower? The towerman could not see over the wall.

* * *

This one takes a little more than scientific acumen. Evaluate the continuous radical:

$$\sqrt{23+\sqrt{23+\sqrt{23}}}\ \text{ad infinitum} = ?$$

* * *

Keeping in touch with modern economics, we have a little farm problem. There are three farmer couples. The wives we may call Mary, Priscilla, and Katherine; their spouses we may refer to as Tom, Joe, and Charles, but not respectively. The men and wives shop in the egg market, buying cartons of eggs, and in such a manner that each man spends 63 cents more than his wife. Further each individual pays as many cents per carton as cartons he or she buys. At the conclusion of the purchasing period it is found that Mary has bought 19 more cartons than Joe, while Tom has 23 more than Priscilla. The answer to be supplied is who is married to whom?

We'll give you a start, and no guesses. Let w and h with appropriate subscripts stand for the cartons purchased by one wife and her husband. Set up three equations for the purchases. Remember that there are whole numbers involved.

* * *

Some of the following problems you probably don't feel like working out completely, they won't count in the contest, but just try your algebra or trig on them. Set up the equations, or should we admit that the way to solve these teasers is by such "materialistic" methods?

Given four numeral *4s*. Using all for each solution, with the alternative of using each or any, either as 4 or .4, derive the numbers from 1 to 21 by any combination involving addition, subtraction, multiplication, or division. For example: 4 plus 4 divided by the quantity .4 plus .4 is equal to 10. You find the rest.

* * *

In ancient times it was customary to have a moat around a castle to protect it from robbers and invaders. A man once had a square moat twenty feet wide surrounding his castle. The common way of getting into his castle from the road was to cross a drawbridge. One day the drawbridge failed to work and the man found the only means of reaching the inside of his castle was by the aid of two planks, one 19 feet long and the other 19½ feet long. He could not splice or nail the planks together. How did he arrange them so as to span the moat and allow himself to enter his castle? Yes, it's easy, but did you get the others?

* * *

Tony, the banana man, was just starting out on his day's work when a curious school boy accosted him asking how many bananas he had. Tony, thinking little boys should be seen and not heard, thought he could shut him up with this answer. He said that if he divided the number up into twos, three, fours, fives, and sixes he would always have one left over. But that if he divided them by seven he would come out even. That night the boy met Tony again and told him how many bananas he had started out with that morning. How did he do it?

We wouldn't be at all surprised if the reason the song "'Twas a Sunny Day in May" led the field for the Jaybee's number one song in the balloting was that the civil's liking for the song prompted them to make a few ex officio trips to the P. O. with ballots. The senior civils, by the way, lay claim to the distinction of being the number one bad boys in this here institution, their most recent trouble being the almost impossible task of keeping the doors and windows of their room fully equipped with glass. Dean Leland, however, has an excellent remedy for this.

News of engineering romances has it that Co-captain Ted Mitchell is still ace man with Marjorie Butts. . . . Ridge Baker, also of hockey fame, finds the distance to Chicago and a certain Minneapolis girl a distinct handicap . . . Earle Olson would like to see more of Sylvia Nelson, the charming Chi Omega lass . . . Howard "Reinforced Concrete" Schleiter and Jean Herschler are a constant ratio . . . There also seems to be something to the Ray Day, Natalie Karuch combination . . . A certain young lady is the reason for Bob Neuman's regular calls at Dean Nicholson's office . . . We can't account for the reason Tom Hay had a manicure just after he received his R.O.T.C. promotion, but we have an idea that a young lady was at the bottom of it.

It seems that in the course of the quarter's intramural swimming competition the Delta Tau Deltas were supposed to swim against a neighboring house on a certain night in the new intramural pool, and Arnold Lahti was the only member of his team who showed up the night of the supposed contest. The other team was anxiously awaiting the arrival of the rest of their opponents, with the hands of the clock creeping towards the minute when a forfeit would be chalked against the absent team. **Suddenly** Lahti threw off his bathrobe with the declaration that he would swim all events for his still absent teammates. So there he stood, poised on the edge of the pool with his opponent; the starter raised his gun, his finger tightening around the trigger that would send D.T.D.'s determined star on his way to glory for the old fraternity. **The** shot was never heard, for looking up and following the gaze of the starter, Lahti was surprised to see a group of eight men sauntering through the door of the pool room clad only in their swimming apparatus. It was the missing team and they were not Delts—Lahti had arrived one night too soon.

One of the best stories of the summer, we think, is the one about the missing barber pole that turned up mysteriously at the Civil's surveying camp under somewhat embarrassing circumstances to certain individuals. We wonder if the "B"s and "D"s weren't missprints. And then there is the little incident which happened at the triangle house the other night. It seems that they received an urgent request, via the telephone from the druggist across the street, to shut off their water heater as the druggist wanted to make a soda and all that he could get from the faucet was steam. What happened was that one of the preoccupied engineers in his rush to be on his way had forgotten to turn off the water heater and as a consequence the steam found its way across the street through the water pipe. We suppose that Mr. Torrens, the druggist, had a special that day on steamheated sodas.

All the commotion and free candy the other day was due to the engagement announcements of Margaret Buckley and Phyllis Bjornekamp, both from our ever-loving office force. We were as surprised to hear that Archie Stone and Marcella Clark had gone and gotten married as we imagine Mr. Putnam was when his little son Lucius said, "Well, you see Dad, I've been a married man for a year now." Speaking of marriages we must mention Leon Hamlet and Charlotte Granger, who have just finished middle-aisling it, as well as Dot Simon, the girl from Milwaukee, and Ken Sperry. We wonder when Doug Kuehn is going to add another ring to the one already on Audrey Olson's finger.

Incidentally vague rumors have been drifting in from the backwoods regarding some means of retaliation.

Scandal: A certain group of electrical engineers claim to be aware of the cause for the recent discomfiture of one Bob Auten, when they made a discovery among his personal belongings in his locker. **Bob** claims that he was framed, but in order to clear himself he will have to explain to us the reason for his actions when the evidence was presented.

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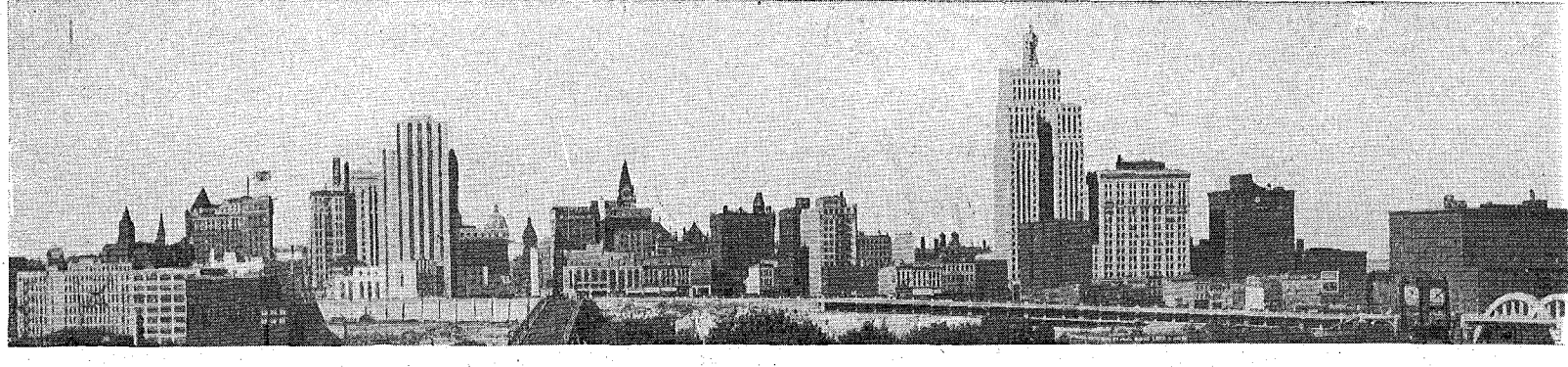

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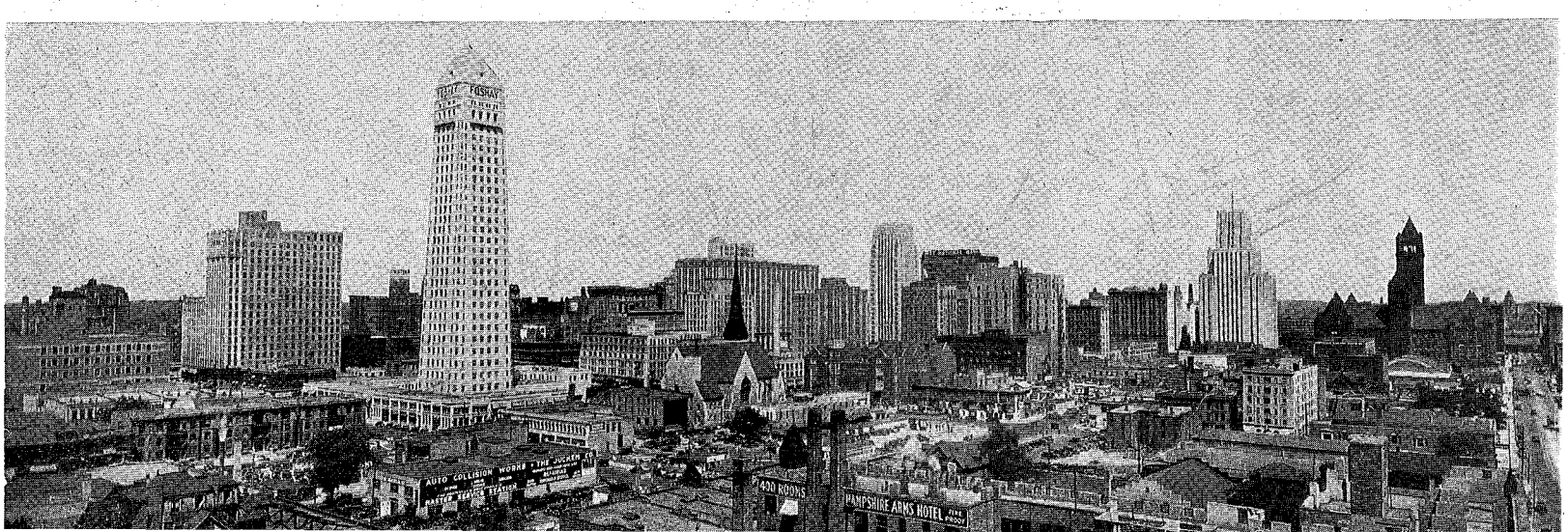
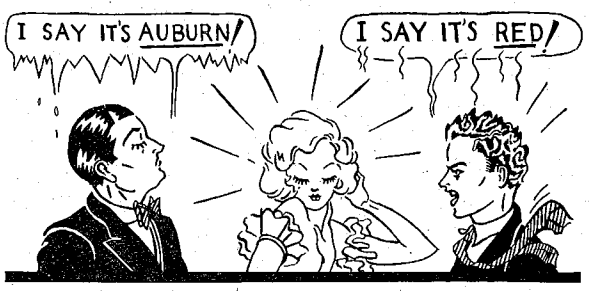


G-E *Campus News*



LET SCIENCE ARBITRATE

In heated arguments of this kind, the color analyzer is the court of last resort. Recording photoelectric spectrophotometer is the official name of this device, which was recently exhibited at a scientific meeting at St. Louis. It recognizes an infinite variety of hues and shades; it distinguishes differences in color too slight for human eyes to detect; it automatically records the exact color prescription.

The spectrophotometer is proving especially useful for standardizing the color specifications of inks, dyes, paints, paper, and textiles. It makes obsolete such vague descriptive names as blue-black, blue-white, and yellow-green, and substitutes carefully drawn graphs extending over the whole visible spectrum. The operation of the device, which is automatic, depends upon an ingenious combination of a phototube and thyratron tubes with a precise optical system.

The previous method of making exact color measurements required hundreds of tiresome readings and consumed most of a day. The recording spectrophotometer produces a curve of comparable accuracy in three minutes.

DIG HERE

In the old days, a mysterious individual, called a dowser, with a forked devining rod of witch hazel, used to be called in to locate lost articles buried in the earth. A new magnetic detector, recently developed in the General Engineering Laboratory of the General Electric Company, is now substituting science for magic and hocus-pocus. With uncanny accuracy, it is tracking down lost pipe lines.

Water and gas pipes are often lost because old surveys are inaccurate or because records have been destroyed. Digging up a whole street, in order to find a missing pipe line, is expensive business. The new detector has solved this problem by successfully locating pipes laid 40 years ago—pipes buried as much as seven feet below the surface. In one case, pipes were found fully 100 feet from their supposed location, and the detector spotted them within one diameter of the pipe.

NEW LIGHT ON THE MIDDLE AGES

Medieval ecclesiastics would cry "Witchcraft!" could they see the cathedral at Burgos, Spain, tonight. Carefully wrought details of architecture and ornamental carving, never before clearly seen in all their seven hundred years, now stand forth in bold relief. The thirteenth-century Gothic structure glows, for two hours each night, in the light of a battery of modern General Electric floodlights.

Burgos was, for centuries, the capital of Old Castile, the kingdom of that Queen Isabella who offered to pawn her jewels to finance Columbus' momentous voyage to America. Now, after 444 years, American lighting equipment returns to add luster to what was one of the most important of Isabella's possessions.

96-237DH

GENERAL ELECTRIC

THE QUEEN
Faith Anderson

ST. PAT
John Hanson

MINNESOTA TECHNO-LOG

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Engineers' Day Issue

April
1936

APRIL 17

ENGINEERS DAY

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ST. PAUL HOTEL

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LEROY ELLICKSON'S BAND

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MINNESOTA Techno-Log

37 ELECTRICAL BUILDING

UNIVERSITY OF MINNESOTA, MINNEAPOLIS

APRIL, 1936

WAYNE STONE
MANAGING EDITOR

ROBERT DIXON
BUSINESS MANAGER

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VOLUME XVI NUMBER 7

	Page
HISTORY	135
EDITORIAL	137
PROGRAM	144
SLIPSTIX	152
CAMPUS NEWS	154
UNIVERSITY FASHIONS	155
STRAY SCRAPS	156
MENTAL TILTS	158

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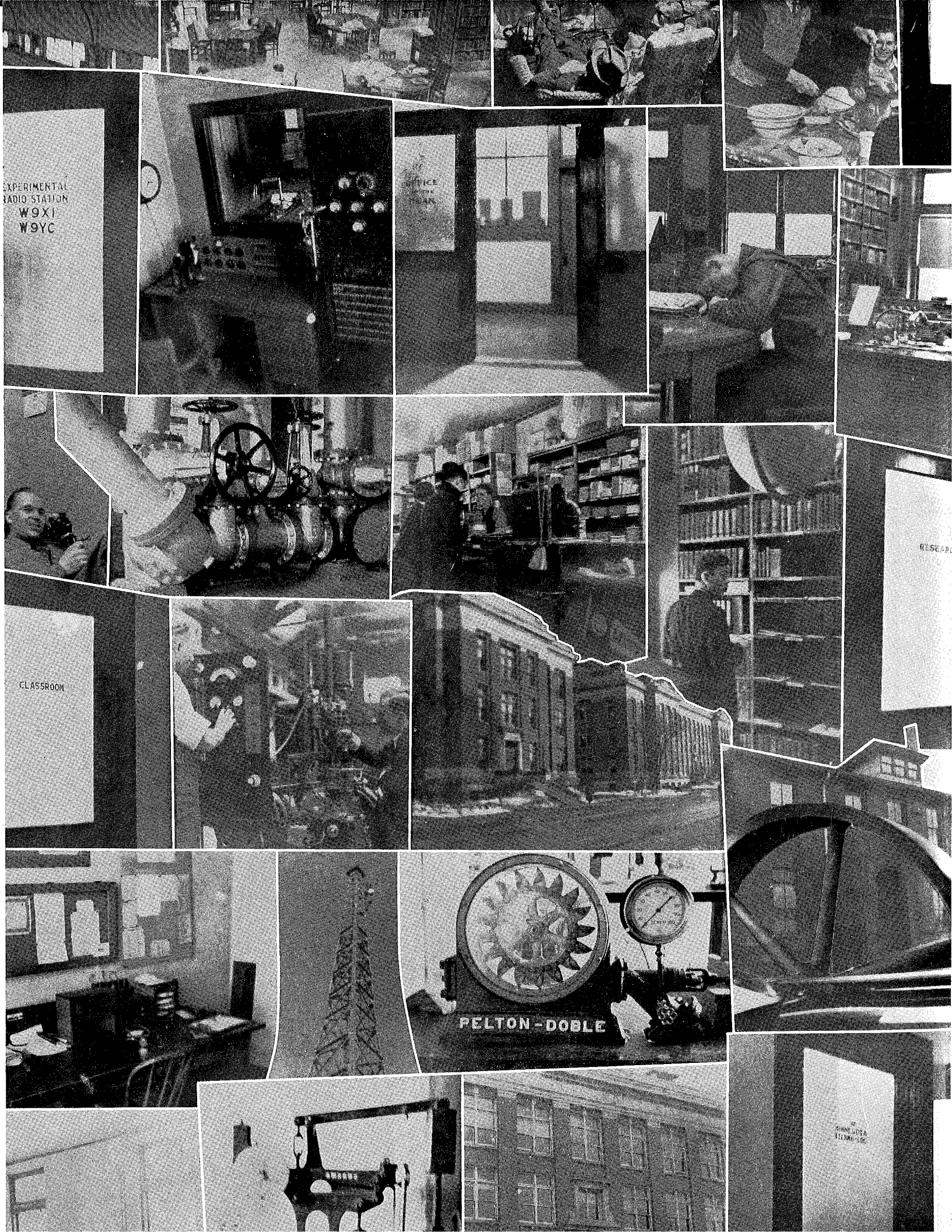
EXPERIMENTAL
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43 years of Technical Journalism at Minnesota

THIS year the TECHNO-LOG is forty-three years old. Forty-three classes of this engineering school have read the TECHNO-LOG in the various forms it has assumed since it first appeared as the "Yearbook of the Society of Engineers." The Society of Engineers had long been an active organization in what was then the College of Engineering, Metallurgy, and the Mechanic Arts. In 1893 it was decided to publish a year book. This year book, which was the first of its kind in connection with the engineering college, was in charge of an editorial committee representing the departments of civil, mechanical, and electrical engineering, mining, and architecture. The volume was essentially technical in scope and consisted entirely of articles contributed by students, graduates, and faculty members in the various scientific departments of the university. Henry B. Avery, M.E. '93, as managing editor, headed the editorial committee in charge of the 1893 edition, and John W. Erf, C.E. '93, was the business manager.

During the fifteen years that followed, the society underwent a gradual expansion until the one hundred twenty-two page yearly publication became inadequate for its needs. In November, 1908, the name was changed to the "Minnesota Engineer" and the magazine appeared on the campus as a quarterly. For the year 1908-09, George M. Shepard, C.E. '09, was chosen editor-in-chief, and Rollo J. Cobarr, E.E. '09, was made business manager.

An editorial by Mr. Shepard in the first issue after the reorganization set forth the aims and policies as follows: "The object of this publication is threefold: first, to be the official organ of the Engineers' Society; second, to be a means of presenting to the public technical articles by alumni, students, and others; and third, to contain current and alumni news."

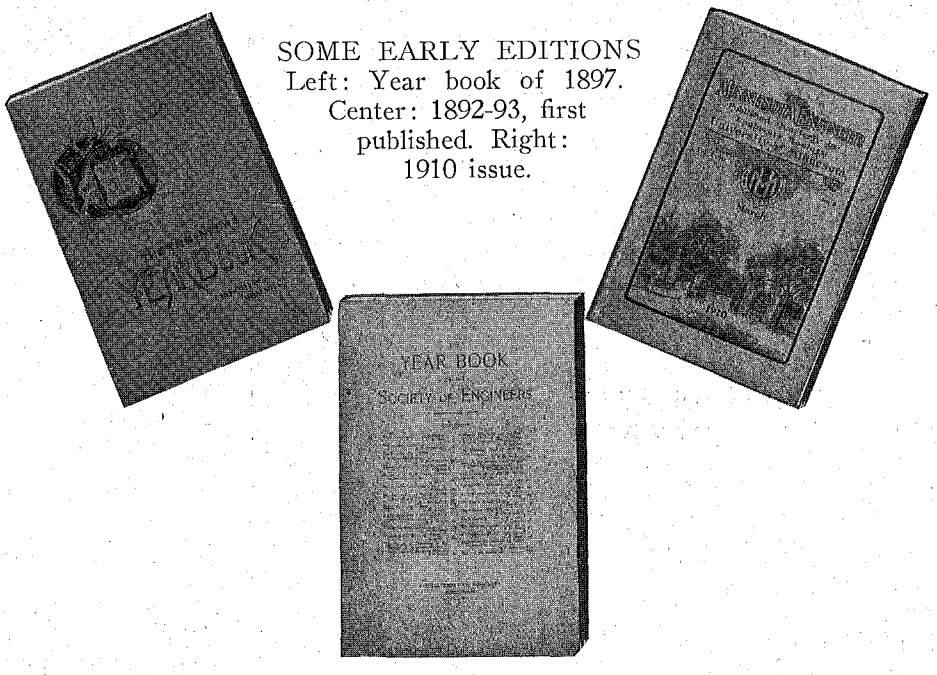
An advisory board composed of Professors Constant, Flather, and Shepardson was formed. Frederick S. Jones, who was at that time dean of the College of Engineering, was named to head the committee. This board, under the leadership of Dean Jones and later of Dean Shenehon, functioned until publication of the "Engineer" was suspended in December, 1915.

During the following six years there was no publication and not a great deal of activity on the technical campus, but in November, 1920, the Association of Engineering Students, a reorganization of the old Society of Engineers, decided to re-establish a magazine in the technical colleges.

As the result of this decision, Martin F. Wichman and O. F. Beeman were chosen managing editor and business manager of the new monthly, which was to be called the MINNESOTA TECHNO-LOG.

A small room on the fourth floor of the Main Engineering building, scarcely more than a "cubby hole," was transformed by virtue of two desks, a plain table, some chairs, a typewriter, and several energetic engineers to the publication office of the MINNESOTA TECHNO-LOG.

Constant changes in the membership of the staff became the rule for the first few issues, and in January, 1921, Carlos W. del Plaine, C.E. '21, succeeded Mr. Wichman as managing editor. As the staff became more thorough-



SOME EARLY EDITIONS
Left: Year book of 1897. Center: 1892-93, first published. Right: 1910 issue.

ly organized, more articles were printed, illustrations became more frequent, and a humor column was added.

The following paragraph taken from an editorial that appeared in the November issue of 1921, of which A. E. Horstkotte, C.E. '21, was managing editor, gives somewhat of an idea of the success with which Mr. del Plaine's efforts of the preceding year met: "When the pressure of other duties made it impossible for Wichman to continue actively as managing editor, that position was filled by Carlos W. del Plaine. Though already a busy man, del Plaine took time to adopt the TECHNO-LOG for his 'hobby,' as he calls it, and under his direction its existence was justified. Each succeeding issue brought favorable comment from the publications of other schools, particularly engineering institutions. Under del Plaine's management, the business and advertising departments were put on a substantial basis."

One of the important episodes in the history of the TECHNO-LOG took place in April, 1922, when L. M. Bergford was managing editor, and Otto Person was business manager and the TECHNO-LOG became a member of the Engineering College Magazines, Associated.

The E.C.M.A. is an association of technical magazines published in the various engineering colleges of the United States. It was formed in 1920 as a means of gaining adequate representation for the widely scattered college publications in soliciting national advertising and to improve the quality of the member magazines.

Prior to actual membership in the Engineering College Magazines Associated, the TECHNO-LOG adopted several of the association's standards of practice, including the seven by ten inch page size, which has since become the standard size for nearly all college periodicals.

Clarence W. Teal, E.E. '24, managing editor, and Philip W. Richardson, E.E. '25, business manager, made an innovation in TECHNO-LOG procedure when they published the edition of June, 1924, in which the regular alumni column was extended to form a directory of all the alumni of the College of Engineering and Architecture, the School of Chemistry, and the School of Mines. This alumni edition established a precedent which was followed with increasing favor until the last regular alumni edition was published in June, 1932. A supplement was published in June, 1933, giving corrections and additions to the preceding issue. Because of poor business conditions an alumni edition has not been published since, but indications are that it will be resumed next year.

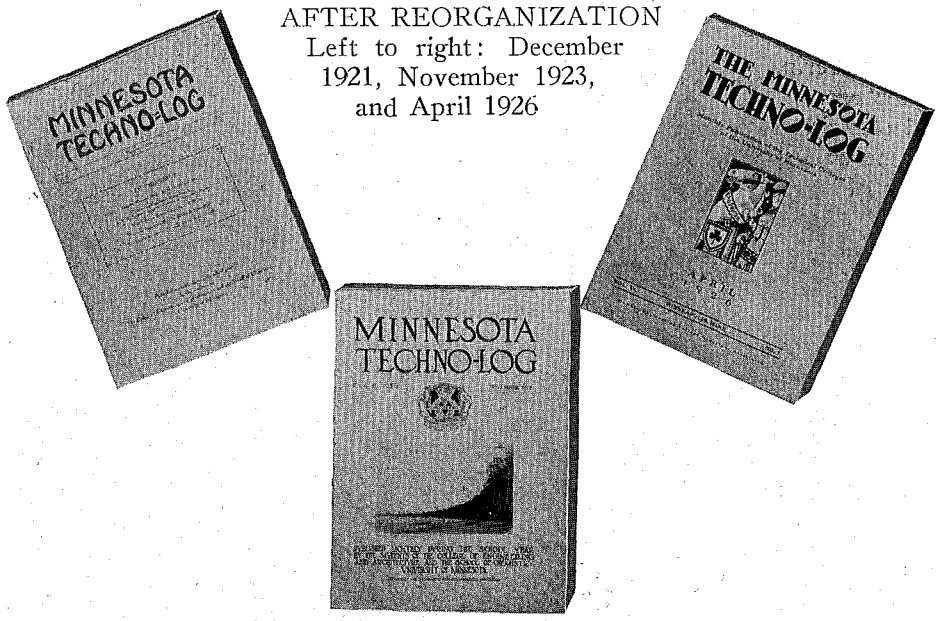
The third of October, 1924, was a memorable day in the life of the TECHNO-LOG, for on this day, as the result of the unceasing efforts of Albert W. Morse, who succeeded Mr. Teal as managing editor, the office was moved from the small, dark room on the top floor of the Main Engineering building to its present quarters—a large, well lighted room on the ground floor of the Electrical Engineering building.

Resigning the managing editorship in January, 1925, in order to take a position with the Minneapolis Civic and Commerce Association, Mr. Morse was succeeded by Kenefick Robertson and Herman F. Beseler as managing editors.

Under the editorial guidance of Paul B. Nelson, E.E. '26, a complete June issue was published in 1926, and in addition to this a forty-four page alumni directory was put out.

Immediately after coming into office in October, 1927, Lawrence A. Clousing, E.E. '28, and Carl E. Swanson, E.E. '28, set out on a campaign to put the magazine on a blanket subscription basis. After a year of work, during which the signatures of over ninety per cent of the engineering students were obtained as being in favor of the blanket tax, the Board of Regents granted the request, and the publication is still under this plan.

The engineering school was startled when the October, 1931, TECHNO-LOG, under the direction of managing editor George Taft, and business manager Steve Gadler, was issued. The magazine definitely heralded a trend toward modernity. Up until this time it had been strictly conservative in page makeup and art work.



AFTER REORGANIZATION
Left to right: December 1921, November 1923, and April 1926

The 1933-34 issue with Ralph Monson as managing editor and Gordon Rosholt as business manager made an excellent national rating, taking first place as the best all-around magazine in the E.C.M.A., first place for best cover design, and third place for best illustrated.

The 1934-35 issue under the guidance of Eugene Price and David Buck made another change in presenting a halftone picture on the cover.

From this brief history of the TECHNO-LOG it might seem that none others than managing editors and business managers had a hand in its growth and development. Of course this is not the case, but as the long list of those whose time and energy went into the making of past TECHNO-LOGS is far too great to reproduce here, let it be said that their work has been greatly appreciated in the past and will be more appreciated in the future.

The MINNESOTA Techno-Log

APRIL, 1936

Veterans of Future Engineers' Days

FOR many years mining engineers, and the rest of the engineers at Minnesota have been separated for apparently no substantial reasons.

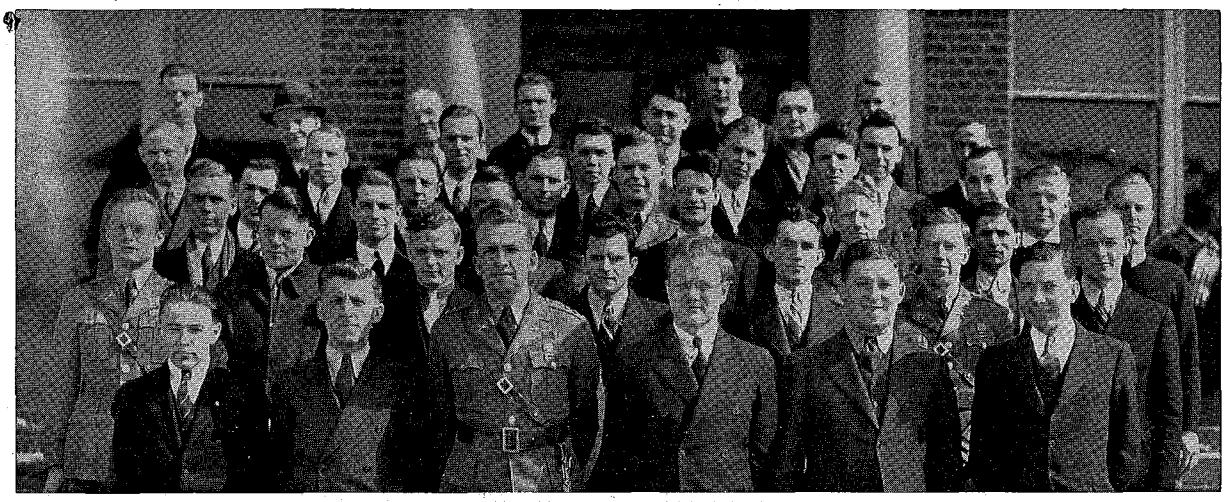
Engineers' Day has always been the occasion for both to do a little mild "egg-throwing" started usually in a vague spirit of tradition, and generally resulting in either a good fight, with resultant hard feelings, or merely the hard feelings. But today, resulting probably from comparisons with the silly antics of European countries, with their little "tiffs," leading up every time to one grand dog-fight, the two classes of engineers have been combined. Both factions can go out now and celebrate together, instead of the one watching out apprehensively for opposition, and the other, composed mostly of Freshmen, offering it.

So instead of having to start a "Veterans of Future Engineers' Day," we can pay off the old pensions, cancel all debts, and once more eliminate an unnecessary obstacle in the path of progress toward a saner, less sorry existence.

At the Desk

HARKING back to 1893, when the first issue of the Minnesota Engineers' Year Book appeared, the first and only article this month heralds the forerunner of the present day TECHNO-LOG.

Engineers' Day is always a "Green-letter" day for the magazine, and this year more so. This is the first issue in which all of the engineering organizations have their pictures, and probably the most pictorial for 43 years, or for many years to come. Circulation also reaches a new peak, as we hope readers' interest does likewise. It might be interesting to note Mental Tilts this month. They require quite a bit of reasoning, and you are advised against trying them the morning after the Brawl. Other innovations are evident, and we will be straining our ears for comments.

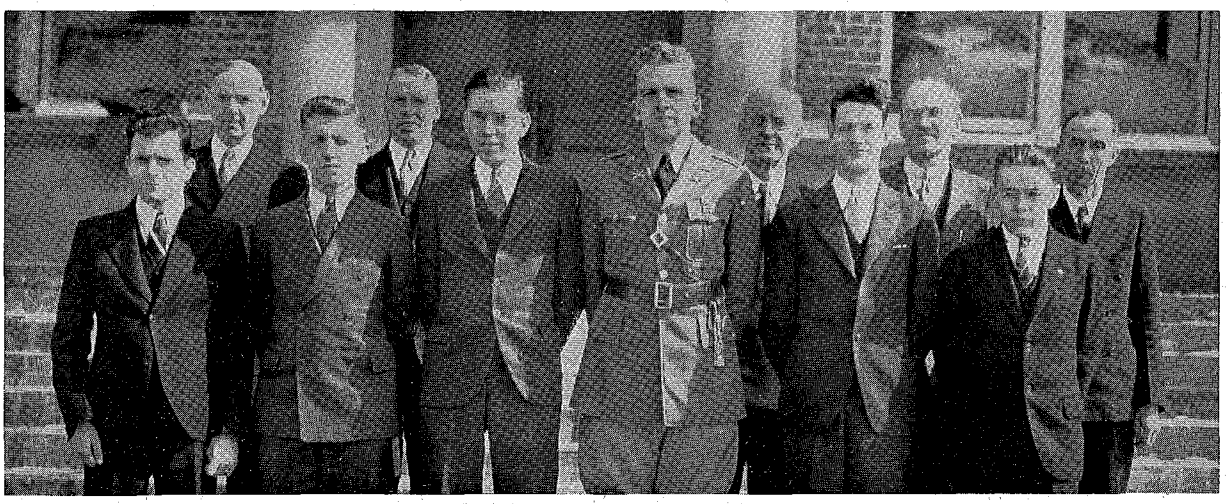


American Society of Mechanical Engineers

A.S.M.E.

Front row: V. Johnson, Mathies, Andeen, Stone, Miller, M. Olson. Second row: Aufterheide, McKay, Ronquist, LaJoy, Mitchell, Francis, Freidland. Third row: Solstad, Poucher, Sjostrom, Stevenson, Scott, Wieriman, Sturm. Fourth row: Cooper, Alinder, Swanson, Lindholm, Abbe, Anderson. Fourth row: DuPriest, Ryan, A. Johnson, Hopkins, Becker, Seel, Brown. Fifth row: Victorson, Martenis, Robertson, Merrill, Brockmeyer, Rowley. Sixth row: Swanson, E. Olson, Acker.

The officers of the A.S.M.E. are Wayne Stone, president; Malven Olson, vice-president; Lester Miller, secretary; Wallace Andeen, treasurer.

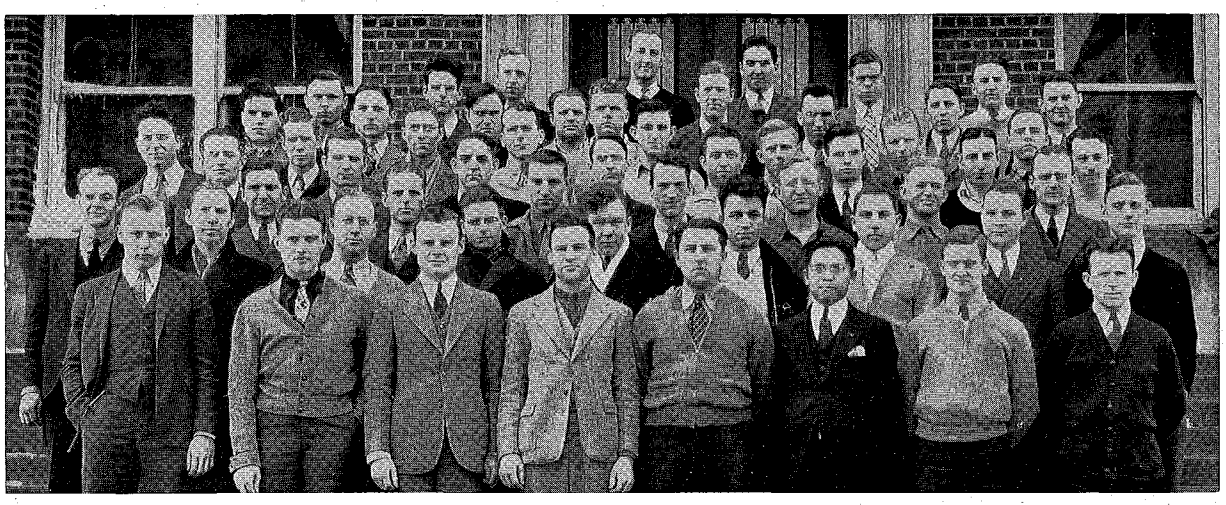


Front row: LaJoy, Mathies, Olson, Andeen, Stevenson, Johnson. Second row: Profs. DuPriest, Ryan, Martenis, Robertson, Rowley. Not present: Seidel, Bolstad, W. Hanson, Finger, Profs. Shoop, Wilcox, Koepke.

Pi Tau Sigma

Honorary Mechanical Engineering Fraternity

The officers of Pi Tau Sigma are Wallace Andeen, president; Millard LaJoy, vice-president; Dale Stevenson, recording secretary; Milo Bolstad, corresponding secretary; Malven Olson, treasurer.



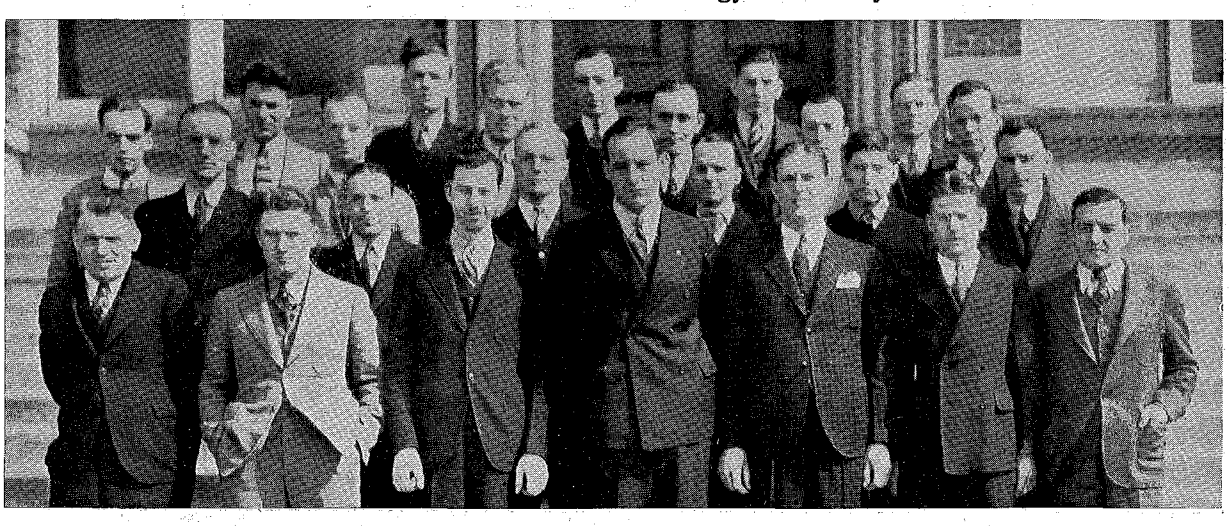
School of Mines Society

Front row: Gustafson, Eidam, Knickerbocker, Lacy, Wexler, Purificacion, Krumm, McCorquodale. 2nd row: Ranta, Helps, Larson, Sarja, Bickford, Linngren, Sward, Nicols. 3rd row: Sabin, Sampson, Larson, Turner, Rice, Collins, Ohnstad, Northfield. 4th row: Linsley, Brown, Jansen, Mather, Kurlonchick, Lynn, Stein, Payne. 5th row: Kaiser, Becker, Simmons, Lauderdale, Mayeron, Nelson, Lundstrom, Harrison. 6th row: Melvin, Johnson, Alkire, Johnson, Kortsan, Donner, Millunchick. 7th row: Baldwin, DuFour, Christensen, Tierney, Halton, Tucci. 8th row: Tenold, Mahle, Tenenbaum.

The officers of the School of Mines Society are John Tenold, president; Gilbert Northfield, vice-president; William Kaiser, secretary-treasurer.

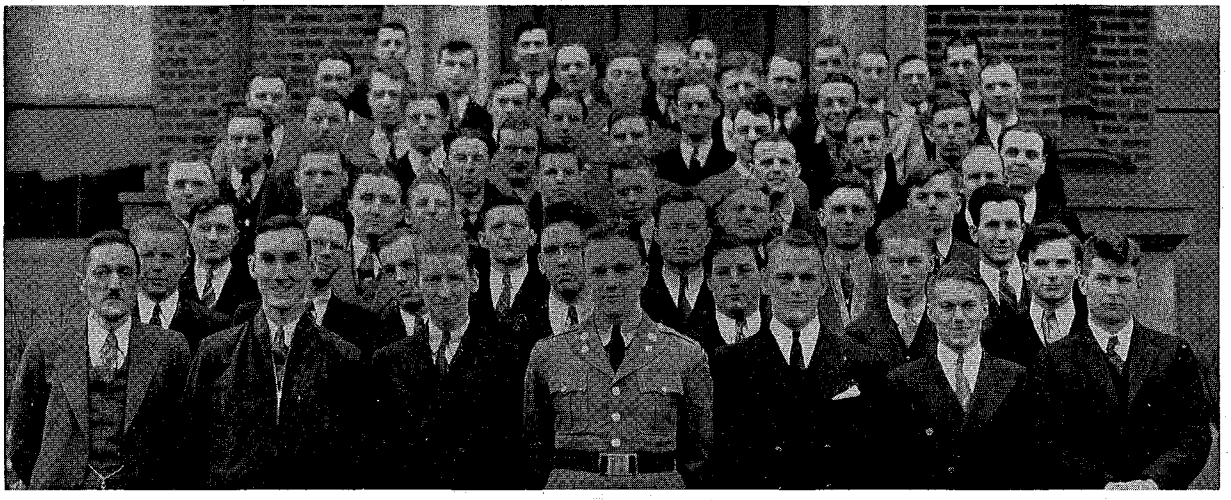
Sigma Gamma Epsilon

Professional Mines and Geology Fraternity



Front row: Wright, Hewitt, Brown, Kruger, Dreveskracht, McHugh, Alvarado. Second row: Frank, Goldich, Dennis, Ashley, Fontaine, Lindner. Third row: Giehart, Grogan, Bergquist, Sundeen, Lancaster, McCullough. Fourth row: Kaiser, Armstrong. Not present: Krumn, Berg, Dobrick, McConnell, Drs. Grout, Stauffer, Thiel, Profs. Pease, Searles, Sanderson.

The officers of Sigma Gamma Epsilon are Lloyd Dreveskracht, president; Fredrick Kruger, vice-president; Charles Brown, secretary-treas.



American Institute of Electrical Engineers

A.I.E.E.

Front row: Prof. Kuhlmann, Steinmetz, Brastad, Becklund, Dynesius, Laing, Savage. Second row: Olson, May, White, Strom, Jordan, Henrice, Morzenti. Third row: Leslie, Varhus, Robinson, Klima, Brierly, Goffstein. Fourth row: Oswald, Smith, Tema, Flohil, English, Lind, Kutscher, Haswell, Nielsen, Tangen.

The officers of the A.I.E.E. are William Brastad, president; Orville Becklund, vice-president; Charles Steinmetz, secretary-treasurer.

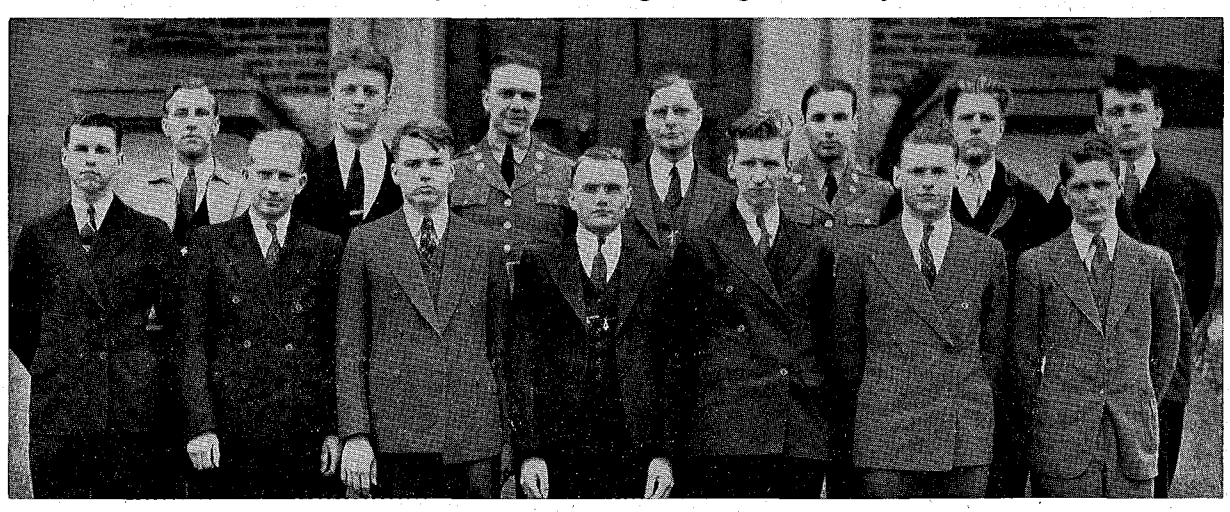
Fifth row: Hopper, West, Parker, Cartwright, Haight, Christof, Williams, Peterson, Lillygren, Stenderson. Sixth row: Hagen, Jacobs, Norton, Hendry, Stuart, Wentz, Hager, Tubbesing. Seventh row: Keranen, Longfellow, Goldstein, Kojola, McCurdy, Weber, Kammerer, Smoots. Eighth row: Shore, Mortick, Marhoun.

Front row: English, Kojola, Nielson, Oswald, Brastad, Smith, Loye. Second row: Weber, Wentz, Becklund, Johnson, Haight, Parker, Longfellow. Not present: Silliman, Burnetti, Specht, Newman, Profs. Bryant, Caverley, Hartig, Ryan.

The officers of Eta Kappa Nu are Albert Oswald, president; William Smith, vice-president; Russell Nielsen, recording secretary; William Brastad, corresponding secretary; John Wentz, treasurer.

Eta Kappa Nu

Honorary Electrical Engineering Fraternity



American Society of Civil Engineers

A.S.C.E.

Front row: McGee, Holm, Rollin, Klingel, Noyes, Springer, Schoell, Ryder. Second row: Merrell, Rhode, Kishel, Johnson, Cornell. Third row: Nystrom, Thorstenson, Phelps, Goettl, Anderson, Davidoff. Fourth row: Johnson, Redmond, Soderberg, Erkkila, Helland, Arksey, Kempe. Fifth row: Franzen, Giebenhain, Wolfe, Cutts, LaFountaine, Person.

The officers of the A.S.C.E. are Richard Springer, president; Thomas O'Loughlin, vice-president; William Schoell, secretary; Douglas Noyes, treasurer.

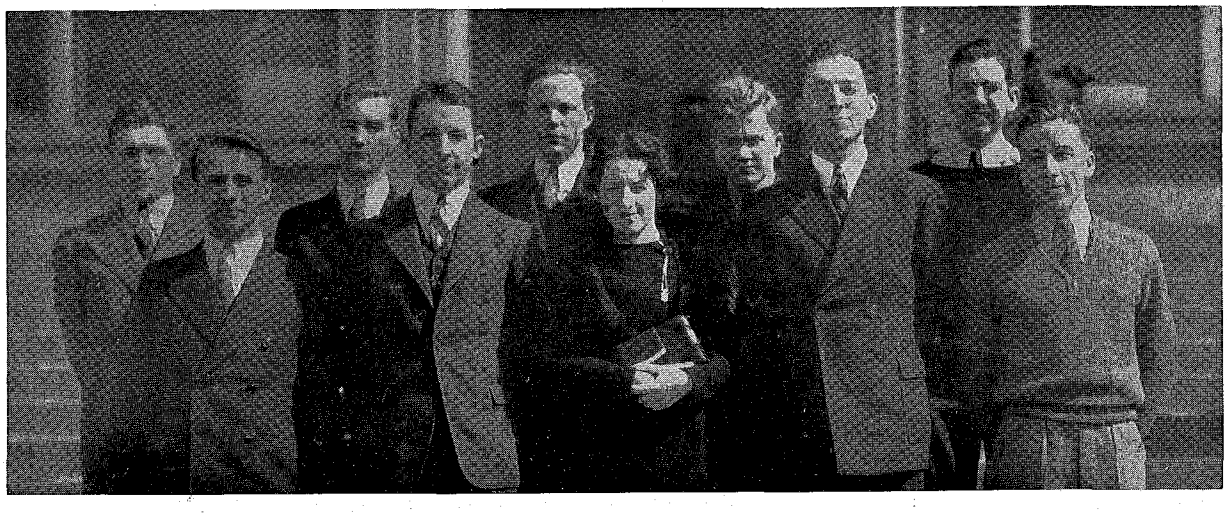
Front row: Kempe, Cutts, Watson, Schoell, Arksey. Back row: McGee, Frickland, Franzen, Peterson, Graves.

The officers of Chi Epsilon are William Schoell, president; Thomas Ruth, vice-president; Gene Cutts, secretary; Frank Kempe, treasurer.

Not present: Blake, Ruth, Dean Leland, Profs. Bass, Cutler, Parcel, Zelner.

Chi Epsilon

Honorary Civil Engineering Fraternity



Institute of Aeronautical Science

I. Ae. S.

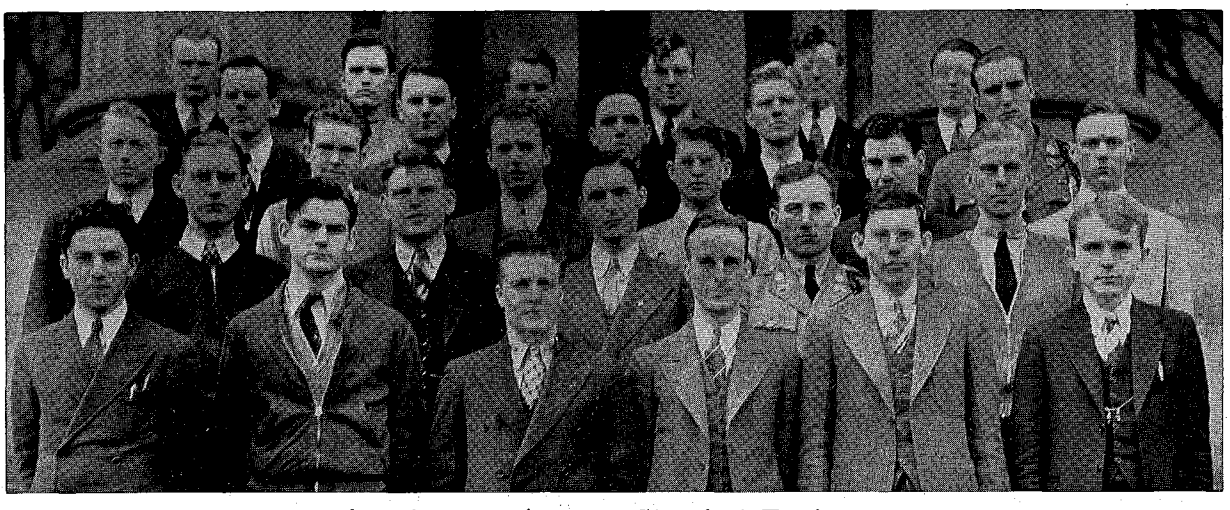
Front row: Wrenn. Second row: Lang, Starloff, Bennetsen, Intlekofer, Petry, Stuck, Feeney, Moore, Larsen. Third row: Johnson, Wodrich, T. Kerker, H. Baker, J. Baker, Burns, Luck, Flushman, Welles. Fourth row: Victoreen, Wilkes, Baseler, Sandgren, McElroy, Budish, Hellman, Gaskell. Fifth row: Johnson, Spoor, VonEschen, Oversee, Strom, Stewart, Carlson. Sixth row: Lessard, Merandi, McCarthy, Bush, Block, Lampland, Bednarek, Erickson. Seventh row: Brandt, Bodey, Echren, Anselmo, Weeks, Clark, Anderson. Eighth row: R. Kerker, Cadwell, Black, Driscoll.

The officers of the I.Ae.S. are Earl Bennetsen, president; John Stuck, vice-president; Vincent Victoreen, secretary; Gordon Strom, treasurer.

Flying Club

Front row: Thompson, Cameron, Fiegel, Lange, Bloomstrand, Hoffman, Driscoll, H. Barlow, R. Barlow. Second row: Feeney, Walsh, Hawes, Intlekofer, Wrenn, May, Nyquist, Barnhill, Kerker, Carhart, Akerman. Third row: Bird, Martin, Johnson, Onsgard, Gary, Bush, Lampland, Bennetsen, Salisbury.

The officers of the Flying Club are Albert Driscoll, president; Idamae Carhart, corresponding secretary. Bob Bush, Leland Fiegel, and Don Martin are executive vice-president, secretary, and treasurer, respectively, of the power section. The officers of the glider section are Harold Thompson, executive vice-president; Thomas Kerker, secretary; Marvin Walseth, treasurer.



American Institute of Chemical Engineers

A.I.Ch.E.

Front row: Root, Oace, Cottingham, Stinger, Chamberlain, Anthes. Second row: Kempf, W. Nelson, Mills, Kish, Ahlin. Third row: Wiest, Cutler, Markham, Bowman, Yaffe, Berg. Fourth row: West, Kleinman, Sedgwick, Meyers, Ellis. Fifth row: Dixon, Cain, Nelson, Mumm, Johnson, Prill.

The officers of the A.I.Ch.E. are Harry Cottingham, president; Robert Ellis, vice-president; Walter Cutler, corresponding secretary; Willard Stinger, recording secretary; Leslie Bernick, treasurer.

Front row: Prof. Schwantes, Anderson, Moore, Snyder, Dingle, Torrance, Rhane. Second row: McVeety, Baldwin, Peterson, Junnila, Finke, Schober.

The officers of the A.S.A.E. are Lee Baldwin, president; Max Finke, vice-president; Walter Peterson, secretary-treasurer.

A.S.A.E.

American Society of Agricultural Engineers

Architecture Open House

GERHARDT BRANDHORST, Chairman

Main Engineering Auditorium

Green Tea, 3:00 to 5:00 p. m.

Main Engineering, Third Floor

Water colors
Charcoal and pencil life drawings
Architectural design problems
Interior design problems
Murals

Electrical Open House

OTTILIO MORZENTI, Chairman

Electrical Building

High tension	Main lab.
Signal corps exhibit	Left lab. balcony
Electrical stunts	Main lab.
Oscilloscope	Third floor
Instrument display	Sophomore lab
Illumination display	
Commercial display	
Radio station WLB	Third floor

Chemistry Open House

HARRY COTTINGHAM and ELI BESSER, Co-chairmen

Chemistry Building

Physical chemistry	First floor
Inorganic chemistry	
Organic chemistry	
Industrial exhibits	
Chemi-luminescence	
Biochemistry	
Analytical chemistry	
Stunts	
Women's exhibit	
Bacteriology	
Photography	
Alpha Chi Sigma Play	Auditorium, 1–5 p.m. beginning each hour
Glassblowing demonstration	
Chemical engineering	Basement

Aeronautical Open House

HERBERT HOFFMAN, Chairman

Armory

Different types of airplanes on display	
Inflated balloon on display	Basketball floor
Motors on display	Basement
Constructional parts of planes and gliders	North wing

Experimental Engineering

Wind tunnel mounted airplane model
Motor running on test stand

COMMITTEES

Arrangements

Melvin Lohmann, chm.
Tom West
Elwood McGee
Roger Lynn
Fred Myers
Vincent Victoreen
Lloyd Bredvold
Charles Sweatt

Parade

Frank Parker, chm.
Paul Cartwright
James Jordon
Orville Becklund
Bill Kaiser

Brawl

Leon Funke, chm.
Harold Haugen
Richard Mallander
Jack Biggam
Art Ronbeck

Broadcasting

Jack Melvin, chm.
Edward Dobrick, chm.
Bill Chandler
Paul Willard
Orville Lindstrom
Ray Sundquist

Buttons

Thomas Klingel, chm.
Betty Vincent, chm.
Phyllis Borget
Alice Youngquist
Paul Fontaine
Dorothy Towne
Mary Lindsey
Paul Thomas

Chemical Show

Harry Cottingham, chm.
Bob Ellis
Ray Kemps
Jerome Haggenmiller
Robert Carlin
Calman Kish
Erwin Wahlsten
Sidney Baumgardner
Eli Besser
Josephine Woodward
Darwin Rathmann

Knighting

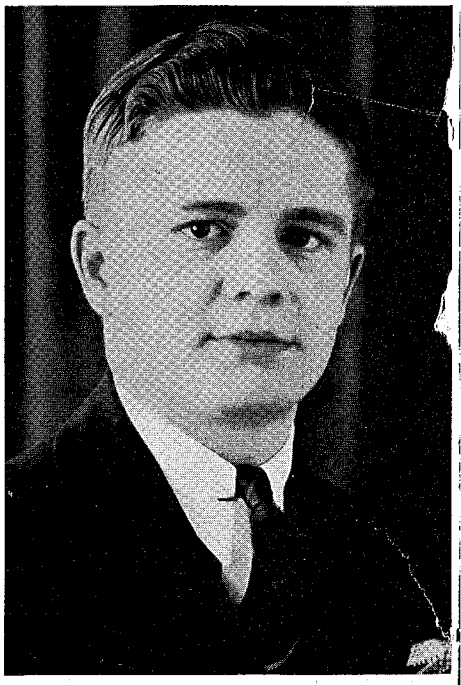
Charles Snyder, chm.
A. A. Anderson
Wilho Junnila
Harvey Anderson

ENGIN

DA

Program of

9:00 a. m.-5:00 p. m.—Open
11:00 a. m.—Parade, starting
12:00 m.—Knighting Cerem
3:00-5:00 p. m.—Dansant—
9:30 p. m.-1:00 a. m.—Brawl



Melvin Lohmann

General Arrangem

E E R S '

Y

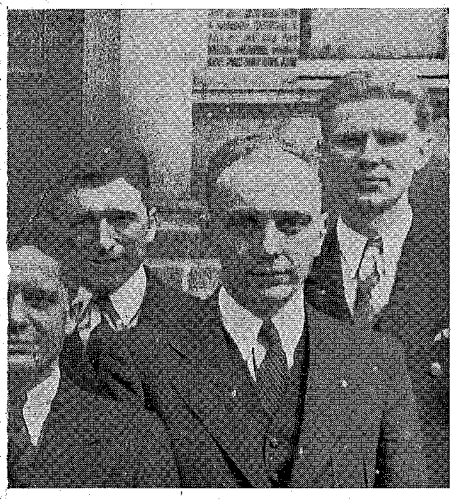
the Day

House (all buildings)
at Electrical Engineering
ony—on the Knoll
Main Engineering Aud.
—St. Paul Hotel

Dansant
Earl Bennetson, chm.
Doris Anderson, chm.
Alice Youngquist
Helen Bischoff
Martha Granger
Don Lampland
Chester Gaskell

Campus Publicity
Edmund Wodrich, chm.
Ed Leach
Robert Rosengren
Robert Teeter
Wesley Wilkes

Downtown Publicity
William Lowe, chm.
Rawson Alkire
Bob Nichols
Joseph Micka
Omar Peterson



ents Committee

Arch. Open House
G. W. Brandhorst, chm.

Civil Open House
Thos. MacKenzie, chm.
Robert Ellison
John D. Holm
Henry Mickelsen

Electrical Open House
Ottilio Morzenti, chm.
R. S. Lind
R. W. Olson
R. Christoff
J. D. Haight

Mines Open House
Fred Speers, chm.
John Hope
Leonard Rice
Don Kugler
Lee Thronson

Mech. Open House
Joe Lightowler, chm.
Wesley Matey
Richard Mooney
Robert Hankee
Burk Senn

Green Tea
Ione Kuechle, chm.
Dorothy Ebel
Nanacey Hanley
Bernadette Kyle

Office
Lloyd English, chm.
Hugo Hesse
Don Benson
James Savage

Aero. Open House
Herbert Hoffman, chm.
Richard Baseler
Charles E. Body
Elden Olson
Don Rialson

Ag. Open House
Harold Butler, chm.
Robert Currie
Nelson Dingle
Carl Magnason
William Snyder

Printing
John Swenson, chm.
Lawrence Rollin
Leonard Starlof
Woodward Thorstenson
Earl Franzen

Civil Open House
Tom Mackenzie, Chairman

Main Engineering

Blueprint souvenirs	
Instrument display	Room 217
Map exhibit	Room 229
Moving pictures	Room 106

Mechanical Open House
Joe Lightowler, Chairman

Mechanical Building

Machine design models	Room 50
Making ash trays	Foundry shop
Flower pot holders	Forge shop
Paper weights	Machine shop
Hat racks	Pattern shop
Candlesticks	Machine shop

Agricultural Open House
Harold Butler, Chairman

Lot Across from Main Engineering
Twenty units running off power takeoff
Tractor with radio
Latest machinery

Main Engineering

Moving pictures all day	Room 135
Drainage and erosion control	Room 136
Rural electrification	
Dairy equipment and machinery	

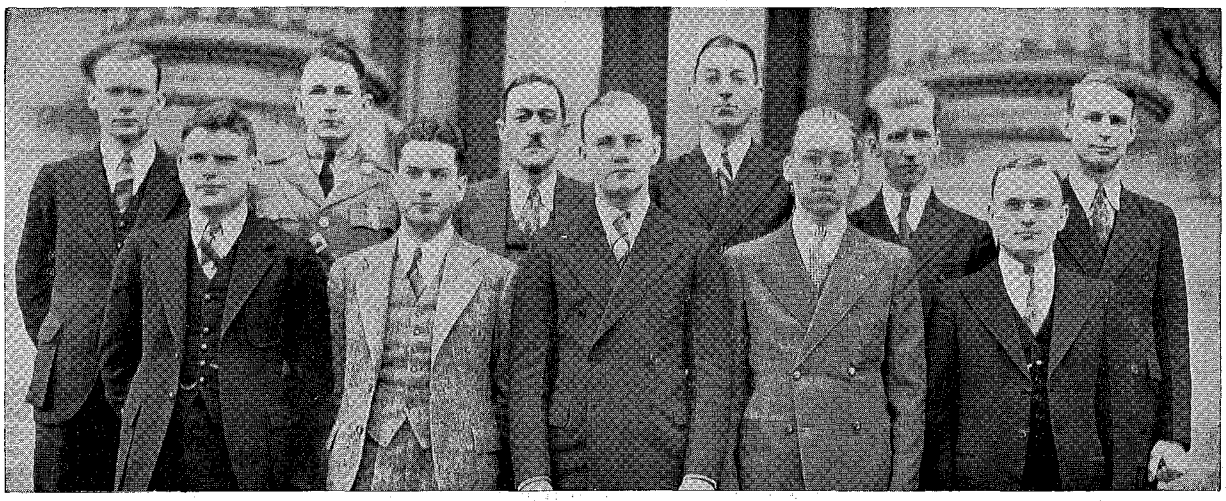
Mines Open House
Fred Speers, Chairman

Mines Building

Registration of visitors and model exhibits	Library
Blueprinted souvenir programs	
Exhibits and demonstrations	Metallography lab.
Drawings and model mines	Junior drafting room
Exhibits and demonstrations	Ore dressing lab.
Moving pictures from the Bureau of Mines	
Petroleum exhibits	
Exhibits and demonstrations	Assay lab.
Miscellaneous exhibits	

Tickets
Albert Jacobs, chm.
Dick Longfellow
Don Raudenbush
Milton Rogness
John Anderson
Richard Sherman
Elwyn Williams

Poster
Fred Mann, chm.
Lloyd Bonget
Bob Hose
Henry Nelson
Gordon Matson
Charles Wolfgang
Ralph Zander



Honorary Senior Engineering Society

Plumb Bob

Front row: Nelson, Intlekofer, Hanson, Springer, Oswald. 2nd row: Dixon, Cutts, Prof. Kuhlman, Schoell, Brastad, Moore. Not present: Seidel, Bolstad, Dean Leland, Prof. Richardson.

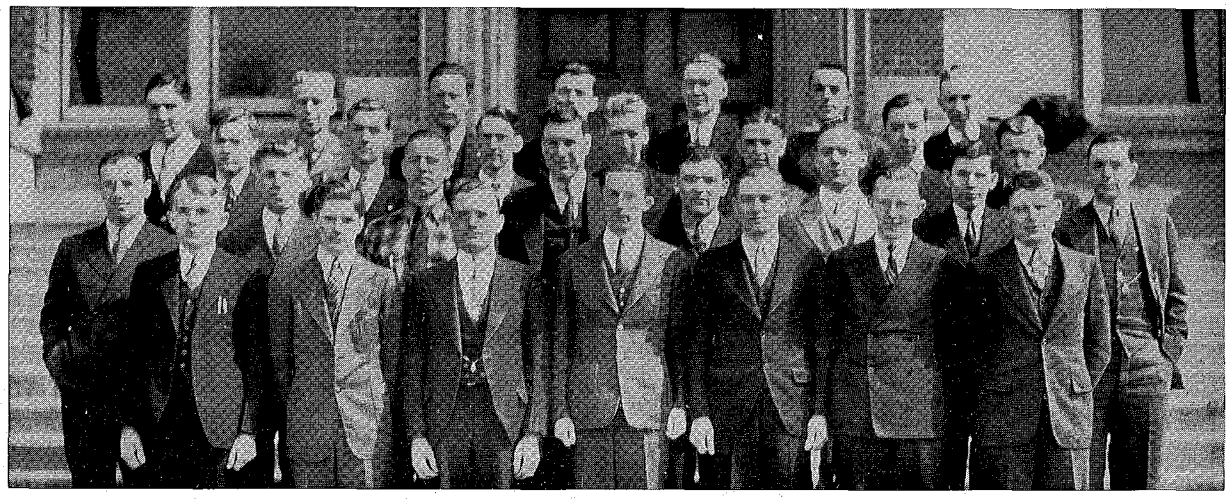
The officers of Plumb Bob are John Hanson, president; Jack Intlekofer, vice-president; Eugene Cutts, secretary; William Schoell, treasurer.

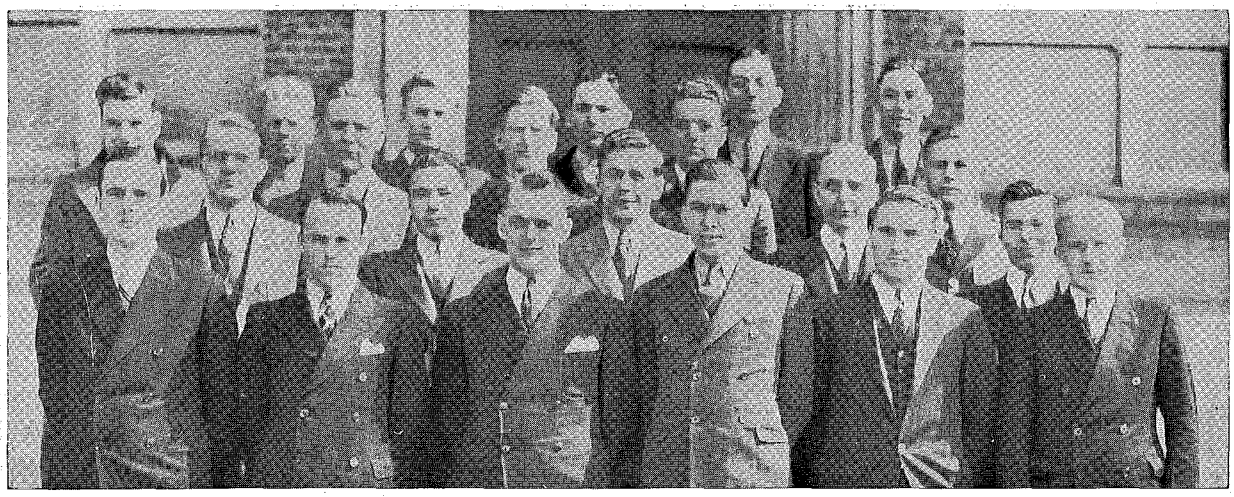
Front row: Anthes, Loye, Oswald, Stewart, Strom, Carlson, Nelson. Second row: Grozovsky, Matthies, Harrison, Lessard, Dech, Berg, Chamberlain, Marshall. Third row: Nielson, Frickland, Mather, Brastad, Amunson, Bolstad, Lind. Fourth row: Tennenbaum, Ahlm, Franzen, Longfellow, Olson, Hansen, Aubrecht.

The officers of Tau Beta Pi are Homer Stewart, president; William Nelson, vice-president; Russell Neilson, recording secretary; Gordon Strom, corresponding secretary; Prof. E. W. Johnson, treasurer.

Tau Beta Pi

Honorary Engineering Fraternity





Professional Engineering Fraternity

Theta Tau

Front row: Paul, Rollin, Dynesius, Olson, Bomback, R. Kojola. 2nd row: Swenson, Lewis, Spoor, Victoreen, Lang. 3rd row: Lessard, Ronbeck, Hodgman, Nygren, Hage. 4th row: Lundstrom, A. Kojola, Johnson, Schoell, Bass. Not present: Bennetsen, Robertson, Heising, Starloff, Aslesen, Dean Comstock, Profs. Holman, Parker, Zelner, Emmons.

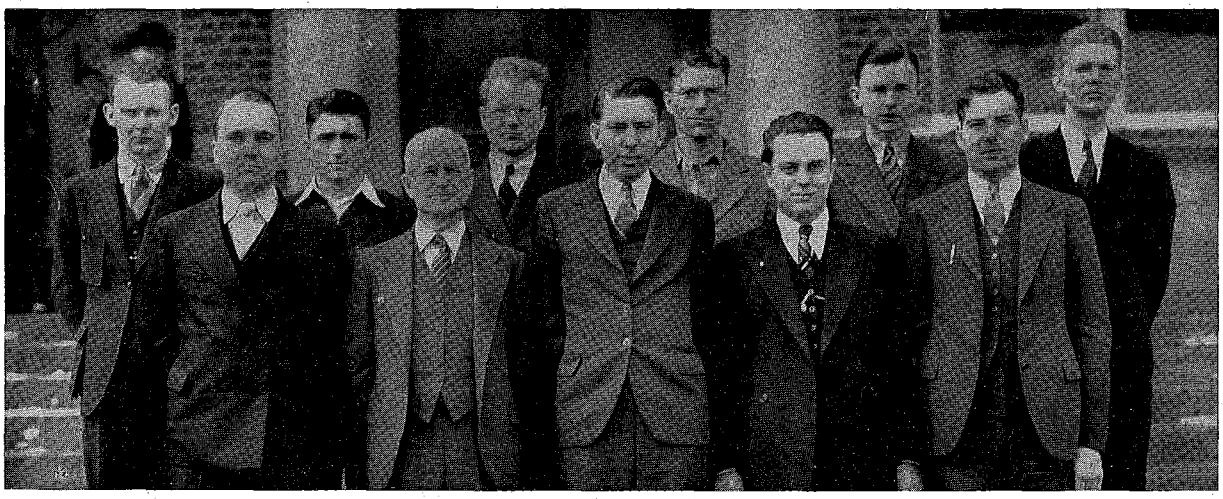
The officers of Theta Tau are Earl Bennetsen, regent; Ronald Robertson, vice-regent; Art Ronbeck, recording scribe; John Swenson, corresponding scribe; Bob Aslesen, treasurer.

Front row: Sweatt, Richardson, Olson, Hopper, Walters. Second row: Dixon, McGee, Stone, Simmons, Erikson, Meyers. Not present: Dean Leland, Edstrom, English, Buck, Teeter.

The officers of Alpha Tau Sigma are Malven Olson, president; Armon Walters, vice-president; Fred Meyers, secretary-treasurer.

Alpha Tau Sigma

Honorary Engineering Journalism Fraternity



Professional Mines Fraternity

Sigma Rho

Front row: Sundquist, Larson, Johnson, Lacy, Purcell. Second row: Hanning, Danchertsen, R. Wilson, Nordquist. Third row: Tierney, Du-four, Mahly, Ossman, Neuberg. Not present: S. Wilson, Profs. Dowdell, Heilig, Christensen, Griswold, Trengrove, Schwartz, Grunner, Lambert.

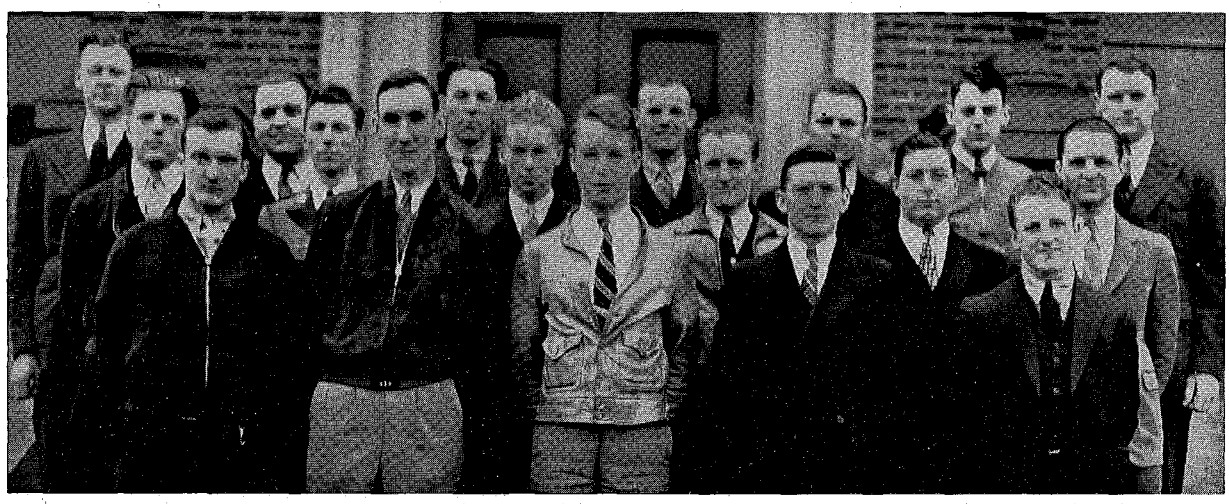
The officers of Sigma Rho are Michael Tierney, president; George Neuberg, secretary-treasurer; Howard Nordquist, corresponding secretary.

Front row: Cartwright, Steinmetz, Jacobs, Robinson, Tema. 2nd row: Parker, Clark, Henrici, Morris, Jordan, Page. 3rd row: Sutherland, Stenderson, Flohil, Haswell, Peterson, Williams, West. Not present: Reynolds, Abrahamson, Kephart.

The officers of Kappa Eta Kappa are Laidman Robinson, president; Albert Jacobs, vice-president; Paul Cartwright, recording secretary; Thomas West, corresponding secretary; Charles Steinmetz, treasurer.

Kappa Eta Kappa

Professional Electrical Engineering Fraternity



Professional Engineering Fraternity

Triangle

Front row: Wodrich, Lohmann, Francis, Ulrich, Aufderheide. Second row: Alkire, Klingel, Bredvold, Solstad, Funke. Third row: Olson, Noyes, Benson, Senn, Brockmeyer.

The officers of Triangle are Charles Francis, president; Lester Solstad, vice-president; Bernhardt Petry, corresponding secretary; Earl Olson, recording secretary; Melvin Lohmann, treasurer.

Fourth row: Nichols, Lynn, Tenold. Not present: Hesse, Schwartz, Petry, Mallander, Dean Leland, Profs. Koepke, DuPriest, Doeringsfeld, Swanson, Wilcox.

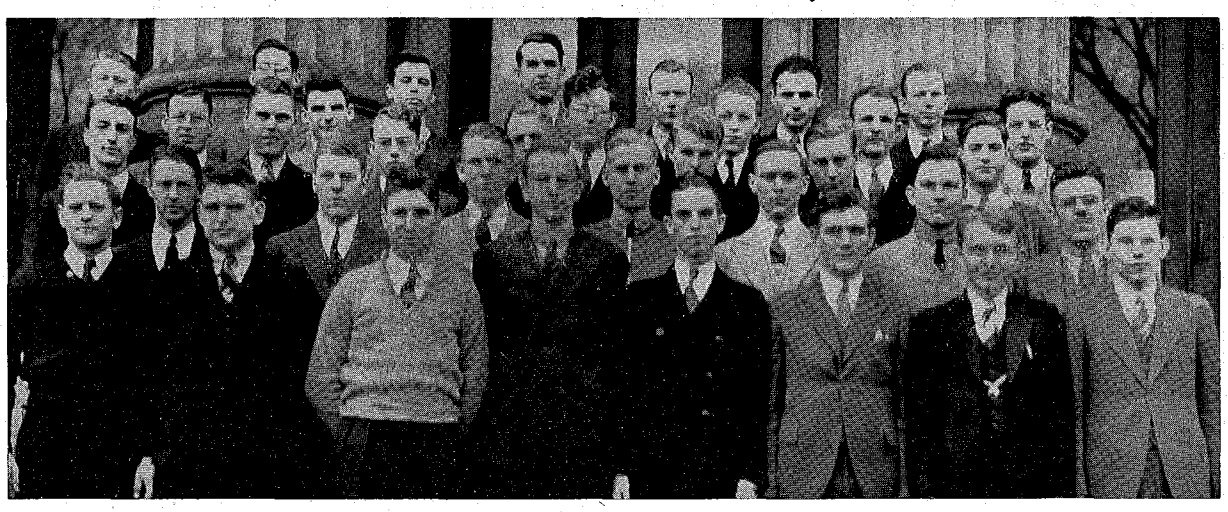
Front row: Meile, Nelson, Murphy, Rode, Carlin, Houk, H. Anthes, Chamberlain. 2nd row: Pings, Lahart, Bester, Ahlm, Berg, Cain, Hollihan. 3rd row: O'Link, Carlson, Behr,

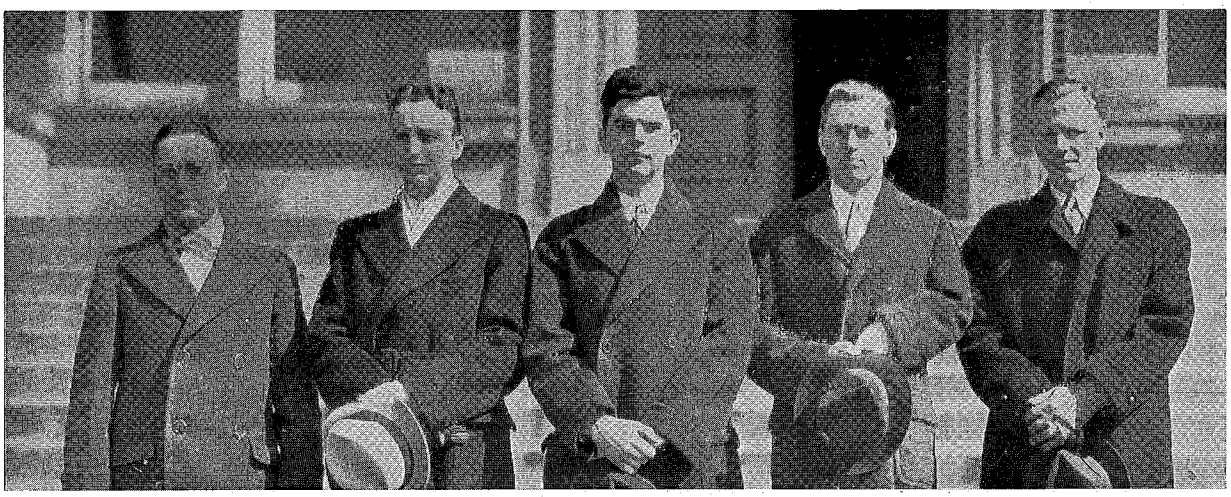
The officers of Alpha Chi Sigma are Jack Rode, president; Clarence Bester, vice-president; William Murphy, recording secretary; Albert Houk, corresponding secretary; Donald Chamberlain; Lloyd Tyler, master of ceremonies.

Merman, J. Anthes, Keyl, Turner. 4th row: Vezina, Mitchell, D. Johnson, K. Johnson, Poynter, MacDonald. 5th row: Wiest, Rieks, Tyler, Kaiser, Dixon, Ungnade, Harrison.

Alpha Chi Sigma

Professional Chemical Fraternity





Ostrow, Bauer, Herman, E. Olson, Lindstrom.

Architectural Engineering Society

A.E.S.

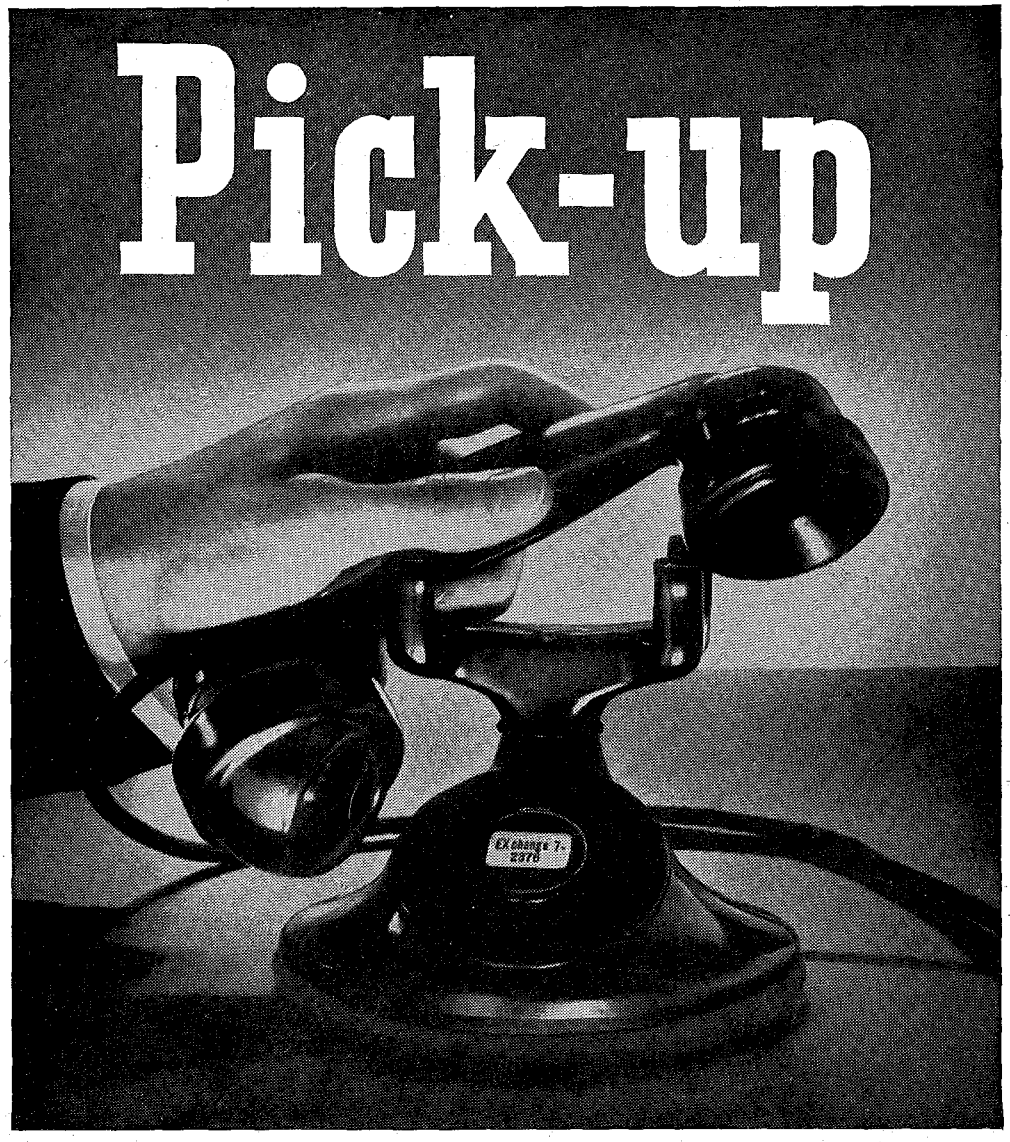
The officers of the A.E.S. are Neil Herman, president; Gilbert Bauer, vice-president; Julias Ostrow, corresponding secretary; Eskil Olson, recording secretary; John Lindstrom, treasurer.

Front row: Schwartz, N. Juster, Freedland, Held. Second row: Besser, Liebermann, Silverman, Sackter. Third row: Ginsberg, M. Juster, Polin. Fourth row: Lexier, Bernick. Not present: Goldstein, Landsburg, Budish, Prof. Levens.

Sigma Alpha Sigma

Professional Engineering Fraternity

The officers of Sigma Alpha Sigma are Lewis Freedland, president; Nathan Juster, vice-president; Lester Bernick, secretary; Raphael Liebermann, treasurer.



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BELL TELEPHONE SYSTEM

SLIPSTIX

Don't Judge Others

There remain time and space for me to mention only one other matter. It is a story I heard between the acts in Berlin about the spherical, rosy, snow-topped Molnar. It seems that recently in Budapest he was subpœnaed as a witness in an important litigation. It would mean his going to court at nine in the morning, and he had never been known to rise before high noon. Two weeks of preparation were devoted to getting him up in time. His cook, his valet, his relatives, the lawyer, the lawyer's clerks, the telephone company, the postman, all entered into the conspiracy, and as a result of their combined efforts he actually tottered out on to the street at 8:55 a. m. The sidewalks presented their usual picture of citizens hurrying to work. He stared at them in dull amazement. "My God!" he faltered, "are they all witnesses?"

—*Alexander Woollcott*

Slips

A middle-aged man strolled through Rock Spring Park early last evening and proceeded to kiss and embrace eleven women on the way. He was apprehended by police at the west entrance and gave his name as Bud Cronel of Dorn, Montana. The man is believed to be sample-minded.

—*Rock Springs Exponent* (Ark.)

It's All in the Use

A customer stepped into a gun store, apparently intent on making a purchase. The salesman set about showing him what was in stock. The first weapon brought out was a handsome, single trigger, over and under Francot, and just about the last word in a very swell shotgun. The customer was quite interested, but the price, $600, was far beyond his means. The next assortment shown was a group of English doubles brought out by gunsmiths known all over the world for their expert craftmanship. Still too high, thought the customer, and then asked if they had something cheaper.

Yes, the salesman said, there were some inexpensive models made in this country and he could let him have one in the neighborhood of $40.

"I'll take one of those," the customer told the salesman with considerable enthusiasm. "It's really going to be a very simple wedding."

—*Petroleum Engineer*

The Great American Indian

Recent news items that the Soviet government has thought up penalties for malingering Russian workmen has reminded an engineer (who writes us) of a letter he received not so long ago from a colleague in Russia. This colleague, also an engineer, wished to convey the news to his friend in America that work on the construction of the Dnieprostroy power station had been seriously handicapped through the lack of coöperation on the part of Mongol tribesmen. To get this bald statement of affairs in Russia past the Soviet censorship was impossible, because everything is coöperation over there. The engineer managed, however, to get his idea across. He wrote his friend thus: "I have found no evidence whatever of forced labor. On the contrary the natives have been willing to coöperate on the project with the same spirit in which the American Indian aided in the colonization of the West." The censors were apparently pleased at this comparison, and sped the message on its way.

—*The Highway Magazine*

What are Little Girls Made of?

What are little girls made of? No doubt you have often wondered that yourself. In an effort to solve this age-old question the Albany Medical College has studied the composition of the average girl and made its report.

One girl is composed of enough glycerine to furnish the bursting charge of a naval shell. And then they say that she belongs to the weaker sex. Nothing very weak about a naval shell, says I. So just remember that, men, when you have your next date.

The amount of lime in one of our beauteous coeds is sufficient to whitewash a chicken-coop. Thus is their ability to wash the slate clean and start all over again explained.

No wonder women have been called the chief gossipers in this world of ours, no matter how unjustly. Do you realize that only one of them contains the equivalent of 1,400 cubic feet of oxygen?

Magnesium enough for ten flashlight photos enables a femme to see right through these stereotyped lines that college boys try to put over.

The clinging vine type of female is readily understood, now that we know that she is composed of enough glutin to make five pounds of glue.

Even our slimmest maidens consist of fat enough to make ten bars of soap, so they say; and enough sulphur to rid a dog of fleas.

If we encourage our dames to patronize the local swimming pools, our sanitation worries should be over. After all, just one of them contains enough chlorine to sanitize three swimming pools.

Just to prove that she is no "softy" a girl also carries aroung enough iron to make a 6-penny nail, 30 teaspoons of salt, 10 gallons of water, 31 pounds of carbon and a quarter pound of sugar.

When one thinks of all these things that a woman is composed of, it suggests the obvious question, "What is left for man?"

—*The Syracuse Daily Orange*

Compass Finds Pipes

To locate "lost" pipes, and conduits of like nature which are of magnetic material, a surveying compass with an adjustable bar magnet is now being used. Fixed to a compass box, and turning with it, two radial fins serve as the magnetic antennas. For use in tracing non-magnetic pipe, an electric current must be sent through the pipe. This method will also determine the approximate depth of the pipe.

Airplane Safety Glass

Airplanes are now installing a safety glass which is flexible enough to dent or yield on impact, yet has strength enough to resist penetration. This glass, called Plexite, is made by applying a film of a composition having the resiliency of rubber, in the liquid state, to glass. Some of its advantages over other glass of the same type are the elimination of edge sealing, non-coloring characteristics, moisture resisting qualities, and light weight.

Jean Piccard, Aero Instructor, Plans New Stratosphere Flight

"Three or four hundred students wanted," is the reiterated statement of Dr. Jean Piccard, new instructor in aeronautical engineering. Such a large ground crew is necessary when it is seen that a stratosphere balloon, even when partially inflated, is several hundred feet in height, and is affected by every stray breeze. Dates are still tentative as to the proposed ascension, and much backing must yet be gained.

Dr. Piccard has taught in several schools before, in California and at Chicago, and is here primarily to discuss the coming flight with Prof. Ackerman, and to make arrangements for the flight. The ascension will involve some new problems, but on the whole, the equipment and instruments will resemble those formerly used. As regards the hydrogen used, he said the danger from explosion is so little that the decreased cost and added lifting power gives it preference over helium, which was used in the National Geographic-Army flights.

The height to which he proposes to go this time is almost to the top of the column of air pressing down on the earth, where the atmosphere is 1/100th of the density on the earth. As regards the latest Russian attempts to reach the upper strata of air, by means of gliders fastened to steel cables, Dr. Piccard predicts failure, inasmuch as the weight of the cables would break themselves when seven or eight miles long. This would be nothing but a modified form of a kite, and little apparatus could be taken along.

Study of the stratosphere is extremely practical because the level of airlanes is going higher all the time, and fast overseas flights above all atmospheric disturbances are possible only in these upper levels.

University Fashions--

By Bob Dixon

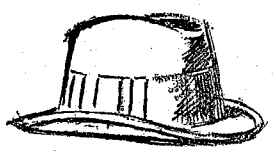
SHOES, an important part of the well dressed man's costume, show a definite trend away from the old toothpick style of a few seasons back. This style has yielded place to the softer rounded toe last that is so much more comfortable to wear. The toe is not cut off square or blunted but follows the general outlines of the foot. Along with the softer lines of the shoes are the softer tones of leather. Browns are getting more preference than the black of former years and the lighter tones of leather are more in vogue instead of the darker, almost black, browns.

The brown bucks or reversed-calf shoes that have been mounting in popularity the past couple of seasons will really come into their own this year. They will be seen in many shades, such as brown, green and blue, as well as the conventional white for summer. Some features of this summer's sport shoes are the highland kiltie fringed tongue that lays over the laces, and strapped model shoes.

From shirts and ties come the stripes now fast becoming popular in socks. Circular stripes are leading the vertical as to popularity, with scottish plaids and checks seen on many a well-dressed ankle on the campus.

The hat manufacturers may again breathe easy, as very few heads are seen unclad today, even on the campus. Perhaps it was the cold winter, or the return of prosperity, but this spring will see some very smart hats and an increase in their popularity. Two modes are evident—lowness of the crown, and wideness of the brim. These are in direct contrast to the styles of the past decade, and will prove an inducement to the man who has hitherto felt that he didn't look good with a narrow brim. Homburgs are also furnishing much competition to snap brims, and the off-the-face models offer considerably more dignity than heretofore. Spring styles will see the slow death of the more extreme Tyrol models. Only a slight taper is retained, and there is much less "rake" to the brim. Of the more popular new styles, the welt edge is being shown in the better men's stores. Along the line of the newer color shades, green is the most fashionable; while slightly silver pastel shades of the leading colors, gray and brown, are also being shown.

Tricky trimmings are also the order of the day, with novelty bow arrangements, and many "whisker" effects, what with actual trout flies, hook and all. Enamel and gold clasps are part of the trimmings. Two and three-cord bands from the Tyrol are being retained.



THE weather on Engineers' Day for the past five years has been perfect. If the record is spoiled this year we can lay the blame upon the miners, who, we understand, were highly indignant when they found the basement of their building full of water last year on that day. . . . We have just uncovered a bit of information which we know will disappoint the Foresters. It seems that there is a shortage of over-ripe turkey eggs this year, weapons which they used effectively last year to temporarily halt the progress of the engineers' parade. We understand that although they were somewhat disappointed at not receiving any engineering visitors on Foresters' Day, they have decided to come out of the brush and avenge themselves for the hardship, imposed upon them last year, of earning ten extra credits for having presented themselves at the parade in a very undignified manner. We don't believe that they will be around, however, due to the fact that Engineers' Day is much earlier this year than usual, and that it takes quite a while for the news to penetrate into the woods. . . . Personally we would enjoy such a visit from them as we have always wanted to know what a forester looks like.

We would give some of our hard earned dough to know who the charming little lass was that wandered into the Engineers' libe the other a. m. and caused no small number of future engineers to go to classes with their lessons unprepared. . . . This department denies any truth in

the rumors that the Triangle boys have been paying for space regularly in this column. However, if some of you boys feel so inclined we could well use the money. . . . Imagine the embarrassment of Bob Pierce the other day up in the architectural drafting room when Prof. R. C. Jones asked Bob for the criticism which he had given him previously on his design problem, and Pierce had to fish it out of the wastebasket in front of Jones. . . . Elmer Peterson and the Kappa Eta Kappa boys have a new method of supplying water for the radiator of their car. Whether they have copyrighted the procedure could not be determined. . . . This corner will offer a sizeable reward for the Engineer who can produce a member of the fair sex who will cause Bob, "I'll have nothing to do with em," Manley to become interested. . . . We understand that Lou Riegert received quite an education from the natives up in Bismarck last summer, where he and Ken, "Casa Loma," DeVilliers and the boys packed them in.

The music has been going round and round lately and so have we, trying to figure this one out. See what you can do. If a squirrel always keeps on the opposite side of a tree as a hunter walks around it, does the hunter walk around the squirrel? . . . One of life's major heartbreaks —to have to spend your last dollar for the privilege of taking a condition exam. . . . Tongue twister of the month, try saying fast, "Cross crossings cautiously."

Bob Kurtz, recent Architectural Engineering grad, has obtained a patent on a psychrometric slide rule which he has invented and which has received the approval of the head men in the heating and ventilating field. The slide rule is now being manufactured by the Keuffel and Esser Company.

Iowa State College has built a new experimental building for the purpose of converting waste materials into useful products. One of the wastes being feathers which they hope to convert into a fuel. . . . We suppose for airplanes.

Prints of pictures shown in this issue are on sale in the Techno-Log office, Room 37, E.E., for 35c each.

HAVING recently seen the picture "Captain Blood," we looked up all our old treasure maps, and, before setting out on search for adventure, wish to have several problems solved.

One of the ancestors of a present math prof, a robber and a pirate, fixed up this puzzle for us. A treasure is buried in a square field, exactly two rods from one corner, three rods from the next corner, and four rods from the next adjoining corner. It so happened that all of the ten fields in the neighborhood were square, but of different sizes. How many times will a treasure hunter have to dig to cover all possible locations of the buried gold?

* * *

One of his pieces of loot was two chains of solid gold. They were made up of circular rings, one having six more rings than the other. If one chain is sixteen inches long, the other six inches long, and the rings are all of the same size and of metal one-half inch thick, how many rings are there in each chain.

He also wrote that the boys were having a drinking bout one evening, as boys will when they have time on their hands, money in their pockets, and a tavern only a few steps down the lane. Personally, we think he wrote this when slightly ——— but nevertheless, here goes. In front of him was a cask of fine London ale, and in his hands were two measures—one of five pints, and the other of three pints. Pray show how it is possible to put a true pint into each of the measures. Of course, no other vessel or article is to be used, and no marking of the measures is allowed.

* * *

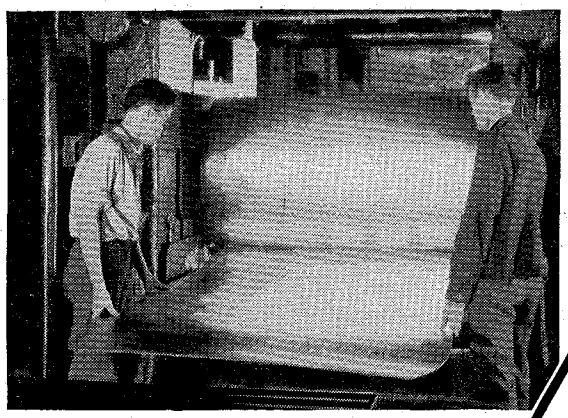
One piece of eight, in the form of a modern dollar bill will be awarded the first would-be pirate who comes in with the answers, correct, of course.

* * *

Last month's winner was Clem Sculley, first with the correct answers, in a close field. Answers, in problem order, $10\sqrt{5}$, 5.321826, and Tom-Mary, Joe-Priscilla, and Charles-Katherine.

ADVERTISING INDEX

	Page
AM. TEL. & TEL. CO.	151
ANN UNGER	153
BOWEN	154
BRUCE	130
CAMPUS PHARMACY	158
CELLOGRAPH	154
CHIPPEWA	158
COMMERCIAL GAS CO.	154
DOW CHEMICAL CO.	Cover 3
ENGINEERS' BOOKSTORE	159
ENGINEERS' DAY BRAWL	Cover 2
FOREMAN & CLARK	155
FRIGIDAIRE CORP.	132
GENERAL ELECTRIC CO.	Back
1936 GOPHER	156
GENERAL MOTORS TRUCK CO.	158
HARVARD GRILL	157
HOWARD & GEESEKA	153
JUSTER BROS.	129
LINDE AIR PRODUCTS CO.	131
LYLE CULVERT & PIPE CO.	156
E. H. MILLER, BOOKBINDER	158
MINNESOTA UNION	154
PAGODA TEA ROOM	154
PIONEER GRAVEL EQUIPMENT CO.	160
ST. PAUL HOTEL	157
ST. PAUL HYDRAULIC CO.	157
STANDARD CLOTHING CO.	155
UNIVERSITY FOTO SHOP	153
ZIEGLER CO.	153

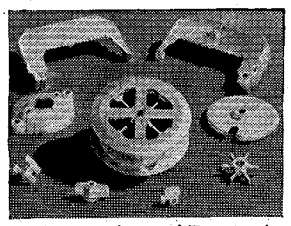


Dowmetal

A TRIUMPH OF CHEMISTRY

MORE than a century has passed since magnesium was first recognized as an oxide of metal and later produced as a metal.

It is also a matter of record that out of Germany came the first large scale production of magnesium alloys—a development of the World War.



A group of typical Dowmetal castings

But, should the history of this lightest of all structural alloys be written, The Dow Chemical Company of Midland, Michigan, would occupy a singular and honored place.

For, aside from being the sole producer of magnesium alloys in this country, it is to the everlasting credit of Dow chemists and technicians that this valuable metal is now produced at a price making it available to all industry.

Today, under the trade name of Dowmetal, Dow magnesium alloys are bringing the great benefits of lightness combined with toughness and strength to countless products.

Being a full third lighter than aluminum and only a quarter the weight of steel, it is obvious that the aircraft industry became its first big user. Engine crankcases, landing wheels and many other parts, large and small, are made of Dowmetal. The recent stratosphere explorations were made in Dowmetal gondolas.

Beginning there, the list broadens from machinery to household appliances—from truck bodies to camera parts, portable power tools, typewriters and a host of other applications.

In addition to producing a range of alloys, Dow offers a complete pre-fabrication service covering castings, forgings, sheets, plates and extruded shapes. In addition, an engineering and technical staff is available to cooperate with users in the practical and efficient application of Dowmetal to their products or equipment.

The commercial development of Dowmetal symbolizes and parallels the successful 45-year history of The Dow Chemical Company.

Manufacturing 250 separate and distinct products, The Dow Chemical Company has risen to a respected leadership through constructive and original research and the fundamental objective of applying chemistry as a means of making valuable materials cost less.

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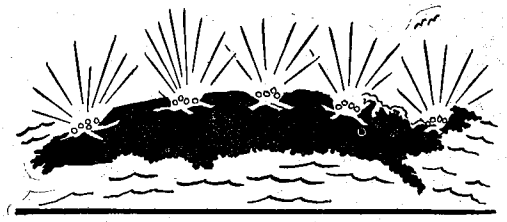
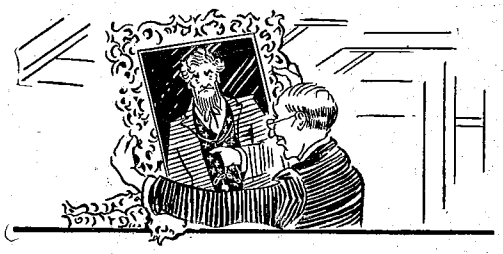


MORE BRIGHT SPOTS ON THE GLOBE

THE mellow, golden-orange glow of sodium lighting is springing up all across the continent. The latest installation, the largest in the United States, is located in the state of Washington. Here sixty-six 10,000-lumen General Electric units line almost three miles of the four-lane Pacific highway between Tacoma and Fort Lewis.

Less than three years ago the sodium lamp made its first American appearance on a highway near Schenectady. Today the largest installation is on the Pacific coast, and the second-largest is at Lynn, Mass., on the Atlantic. In between, highways, bridges, traffic circles, and underpasses are being lighted for safety with these new luminaires, and G-E sodium lighting units have been installed in Canada, Hawaii, India, Spain, South Africa, Dutch East Indies, and Brazil.

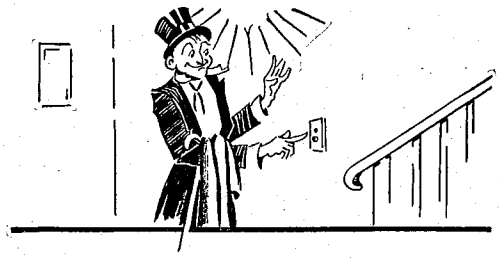


X-RAY FOR ART'S SAKE

IS there a portrait of Great Uncle Ezra gathering dust in the attic? It may pay to x-ray Uncle before handing him over to the junkman, for behind Ezra's imposing whiskers may be hiding the sister of the Mona Lisa.

Not long ago, a portable G-E X-Ray Corporation unit disclosed a valuable canvas by the seventeenth-century artist, Goya, concealed under an apparently worthless picture. More recently a New Orleans painter and art expert has used the x-ray to discover a genuine da Vinci signature beneath layers of paint applied by a later and less-capable artist. A sister painting to the newly found da Vinci recently sold for a quarter of a million dollars.

The x-ray does more than discover lost Old Masters; it tells how the great artists of the past worked. A series of radiographs can disclose the full story of their brushwork from the first rough sketch to the last correction and afterthought. The art student of today, by an intelligent use of the x-ray, is in a position to take lessons from the geniuses of the past.



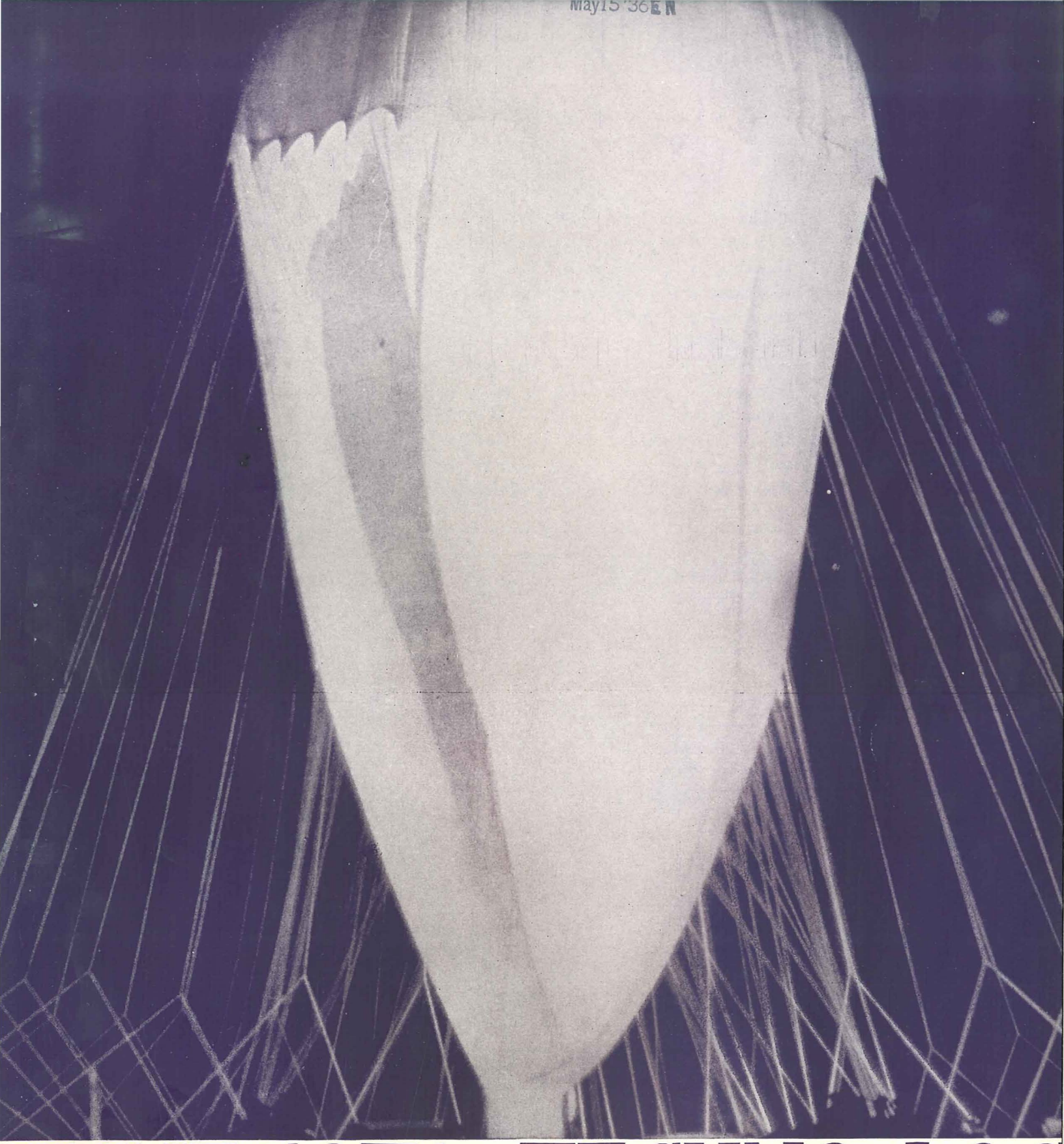
NO CLICK!

THE life of the party, coming home with the milkman, need no longer fear the betraying click of the light switch if his house wiring includes the latest electric switch developed in the G-E Research Laboratory.

Two shallow chrome-steel cups, sealed together with a strip of glass, form the two contacts. A ceramic disk with a hole in it, and a few drops of mercury, partly fill the enclosure between the cups. The device is filled with hydrogen and sealed by welding. In the "off" position, the hole in the disk is above the mercury level. A rotation of twenty degrees to the "on" position permits the mercury to flow through the hole and make the electric connection.

The time-honored click of the switch is abolished. In the laboratory in Schenectady, one of these mercury switches has turned a 200-watt lamp on and off some 65 million times in the last two years, and there are no signs of wearing out or failure.

96-245DH



MINNESOTA TECHNO-LOG

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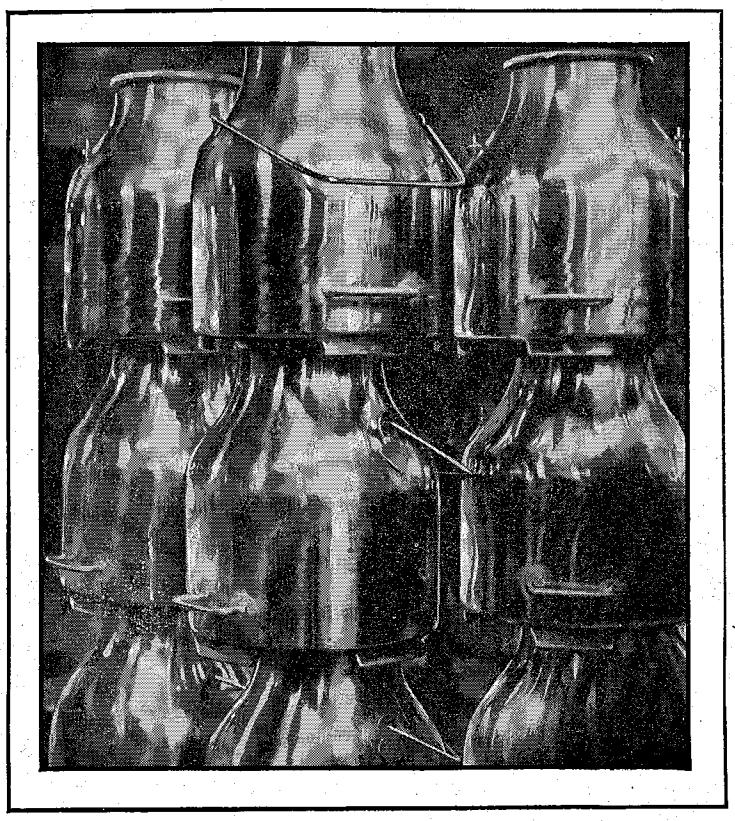
May
1936

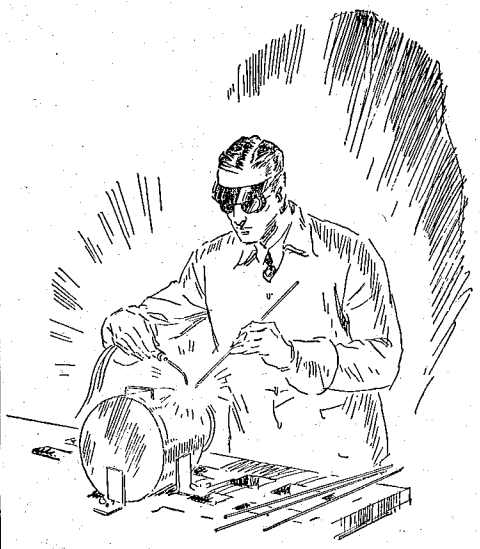
Better . . because IT'S WELDED

● The modern milk can is better because it's welded. Whether the can is made of aluminum or stainless steel—from the standpoints of cleanliness, sturdiness and serviceability—it is easy to see why the use of welded joints is beneficial.

Welding has made many good products better—milk cans, automobiles, airplanes, radios, refrigerators, streamlined trains and a thousand other things. This modern method of manufacture is applicable to the widest range of materials—steel and iron, aluminum, copper, brass and all other alloys and metals, even platinum. It is ideal for use where strong, smooth, invisible joints are necessary for enameling, for cleanliness or for appearance.

Tomorrow's engineers will be expected to know how to apply this modern metal-working process. Several valuable and interesting technical booklets describing the application of the oxy-acetylene process of welding and cutting in design, construction and fabrication are available from Linde offices in principal cities. Write The Linde Air Products Company, Unit of Union Carbide and Carbon Corporation, 30 East 42nd Street, New York, N. Y.





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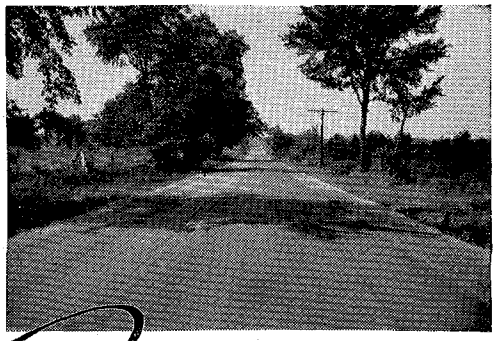

Chemistry's CONTRIBUTION *to* DUSTLESS, LOW-COST ROADS

STATISTICALLY, it may be interesting to record that The Dow Chemical Company is one of the foremost producers of calcium chloride which it markets under the trade name, Dowflake.

But, far more gratifying to Dow than large tonnage is the ever-growing acceptance of Dow methods and Dowflake in the building and maintenance of better roads.

Fifteen years ago Dow chemists saw in the basic water-attracting and holding characteristics of calcium chloride an answer to a pressing public problem—dusty roads.

Rapidly growing traffic—faster vehicles—both combined to focus attention on road dust. For not only did dust constitute an annoyance and hazard—it represented the loss of actual *road surface*—material that must be replaced. In short, it represented the taxpayers' money—the cost of road crews, of equipment and materials.

Thus, Dow pioneered and advocated the application of calcium chloride as a method of road dust control. Spread upon the surface it gathers and retains sufficient moisture to greatly retard the development of dust.

Following this primary use, further research and study brought forth a totally new technique in road construction. Within a special laboratory, Dow built sample roads to determine the best combination of dirt road materials.

Out of this effort Dow gave to road engineers a method of stabilized road construction wherein low cost aggregates, soil binders and Dowflake are scientifically combined to give a surface of boulevard-like smoothness, dust-free, with exceptional wearability.

In addition to its great service in road building and maintenance, Dowflake (calcium chloride) does many other things. Notably, it has speeded concrete construction (both road and structural) by accelerating the set.

It is used in fighting icy pavements. Combined with sand or cinders, it prevents these abrasives from freezing; keeps them ready for fast spreading and embeds them into ice through its melting action.

Coal treatment is still another instance. Here, under the Dow tradename of Koltreat, calcium chloride prevents dust which is obnoxious in the home and, developed at the dealer's yards, represents a cash loss to him.

Obviously, the value of calcium chloride for dust control on public roads is carried to private estates, to tennis courts, playgrounds, race tracks, fairs and other places where dust is objectionable.

Calcium chloride is only one of more than 250 chemical products bearing the Dow name. Each in its field is respected and each, like Dowflake, brings definite benefits or advantages to millions of people.

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MINNESOTA Techno-Log

37 ELECTRICAL BUILDING

UNIVERSITY OF MINNESOTA, MINNEAPOLIS

MAY, 1936

WAYNE STONE
MANAGING EDITOR

ROBERT DIXON
BUSINESS MANAGER

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VOLUME XVI NUMBER 8

	Page
HANDING DOWN THE PEN	164
THE STRATOSPHERE	165
VERTICAL ANTENNA	168
FIVE MINUTES PER BUSHEL	170
EDITORIAL	172
NOW HERE'S A BOOK	173
PROGRESS	174
BUILDING PROJECTS	175
ALUMNOTES	176
CAMPUS NEWS	178
STRAY SCRAPS	182
CLASSIFIED	184

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1935 - 36

Wayne Stone

As we sit pounding on the typewriter in rythm to the "Pedal Harmonica" which is being continually "chopsticked" by the editor, we find it hard to realize that we have no organist for next year. The nautical atmosphere will be missing also, and every article that comes in with boats mentioned in it probably won't be immediately snapped up. As an example to future aspiring editors, Wayne worked only one year on the mag before becoming head. Red sandy hair, president of A. S. M. E., and mechanical engineer complete our little portrait of him.

Robert Dixon

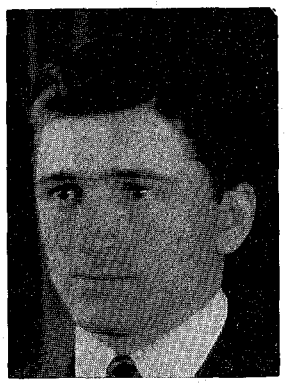
The Tech Board certainly went for auburn tresses in a big way last year, as our business manager, and fashion columnist also, is crowned with a halo of red, waving curls. We need only to mention the following honors Bob has received to show what a busy man he is. Member of Phoenix, Iron Wedge, Plumb Bob, Alpha Tau Sigma, A. I. Ch. E., Alpha Chi Sigma, and secretary of the Union Board of Governors. Depreciation set-by was a little too much this year, he claims, and won't even let us have a new clock after some mechanicals took the old one apart.

1936 - 37

Robert Teeter

From Corvallis to Portland, Oregon, to Minneapolis, Minnesota, comes the editor for next year. He was recently initiated into Tau Beta Pi, and is one of the few smart fellows around the office. Bob wears dark blue shirts, has brown, gray, and black buck shoes, and his present ambition is to own a pair of the new dark blue ones. Daily copy reader and night editor, and copy editor of the TECHNO-LOG comprise his experience, and he has a host of new "make-up" ideas. As a tinkering mechanical, Bob says he will work hard to get another clock in the office for spare-time practice.

Elwood McGee



On being interviewed, Mr. McGee said he was born in a gamboling white house with green shutters (we suspect in Ireland). This summer he will be surveying both the fields at summer Civil Camp, and the advertisers. As a member of Chi Epsilon, Alpha Tau Sigma, A. S. C. E., and treasurer of the Board of Publications, he will be kept pretty busy next year. A technique all his own is responsible for his success in selling ads, and would-be ad salesmen are cordially invited to observe a demonstration of the high-pressure McGee system.

Why do We Go to The Stratosphere?

By Dr. Jean Piccard
Lecturer in Aeronautical Engineering

I HAVE been asked to tell you why we go to the Stratosphere. Why do we do research work and exploration work at all? Why do men go to the poles? Why do they climb Mount Everest? Why do they cross the Arabian deserts? Is it not dangerous? Why do men experiment with explosives, with corrosive chemicals, with high pressure tanks? That work is also dangerous and, too, it is dangerous to experiment with any new kind of an airplane. Why then do men do it?

We have an inborn instinct for adventure and research. Why does a little boy open the alarm clock to find out what makes it tick? Why does a chemist take apart the molecule of indigo to see what makes it blue? Why does the physicist break up an atom of radium to see what makes it hot? Why did prehistoric man, who had accidentally discovered a fire, put more wood in it to make it grow? Why, much later, did his descendants put ore in a fire? Why, much later still, did men play with iron and magnetite? Why did they transfer the magnetic property from the stone to the metal, invent the compass and sail the seven seas?

It is all for exactly the same reason. Because we have in us the instinct for research, the instinctive desire to do things which have not been done before. That is what differentiates us from the animal. It is not the strength of our arms or the sharpness of our teeth which allows us to call ourselves the masters of the world. It is, in the last analysis, this queer instinct to explore and investigate and to use the results of this investigation. To *use* these results!

Everything has its antidote. Fire is fought by water. Acid is neutralized by alkali. The high jumper is held close to the ground by gravitation. This is very fortunate because without gravitation our best jumpers would be lost in space. Any unbounded spirit of adventure is fatal. The spirit of adventure must be checked by something else. When man was made, therefore, he received from Nature not only the instinct of adventure but also the instinct of tradition.

Tradition is as old as the human brain. The advance of civilization is an endless fight between these two fundamental instincts. The young mother who feeds her baby with milk may want to replace milk by the white juice of the milk-weed. The boy in the woods may desire to eat a certain unknown fruit. He shall not do it. Tradition takes the form of a command, "Thou shalt not."

Among barbaric people the duty of the priest or medicineman is to keep the tribe alive. New ideas are not tolerated. It is dangerous to walk on untrodden paths. In central Europe, for instance, there were laws, kept until the late Middle Ages, forbidding men to climb mountains.

The most general form of these old laws is, "Thou shalt not eat of the forbidden fruit." The law does not say, "It is dangerous." If any reason is given, it is said, "It is against the will of the gods." Socrates was given the poisonous goblet because his teachings were new. He believed in a single god. Galileo was condemned because he taught that the earth was moving in space.

Holy tradition is blind. It is sometimes good, sometimes bad. When we believe a certain tradition to be good we call it the wisdom of our forefathers. When we believe another tradition to be wrong we call it superstition. Old lady tradition is then deeply offended and makes a last stand, wrapping herself in the holy cloak of morality. However, and this makes progress of civilization possible, when tradition is definitely shown to be wrong, it gradually gives up the fight. Step by step it slowly recedes—but it recedes.

Tradition wants bathing suits from the neck to the ankles, but when the beneficial effect of sunlight is demonstrated, the bathing suit, if any, grows very short indeed.

We need tradition. Without tradition every child would open every alarm clock in town, people would not go to church at all, people would swarm into the saloons and run wild on the streets. But who can draw the line between tradition and superstition?

It is our good luck to live in a period of human development where tradition, if wrong, "beats it" relatively fast. Where our ancestors used centuries to overcome a certain tradition, we do it in a few years.

When holy tradition did not allow mountain climbing, what would the old lady have said about ballooning and air-plane flying? "If men were made to fly, the Lord would have given them wings." They flew and the very fact that they are flying is a proof that the Lord has made men to fly.

When one was accustomed to see men flying as high up as the density of air allowed them to breathe, one

gradually made up one's mind that this was O.K. When Auguste Piccard, however, proposed to use an air tight gondola and to investigate the regions where there is not enough air for breathing he was told that he should not go. "Man," they said, "is not made for going there. Even if you take oxygen with you the 'death rays' will kill you." Just as well tell the child, "Don't go in the cellar at night or the Boogy Man will get you." He went. The Boogy Man did not catch him.

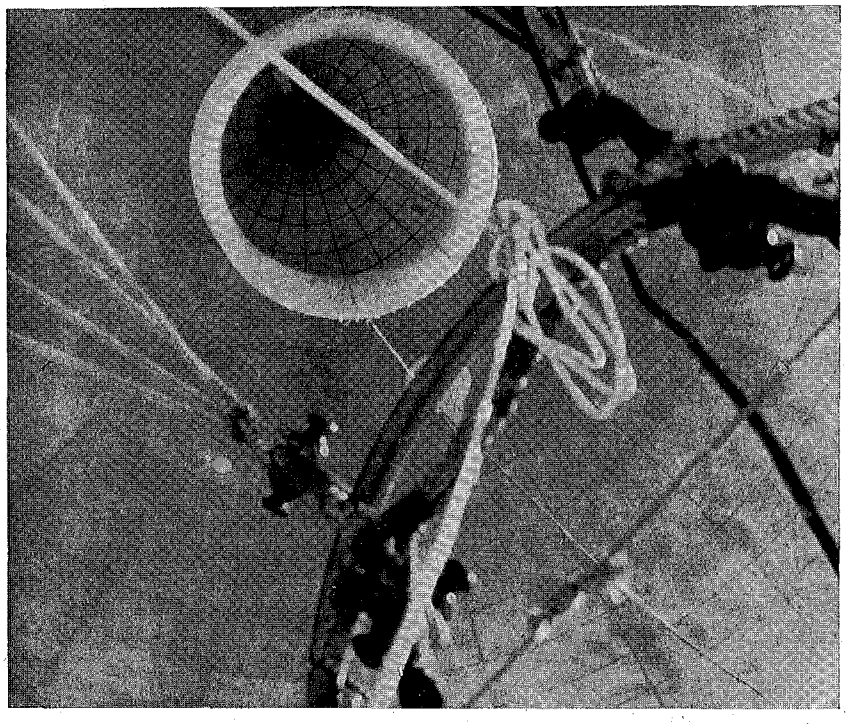
We need tradition, but we need the right to stand up against tradition if tradition is against progress.

Why do we go to the poles? Why do we climb Mount Everest and cross the Arabian Desert? Why do we go to the Stratosphere? Why? Because in this field, as in many others, tradition has reluctantly and slowly but definitely given the right of way to exploration and investigation, to science. Why, then, does one go to the Stratosphere?

Captain Grey, U. S. A., was probably the first man to go really into the Stratosphere. He displayed tremendous courage and endured great hardship. It takes courage and endurance to go to the Stratosphere in an open basket. Captain Grey "had what it takes."

Auguste Piccard was the first man to penetrate the 10 mile limit. But the stratosphere balloon with its hermetically sealed gondola can go higher. Lt. Commander Settle, U. S. N., went to 11 miles. Captain Stevens went to 14 miles. Others will go to 16 miles, to 20 miles. The stratosphere balloon has opened to exploration the whole layer from 10 miles up to 20 miles. It has doubled the volume of space open to man.

Man's penetration into the Stratosphere has, however, been wrongly compared to the discovery of the new world by Columbus. The doubling of space does not, necessarily, mean the doubling of content. Indeed the Stratosphere is mostly empty space.



The balloon from the gondola, as one looks through the appendix while descending from the stratosphere

If the professor of geology goes into the Stratosphere he will find nothing of interest to his science. It is too high. The botanist will find nothing of interest or, perhaps, just a few spores. Nor will the zoologist find any life at all. The Stratosphere is too high. Not even the professor of divinity will find any material for his science. The Stratosphere is not high enough.

But the physicist? Ah yes, he will find a wealth of information. The upper limit of our atmosphere is the place where our planet gets in contact with space. The Stratosphere is the place the nearest to the cosmos. It is the region where we touch eternity.

The top layer of the atmosphere receives the unadulterated rays from outside. The air molecules there are so rare that collisions are far less frequent than in the lower atmosphere. The molecules not only receive the various rays from outside with unrestricted power, but they keep the energy of internal excitement much longer than they could do it under greater pressure, where the frequent molecular collisions transform the intra-atomic energy into heat.

You have all seen the various luminescent electric tubes, the old Geissler Tube or the modern neon light. They all contain gases under reduced pressure. You all have seen, and admired in awe, the glorious phenomenon of the Northern Lights. It is luminescence produced in the upper Stratosphere by some incoming rays.

There is one incoming ray which is of special interest to the modern physicist, the cosmic ray, the ray that smashes atoms to pieces like a rifle bullet explodes a thin glass ball. It is the ray that goes in a straight line through many feet of lead.

In the Universe at large, light and heat are very local things only. Just around our sun, light is quite strong, but already at the edge of our planetary system the sun's rays are so weak that you would not even feel their heat with the bare arm. A little further out the sun looks like any other star. Most of the interstellar space is dark. An observer outside our own milky way, our galaxy, would not even see stars without the use of a telescope. Perfect blackness. But the cosmic ray is everywhere. It is really cosmic. There is as much or more energy in the Universe at large in cosmic rays than there is in rays of light and heat. The importance of the cosmic rays as a factor in the Universe is only equalled by our own lack of knowledge as to where they come from, and where they go to.

Most cosmic rays do not penetrate to the bottom of the atmosphere or, at least, they are badly altered before they reach the earth. To study the cosmic ray from the surface of the earth, from the lowland especially, is about as difficult as to study the sea gulls and the albatross from a point of observation located at the bottom of the ocean.

For this reason in the last twenty years several physicists have taken to the free balloon to study the cosmic rays. But the free balloon, as developed through a century and a half by science and sport, did not go high enough and this is why my

brother, Auguste Piccard, designed his great stratosphere balloon about twice as big in diameter, eight times as large by volume, as ordinary free balloons. By attaching to this bag his air-tight gondola he obtained a vehicle which brought him 10 miles up and which, further enlarged, brought Lt. Commander Settle and finally, still further enlarged, Captain Stevens to their great records. The three Belgian flights, two by my brother and one by Cosyns, and the four American flights, including our own flight from Ford Airport in Detroit, brought down a rich harvest of information about the cosmic rays. Dr. Swann, director of the Bartol research Foundation of the Franklin Institute, constructed most of the cosmic ray equipment of our flight and of Captain Stevens' two flights. Much information also was exchanged between Captain Stevens and myself; and, from a scientific point of view, the three flights form one great unit.

Inflation of the balloon at Dearborn. Roadways were marked on the film by auto lights.

Dr. Swann's apparatus, brought back to the laboratory, told a story more exciting than any fiction story. It told of experiences while in contact with the virgin—or almost virgin—cosmic rays of the upper atmosphere.

Of course, after every flight one makes improvements. Each flight calls for a new one. It is grand to be there, between heaven and earth, having at least nine-tenths of the air below you. The ultimate aim of the stratosphere balloon is to get to an altitude, about 20 miles, where one will have 99 per cent of the air below and only one hundredth of an atmosphere will separate the explorer from the absolute vacuum of empty interstellar space. This will be about the limit for human flying. Above 20 miles it would begin to be dangerous.

The scientific results which we are still expecting from future stratosphere flights are tremendous, but there is another even more important aspect of the stratosphere problem. Where the balloon goes today the airplane will go tomorrow. The balloon has no commercial possibilities, but as it has opened the troposhere to our airplanes, the stratosphere balloon will open the Stratosphere—is opening it—to swift commercial planes. The Stratosphere is the high road of international relations.

There the great planes will fly above clouds and thunderstorms. No air pockets, no bumps, no fog, no ice. Perfect flying conditions 24 hours every day in the year. And the speed in the rarefied atmosphere will be as close to the speed of sound as feasible.

And now there comes a grave question. "What good will it do to humanity? Will it bring civilization ahead or backward?"

The antipodes will be our neighbors. But remember, one makes war upon one's neighbor. The Romans did not fight the Celts in Great Britain before they had ships to go there. The British did not fight the Chinese before better ships had brought China to England's door steps. Nor did the white men fight the American Indians before they could cross the Atlantic Ocean.

Will further improvements of communication produce more foreign wars?

Here science is blind. Science will give us the instruments to increase, through the Stratosphere, our relations with all the people on earth, but science sets us free to use the new possibilities for good will or for bad will, for trade or for war.

If you look down on human history in the last two thousand years, the future is not as black as one might conclude from what I have said just now. The improved transportation possibilities have also brought close neighbors so near that they have stopped fighting each other.

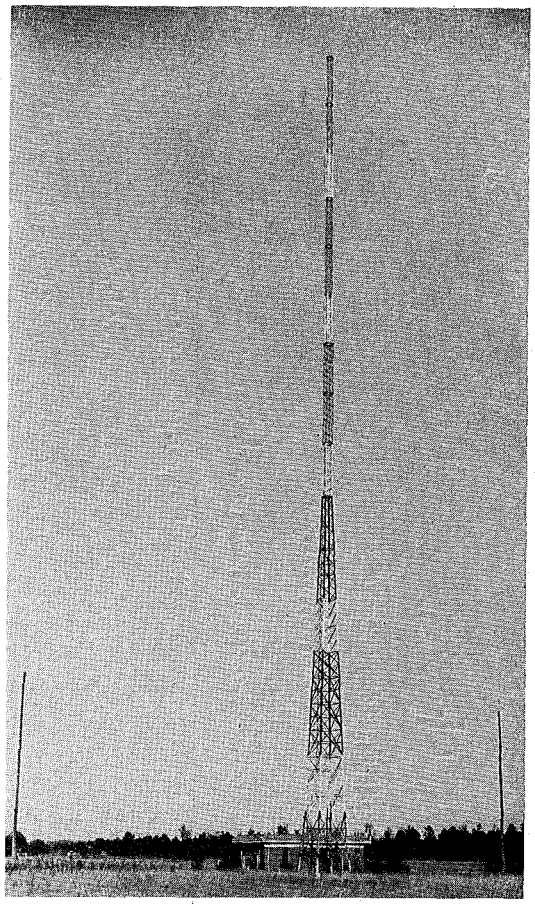
The wars between England and Scotland are a thing of the past. The Duchies of France which used to go warring against each other or against their king have disappeared. The wars between the various German Principalities will never come back. The same thing is true here on our continent. Not only a war among the American States would be impossible but even a war between us and Canada is unthinkable. We are too close neighbors.

Modern communication enlarges the areas within which we can avoid war. This is encouraging. The powerful stratosphere plane by itself will bring neither war nor peace. History shows that it is as impossible to avoid war by having the strongest army in the world as it is to prevent war by abolition of all armament. Men, not weapons make war. What matters is justice, good will and generosity of spirit, in short, kindly neighborliness.

When airplanes fly in a few hours from here to South America and to other continents, may they never contain explosives or poison gases, and the planes coming here from the Tropics may they never contain their venomous snakes. May they contain their multicolored tropical flowers and may our planes bring to foreign countries the books of our libraries and the instruments of our laboratories.

May the deep blue Stratosphere carry only messages of peace and may it never be desecrated by instruments of war.

Vertical Antenna



—*Cuts courtesy C. B. S.*

Self-supporting Antenna at WDOD

By **Fred Hager, E. E. '37**

THE comparatively new design of broadcast antenna, the vertical radiator, permits, by its physical configuration, control of the pattern of radiation and the concentration of all the available power on the primary service area. This area may be defined as the area in which a satisfactory signal may be received which is free of both fading and noise. The vertical radiator consists of a vertical metallic tower which is insulated from the earth and from which the energy of the station is radiated. It may be divided into two types, either the self-supporting or the guyed vertical radiator, depending upon the method used in supporting the tower. Although the construction of the two types may differ somewhat, the results that are obtained from both are practically the same.

The self-supporting radiator, an illustration of which is the antenna at WDOD, depends solely upon its four insulated base legs for support, as no other means are used to keep the antenna in place. Here it is necessary that the base be constructed much wider than the rest of the tower. As much of the radiator, however, is kept at a constant width, so as to more closely approach the performance of the theoretical vertical single wire antenna, the necessary large base introduces a larger base capacitance and voltage gradient between the earth as well as the dielectric loss than would have been obtained with the guyed vertical radiator. These losses may be remedied, however, by the installation of a screen on or near the earth directly underneath the antenna.

The guyed-vertical antenna, of which the antenna at WBT is representative, is supported at its base upon a single insulator and is kept in place by numerous guy cables attached near the center of the tower. The base, which is a single leg, does not introduce the base capacitance such as secured with the self-supporting antenna. The guy cables used, even though properly designed, will distort the pattern of radiation and cause losses by absorption and re-radiation of the energy picked up by them. As an example of this type of antenna, consider the guyed-vertical radiator at WLW, which is 831 feet high, 35 feet wide at the 350 foot level, and rests upon a single porcelain insulator which has a pressure of about 900,000 pounds applied on it. The whole tower is held in place by eight 2-inch guy cables, each of which are broken up by seven insulators. These physical dimensions are more appreciative of the design and construction involved in this type of broadcast antenna.

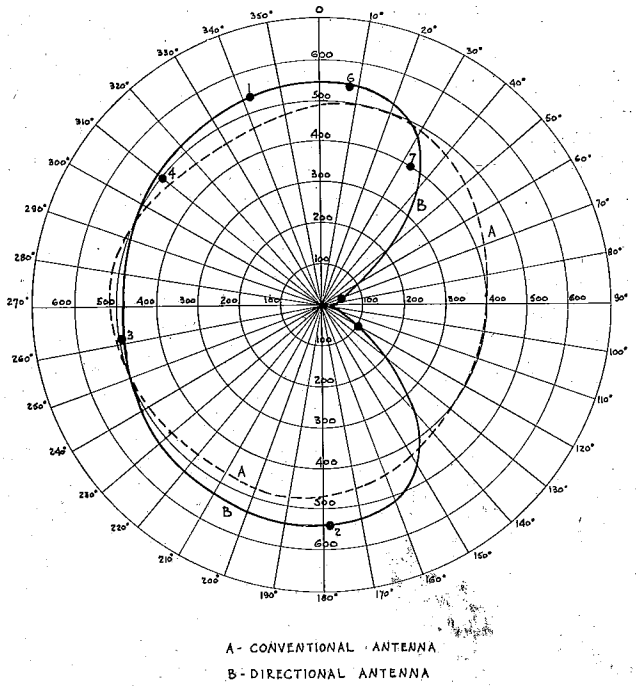
The height of the vertical radiator is determined by the frequency on which the station operates and the conductivity of the earth at the antenna site. The height is determined so as to secure a maximum primary range and as strong a ground wave intensity as possible. The field strength intensity is secured by $E \div \sqrt{P}$, where E is the field strength on the horizon and P is the power that

is being radiated. The maximum intensity was secured where the radiator height was $h/\lambda = .625$, or $h/\lambda = 5/8$ of the fundamental wavelength, and gave a 40 per cent increase over the field intensity secured by a fundamental (1/4 wave) antenna.

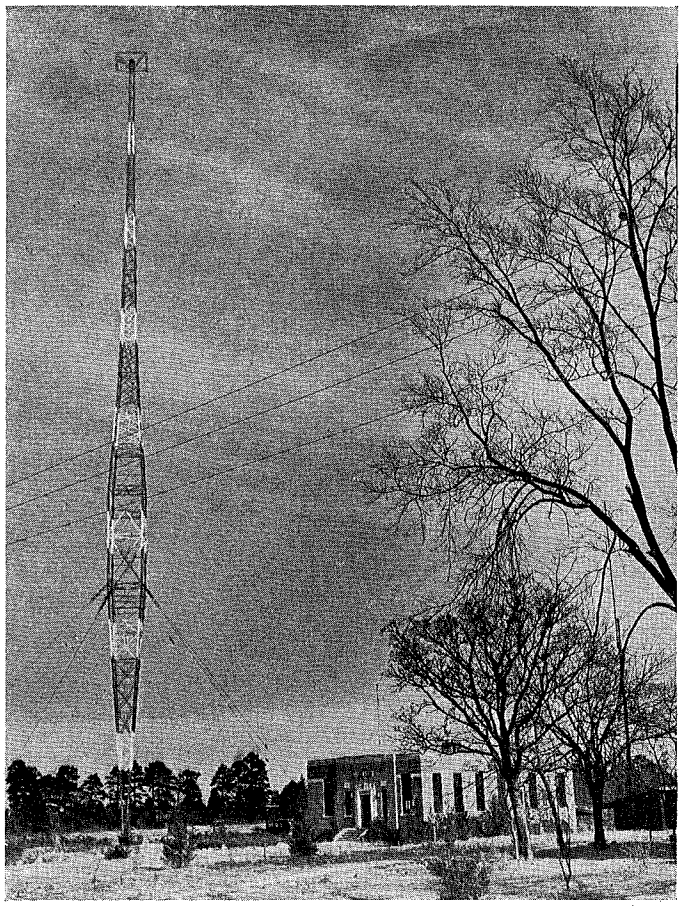
Although the .625 height gave the greatest ground signal intensity, it does not necessarily secure the largest primary service range. The maximum fading-free primary area is secured at lower values of h/λ down to .5, the value depending upon the attenuation of the earth for the antenna location. For the reasonably flat middle western states the earth has a conductivity $= 10^{-13}$ e. m. u. and an inductivity $= 20$. By moving the value of h/λ down toward .5, we also move the voltage node on the radiator up toward the point of guy attachment, thus somewhat relieving the electrical stress upon the base insulator. It may be seen that the frequency, conductivity of the earth, and the desired primary range and intensity must be taken into consideration when determining the height of the antenna.

The ground system of any broadcast antenna is always of the utmost importance and particularly so with the high vertical antennas if the ground resistance loss, the absorption of the ground wave, and the dielectric losses are to be kept at a minimum. The ground system usually consists of a number of wires of good conductance which are buried close to the surface of the earth and spread radially from the base of the antenna for a distance of at least 1/2 the wavelength. The more the radial distance is made, the stronger the field strength will be and, if economically possible, the distance should be made the height of the antenna.

The reflection ability of the ground system within the immediate vicinity of the antenna decreases the sky radiation which interferes with the ground wave and helps produce fading. Hence the ground system must be carefully considered if the maximum primary range of broadcasting is to be secured.



Antenna Radiation Curves



WBT's Guyed-vertical Antenna

Although the vertical antenna is designed primarily to secure a circular field of radiation, it is possible with two vertical radiators, properly arranged, to secure a directional radiation system. This is usually done where it is necessary to secure an increase of radiation in a desired direction or to meet certain interference problems. The curve A is the radiation pattern of a 10 kilowatt transmitter using the conventional type of antenna.

The curve B, in the same figure, is the radiation pattern of the same transmitter but using an antenna system of two vertical radiators which in this case are in line with east and west. It may be readily seen that the decreased radiation in the east, necessary perhaps for interference reasons, was secured very satisfactorily. It seems very likely that, with proper design and installation of two vertical tower radiators acting as a directional system, it is possible to secure any type of radiation pattern provided the earth construction is uniform.

Recently, a test was made using a receiver without automatic volume control which gives satisfactory results when fading does not exceed 6 decibels and a receiver with automatic-volume control which produces satisfactory results when the fading does not exceed 20 decibels. When the vertical radiator was installed at the broadcasting station, the non-fading service for the first receiver was increased 66% while that for the second receiver was increased 168%.

Since the power output of the broadcast stations is regulated by government and economic limits, the installation of a vertical antenna presents a good method of increasing the present service range of the station.

Harvesting Wheat

Five Minutes per Bushel

By Machinery

By Walter Peterson, Ag. E. '36

THE ancient Egyptians found it necessary to engage a young gentleman named Joseph as administrator of their AAA to dole out the supplies of grain during the lean years. Such stringent policies as he had to use would seem very strange to us who are accustomed to having all the bread we want, together with a supply of dainties that Pharaoh himself might have given half his slaves to secure. Much progress has been made since the time of Pharaoh, but practically all of this progress has been made in the past century. An early American farmer would have been perfectly at home with the tools used by the Egyptian farmer of 2,500 years before. One writer has said that a man born at the time of Moses and living untill 1860 would have witnessed fewer changes than he had witnessed in his 70 years of life.

Not only were the tools of agriculture crude, previous to the last century, but farm power was far inferior to that we now have. Crops were mere samples of present production. It has not been long since cows barely produced enough milk for their calves, while a well bred dairy cow today produces far more milk than her calf could possibly consume. If, again, our agriculture could produce only the same varieties of wheat with which the ancient Egyptians had to be content, the farmer would not be getting his present high yields per acre and per worker.

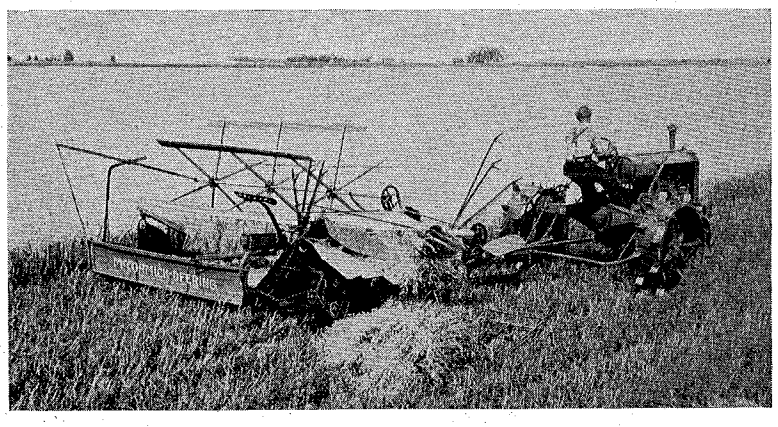
There is no one thing that can be singled out as the most important factor in increased agricultural production; but rather increased production is a result of many improvements in agricultural methods, agricultural machinery, crop varieties, animal breeds, and transportation facilities. There can be little doubt, however, that in the past century the greatest progress has been a result of the introduction of machine methods for farm operations.

The extent to which we have been released individually from agricultural pursuits in the past century is quite striking and perhaps to many, gratifying. A hundred years ago over three-fourths of the population was needed in agriculture to keep people clothed and fed. Today less than one-fifth of the population is required, yet all enjoy better diets than before and there is a surplus for export as well. Since 1850 the number of people gainfully employed in agriculture has doubled only, while the number in all occupations has increased six times and the number in factories has increased ten times.

While changes in transportation have been taking place, there were changes in harvesting and threshing methods which made the increased time available for production even more valuable than it formerly had been. The wheat that granddad hauled he cut with a cradle, not because he had any love for that kind of hard work but because it was the most practical method available to him. If a man had enough fortitude he could in the course of a long day cut about two acres of grain with a cradle, and his wife and older children could bind this into sheaves by equal hours of diligent work.

In 1831 two ingenious men, McCormick and Hussey, invented a machine to take the place of the cradle and transfer most of the hard labor of cutting grain from the family to the family horse. These men worked independently and each developed a machine. There was some controversy about patents and Hussey soon lost his interest in the reaper. The reaper was a simple machine, consisting chiefly of a reciprocating knife and a reel to force the grain against the knife while it was being cut and also to lay the cut grain on the platform from which it was raked by hand in bunches. It was drawn by one horse and operated by two men, one to drive the horse and the other to rake the cut grain off the platform.

The reaper reduced the number of man-hours per acre for cutting to about one-fifth of that previously required, but the binding was still the same laborious task. The reaper did not come into common use for some time after its first development, partly because of unsatisfactory performance and partly because of lack of facilities for pro-



Tractor binder in operation

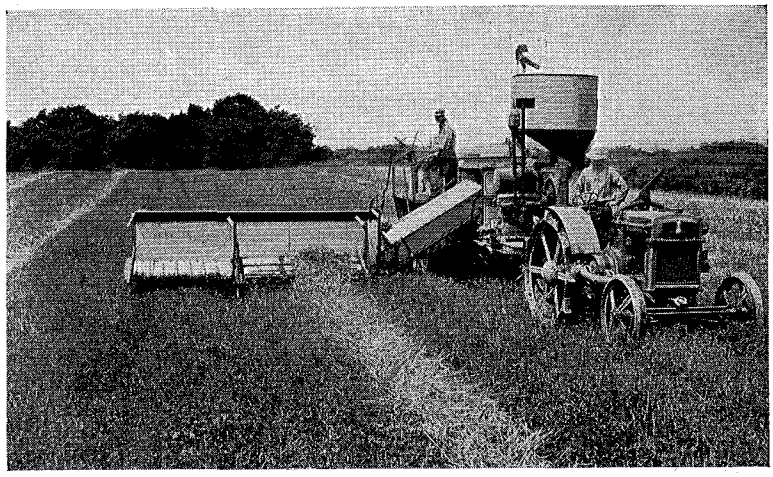
duction in large numbers. Soon after the reaper came into common use, a self-binding reaper was developed which bound the bundles with wire but this never became very popular.

It remained for the Appleby knotter, invented in 1869, to make the self-binding reaper a success. This knotter used twine to bind the bundles and is still the type of knotter used in our modern grain binders. The self-binding reaper has increased steadily in size until it has become a tractor drawn machine capable of cutting a 10 foot swath at 3 to 4 miles per hour. One man with a tractor binder can cut and bind about 30 acres of grain in one day, a marked improvement over the old two acres per day per family.

Threshing by hand methods was even more tedious than harvesting. A man threshing with a flail could thresh from seven to twenty bushels of grain per day. A flail consisted of a long handle with a shorter piece of wood attached to its end by a thong or a rope. The operation of threshing with a flail was to swing it in much the same manner as one would swing an axe and thus beat the grain out of the heads. The separating of the grain from the chaff was done by pouring the grain and chaff from a basket and letting the wind blow the chaff away while the grain fell straight downward. Another old threshing method that spared the farmer considerable hard work without increasing his capacity very much was by driving oxen or other cattle over the grain to loosen the grain from the heads. If a man had enough cattle he could get a little more done this way than he could with a flail, but it was not a sanitary method.

Perhaps the first really forward step in threshing was the horsepower thresher which was powered with eight to fourteen horses. Horses were driven in a treadmill or more often in a circle at the ends of long sweeps connected through bevel gears to the thresher. About sixty years ago these machines were the most common method of threshing but they were not numerous so the threshing season often lasted from early fall until into the winter. A modern farmer would not look with favor upon threshing methods that required rising at 4 or 5 a. m. on a December morning, but at that time it was the "modern" practice.

It was not long until the steam engine was adapted to displace horses as a source of power for threshing. At first the steam engines were not automotive and it was necessary to haul them from one place to another with horses. A little later it was discovered that a simple transmission system would make it possible for steam engines to be moved by their own power. The steam engine did not hold its place in the threshing field much longer than horses had held theirs; it was soon displaced by the gas tractor although it is still used by some threshermen. The gas tractor was better adapted to tillage operations and other drawbar work than the steam engine. As a result of this adaptability it became very popular, especially in the smaller sizes, until it has become the most important source of farm power. The entrance of the small tractor into the farm field has brought with it the small thresher in large numbers until now the threshing season has been reduced two or three weeks and the output per man has increased into the hundreds of bushels per day.



Combine harvester at work in a grain field

The latest advance in harvesting and threshing methods is represented by the "combine," which, as the name implies, is a machine for harvesting and threshing in one operation. The grain is cut with a sickle as in the grain binder, but instead of being bound into bundles it passes directly into the threshing cylinder and is threshed, separated, and delivered to a truck or wagon without the necessity of any manual handling by the operator. With a modern combine it is possible to drive into a 40 acre field of standing grain in the morning and by evening of the same day have all the grain from that field stored in the granary.

In those regions where the combine has proved itself practical it is rapidly becoming the most common method of harvesting and by its use the efficiency of the farm worker has reached a stage that would have appeared fantastic to our grandfathers. A crew of three or four men operating a tractor, a combine, and a truck will harvest, thresh, and deliver to storage from 30 to 60 acres of grain per day.

With the introduction of machinery the time required to produce a bushel of wheat has been reduced from about 3 hours per bushel by the old hand methods, to 10 minutes per bushel with the binder and stationary thresher, or to five minutes per bushel with a combine.

There have also been increases in efficiency in the production of other crops. In 1850 it required 34 hours to take corn from one acre. In 1935 this has been reduced to 7 hours and in some cases to 5 hours. In the production of cotton, progress has been more moderate, the change being from 148 hours per acre in 1840 to 100 hours in 1930.

There is still room for improvement in many farming practices. There is encouragement in the fact that one farmer is now able to supply the food needs of 20 people, whereas a farmer of 1850 was not much more than self-sufficient. This figure may be increased from time to time. How many people one farmer will be able to feed when his farm becomes completely mechanized would not be a safe prediction to make. In view of recent progress such an estimate would very likely be too low. There can be no doubt that the 20 per cent of the population now engaged in agricultural pursuits will be more than sufficient to supply all our needs in the future.

The MINNESOTA Techno-Log

MAY, 1936

The Last Word

TO THE succeeding editor of the MINNESOTA TECHNO-LOG I present my congratulations. I know that he will carry out his duties in a commendable manner and will maintain the high position and prestige which preceding editors have worked so hard and so long through the past forty-three years to build up. To the students, I urge that every support be given to the new editor. His job is not a soft one. He must be ringmaster of a three-ring circus. He must constantly strive to produce the best magazine with a minimum of money. He must be the battleground on which editorial policies are fought out. And he must have the answer to everything. When some part of the work is not done or is done improperly, there is no one to whom the editor can pass it. So encourage him in his efforts, bear with him if he makes errors, and present him with compliments if he so deserves. His lot is not easy.

To the remainder of the staff I extend my appreciation for the cooperation which has so whole-heartedly been given me this year. To Bob Teeter, Fred Meyers, Don Erickson, Carl Edstrom, and to Ruth Bell, our secretary, goes the credit for having been the backbone of the editorial staff.

To Bob Dixon goes a great deal of credit for his able handling of the ever-present financial problem. The magazine financially is now definitely on the upswing. To him and his staff, Elwood McGee, Armon Walters, Don Raudenbush, Lloyd English, Richard Pratt, and Ray Hopper, congratulations.

During the past year I have enjoyed my work with the magazine greatly. There have been some disappointments. But every editor has great plans when he opens his desk in October; and, in the course of a year, many of them are doomed to be somewhat battered when he closes it in June. However, the experience gained is invaluable. Problems never brought up in the classroom or written in books are met and dealt with. It might be an interesting sidelight that all of the seniors now working on the TECHNO-LOG, four in number, have been offered and have accepted jobs.

And so I close my desk.

—*Wayne Stone.*

At the Desk

THE most famous of our instructors, Dr. Jean Piccard, this month favors us with an article, "Why Do We Go to the Stratosphere?" It is the introduction and conclusion of an illustrated lecture that he gave to the freshman Orientation class recently. The cover picture shows the balloon being inflated in which Dr. and Mrs. Piccard ascended to the stratosphere from Dearborn, Mich.

Look at that frontispiece again. There in full blossom are the faces and life histories of the present and succeeding editors and business managers.

A technical article on the Vertical Antenna is the contribution of Fred Hager. A vertical antenna is equal to doubling the power of the station, claims Fred.

"Five Minutes per Bushel" is the title of an article by Walter Peterson on page 170. He reviews the history and growth of agricultural methods for us.

A short on the new buildings on the campus, the regular Progress page, Alumnotes, "Now Here's a Book," news page, and Stray Scraps complete the issue.

The First Word

TO STUDENTS and faculty and alumni, next year's heads of the TECHNO-LOG send a call for contributions, new staff members, and student loyalty. We would like to hear criticisms by which we may govern ourselves in planning for another year.

Every student, alumnus, and faculty member of the Institute of Technology is invited to present papers for publication, as they have always been welcome to do. In your work or travel this summer, keep a record of interesting places, and interesting engineering developments you see. If not, let us have access to your findings.

On the editorial staff there is room for many new staff members. Out of town students should try to join us during Freshman Week, but, better still, the new editor will attempt to keep the office open for consultation throughout the spring and part of the summer. Major appointments will be made in the fall.

The business staff of the TECHNO-LOG offers an excellent opportunity for technical students to obtain experience in meeting business men. Technical graduates are often said to be lacking in a knowledge of general business methods. So, future engineering executives, don't pass up a chance to be on next year's business staff.

A staff much larger than the present is desirable to carry out the work in the most efficient manner. There will be a need for a half dozen advertising salesmen, collectors, bookkeepers, survey managers, secretaries, typists, etc. Besides these there are many miscellaneous jobs. As it will be necessary for some work to be done previous to the start of school next fall a meeting will be called within a short time. When it is made be sure to be on deck. Remember every staff member will have an opportunity to become a future business manager.

—Robert Teeter and Elwood McGee.

Now Here's A Book

By Clifford I. Haga

Instructor in English

BERNARD JAFFE's "Outposts of Science" is the best book I have reviewed this year. In its class, popular science, it is one of the best that has appeared since E. E. Slosson's "Creative Chemistry" of a dozen or more years ago. Ingeniously planned, soundly developed, well-written, it is singularly successful in the completeness with which it fulfills its promise: to give the intelligent, interested layman a picture of the present status of half a dozen major branches of the physical sciences in some thirteen specialties. I speak of its competence with apparent authority because the tone and quality of the book are such as to make confidence contagious—it exudes reliability.

Why does it give an impression of authority and reliability so convincing that even a layman feels no impertinence in praising it for those qualities he cannot be expected to evaluate professionally? Its plan of organization is one answer, and the manner of executing that plan is another. When Jaffe, who is a chemist, started the book, he knew, of course, that he had at best only an intelligent ignorance of the intimate problems of the other sciences. But he was willing to risk the hazards of exploration. First, with the help of other scientists, he picked out the branches of science to which America is making the greatest or the most spectacular contributions. There were thirteen: genetics, anthropology, medical research, cancer research, endocrinology, psychiatry, nutrition, economic entomology, atomic physics, radiation, astrophysics, weather-forecasting, mathematical astronomy. Guided by this list, he read as much as he could understand of these things, haunted the laboratories and observatories where the work was being done, hounded the leading research men and pumped them—and then wrote his book. Finally, he sent each completed chapter to the leading men in its subject for thorough criticism and revision. Such a plan faithfully adhered to should produce an authoritative and reliable book. I think it has done so.

But it is not a heavy or sluggish book—Jaffe writes too well for that. Those who read his "Crucibles" of six years ago know the quality of his style. He is animated, clear, rapid—without looseness in word or thought. In addition to these normal virtues of the good expositor, he has another literary talent: narrative ability of a high order. He can tell the story of an experiment or a series of tests in such a way that we not only get some satisfying glimpses of the scientific principles involved but we also receive something of more enduring value: an illuminating insight into the purely human values of science as they are represented by the character of the individual scientist. We learn what was discovered and how it was discovered —and we learn something of the humanity of the discoverer.

As a study in human character, Jaffe's "Outposts of Science" is fully as enlightening as in its ostensible purpose. In a world of turmoil and irresolution whose superficial social and economic maladjustments seem to have corrupted our moral and intellectual life, both individual and communal, there remain few havens of integrity, humanity, serenity.

Integrity, humanity, serenity—those seem to be the common qualities of the men Jaffe writes about. To learn to know them through their work is to accept a higher standard of human character than that set by the famous or notorious ones shouting at us from the front pages of our newspapers. In the Twentieth Century, in our generation, today, there is in the world of science more of the best in man than in any other world.

You will get from "Outposts of Science" a wealth of facts—and, if you are lucky, a lot of morality. Both are useful.

"never-ending Progress to perfection"

Hydrogen-cooled Generators

THE first hydrogen-cooled turbine generator ever to be made is now under construction at the G. E. laboratories. It is a 40,000 KW unit, and will use steam at 1,250 pounds pressure and 925° F. Operation is at 3,600 rpm, made economically possible only by such a method of cooling. Air cooling would give greater air friction and rotational losses, which are reduced 90% by hydrogen. Efficiency is thus stepped up about 1%. Hydrogen requires considerably less pressure to circulate the necessary volume, and has many times the thermal conductivity of air. Although its use results in a slight increase in capacity for a given physical size, the electrical characteristics still determine the capacity of the unit. Because of present costly construction it cannot be justified in the smaller sizes.

Two-Row Airplane Motors

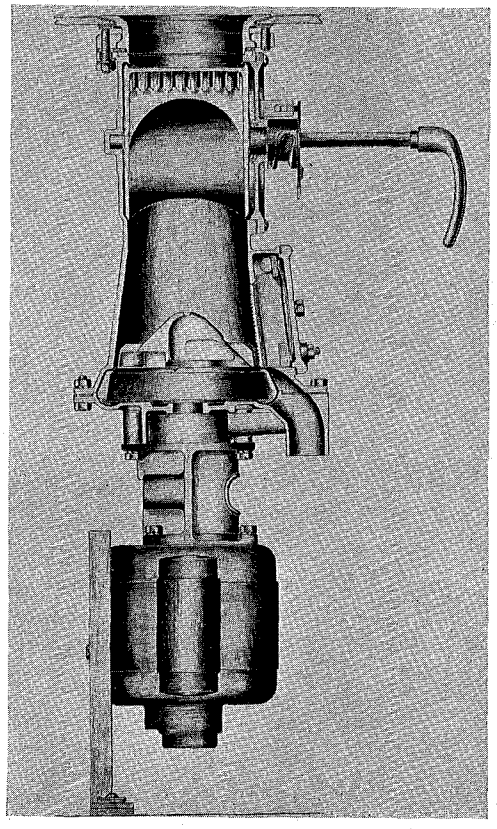
BECAUSE it has long been felt that more efficiency could not be gained by increase in the number of cylinders in a row, experiments recently resulted in the building for the U. S. Navy of a 14 cylinder radial air-cooled aircraft engine by Curtiss-Wright Corp. This engine is rated 765 horsepower for take-off with an altitude output of 700 horsepower at 7,000 feet. It incorporates many of the features of the Wright Cyclone, among these being the dynamic vibration damper, full pressure baffles, mechanism for the operation of a controllable pitch propellor, an 11 inch super-charger, and a simplified accessory section consisting entirely of spur gears. A peculiarity of the new motor is that its tone is the deepest-throated roar that any of the test aviators have heard, actually jarring them all over. The U. S. Navy likes the 2 bank motors so well that they have forbidden any to be sold to foreign countries.

Waste Disposal Unit

A QUARTER-horsepower motor drives a new grinder which quickly gets rid of kitchen waste. Most of the housing is of zinc alloy, characterized by tensile strength and surface hardness and corrosion resistance. The first shredder element is of cutlery stainless steel, while the lower is of Carboloy, a material which approaches the hardness of diamond. Du Prene, used as sink gaskets, is an artificial rubber with ability to withstand the action of oil and grease. This unit will grind all materials up to the hardness of bone. Without modern metallurgy, such a unit would never have been possible.

New Reflecting Aluminum

SILVERED glass and silvered brass are now being replaced by a newly treated aluminum which increases its reflectivity from about 70 per cent to 85 per cent. An anodic electrolytic brightening treatment is responsible for this increased brilliancy. This treatment is just the reverse of the ordinary plating effect. The current, which is sent through the treating tank, is opposite in direction to that which would be used for ordinary electro-plating. The nature of the bath is such that a hard oxide coating is formed which causes substantially no reduction in reflecting efficiency and is resistant to weather. The Alzak process is now doing this commercially to the satisfaction of the world's most foremost lighting engineers. This new aluminum will find increased application in the field of astronomy, where it replaces silvered glass.



New Grinder

—Courtesy Machine Design

Six New University Building Projects In Various Stages

(A résumé of the year's building at the University)

SIX buildings or additions to buildings are in various stages of completion on the campus. Largest and most noticeable transfiguration of the skyline is being made on the site of the Old Parade grounds, where the Adult Education unit's superstructure is fast rising. On the northwest edge of the campus the Women's Gymnasium is being finished, while on the opposite side final inside work as well as outside landscaping is nearly complete on the Intramural Athletic Building. Across University avenue the storehouse has grown another story, and in the medical group, the psychopathic ward has been added as a "penthouse" structure on the hospital. Farthest from the immediate campus will be the new hydraulics laboratory, soon to be an important part in the housing of experimentation at the Institute.

The Adult Education Building will be completed for use fall quarter. It is being built up rapidly, as the concrete has already been poured for the ground floor and foundation, and the steel I-beams have been placed for the next floor. Construction has been speeded by having workmen go ahead on several different parts of the project. While some are working on completion of the main floor, others are already going ahead with superstructure work. Meanwhile the branch from the heating tunnel has been nearly completed by men working 101 feet underground.

The two sports additions have been practically completed, giving the University an athletic plant unequaled and giving coeds their long awaited new gym and swimming pool.

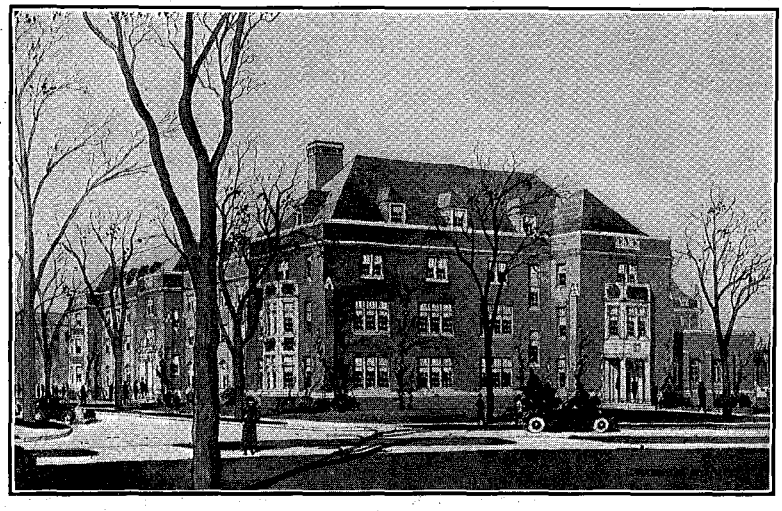
Delayed like several of the other projects by inclement weather, the fourth story addition to the storehouse and the new elevator installation have passed the half-way mark.

Put off even longer because steel for the roof house was not available over a period of three weeks, the psychopathic ward went into faster construction the first of this month. It is the third in a series of roof structures to be added to the hospital unit, their serviceability having been proven practical and simple additions to the already large building.

Under Professor Straub's direction, as designing and supervising engineer, work on the hydraulics lab on Hennepin island has been thrown on three full shifts. The structure will be complete for advanced class work and research in the fall. The main building will have three stories; the first two are now in process, office space to be provided on the third when funds are available for its addition.

These buildings are being built partly from University funds and partly from WPA funds. Workmen are from the WPA and engineering firms are doing construction by contract.

Soundings have been made this spring for the University's connection to the Metropolitan sewage disposal system, but no work on that project has started yet.



The Adult Education Building

ALUMNOTES

THE Aeronautical Alumni of Minnesota in Los Angeles believe in coöperation in solving their mutual problems of work and pleasure. Getting ahead in any job today is difficult to say the least, so the boys from Minnesota have organized the Minnesota Alumni Association for Aeronauticals in Los Angeles. The members to date are: Fred Boeke, John A. Makers, Frank W. Murphy, Nick Napavance, Raymond J. Kochevar, John Brueckner, Roy L. Thompson, Richard Pribil, Bill Zehnder, all working for the Douglas Aircraft Corp. Stanley Uye of the Northrup Aircraft Corp., and Walter Aspivak of the Lockheed Aircraft Corp. are also members of the association.

'10 **Don Westbrook,** M.E., is General Manager of the Canadian Pneumatic Tool Co., Ltd., of Montreal. Don was here for a visit a short time ago. He has three children, all girls.

'15 **Roy O. Dunham,** E.E., has been with the General Electric Company at Schenectady for twenty years and is at present in the marine and aircraft division.

'20 In the personnel department of the Aluminum Company of America at Pittsburgh is **M. M. Anderson,** Ch.E.

'24 **T. F. Schilling,** E.E., is with the Cleveland Gas Company at Cleveland, Ohio.

Getting up in the world close to home is **Manley A. Monsen,** E.E., who is now superintendent of the operating department of the Northern States Power Company in the Red Wing District.

'26 Of the '26 M.E.'s, **C. E. Comfort** is superintendent of shops at the St. Paul Structural Steel Company; **C. H. Fornfeist** is a development engineer with the Peoples Gas, Light and Coke Co. of Chicago; **George W. Mork** is engineer in charge of drag, bucket and dipper division, Bucyrus Erie Co., South Milwaukee, Wisc.; **Harold E. Rollin,** chief draftsman, Pioneer Gravel Equipment Mfg. Co. of Minneapolis.

'27 **Ralph B. Evans,** M.E., is with Fairmont Railway Motors Company, Fairmont, Minn., and **Paul A. Giessel,** also M.E. is a designer at the Pioneer Gravel Equipment Mfg. Co. of Minneapolis.

'30 **Charles L. Meyette,** Ch.E. (M.S. '33), is now working for the Illinois Steel Company at Gary, Ind.

More M.E.'s. **Gordon Conrad** is assistant superintendent of steam and transportation, Minnesota Power and Light Co. of Duluth. Gordon is married and the family now numbers three.

Ralph Baskerville and **Dick Guppy** are back again with the General Electric Co. of Philadelphia. **Ellwood Johnson** is assistant mechanical engineer of the Morrell Packing Co. of Ottawa, Iowa. **Bill Reichow** was in Minneapolis with his wife in April. He is in charge of the Brown Instrument Company office at Kansas City, Mo.

'31 **H. B. Pittelkow,** Aero, has been assigned to the St. Paul District as traffic representative of Northwest Airlines.

'32 **George Michaelson,** Ch.E., left a few weeks ago for Baton Baton Rouge, La., where he has been employed by the Standard Oil Company. George almost beat Old Man Winter out of the state.

Maurice G. Larian, who took his Ph.D. here after taking his other degrees at our neighboring university at Ames, Iowa, has won an assistant professorship at Michigan State College, Lansing.

Maurice King, C.E., is in charge of biological, bacteriological and chemical research of Berth, Levi and Company, New York. They manufacture sausage casing and allied products.

Of the M.E.'s **George Millman** is with Payne Furnace and Supply Co. of Beverly Hills, Calif. **Harold Anderson** is in the steam turbine division of Allis-Chalmers of Milwaukee. **Donald B. Elfes** is working in the research laboratories of General Motors of Detroit. **Forton Christoffer** graduated from the Harvard Business School and is now with the Cincinnati Milling Machine Co.

'34 Aero **Therman Erickson** has been assigned to the position of assistant division superintendent of Pan American Airlines in Rio de Janeiro. **Harold Anderson** is with Douglas Aircraft. Electricals, **P. A. Beckjord** is with Westinghouse Electric, **M. W. Kernkamp** is at Minneapolis Honeywell Regulator Co., **Ivar S. Pearson** is employed by General Electric.

'35 **Theron A. Loveland,** Ch., is working for Frank Buck, the animal trainer. He recently came to the Twin Cities in charge of an animal show presented at the St. Paul Auditorium.

William Borgum, C.E., is tunnelling for the Minneapolis-St. Paul Sanitation project. **Leonard Willis,** M.E., is with the Lyman Refrigerator Company of Minneapolis. **E. H. Hovemeyer,** E.E., is working for the General Electric Company at Erie, Pennsylvania.

Orville J. Sather is an operator at WCCO; **Clyde A. Russ** is employed by the Minneapolis Street Railway Company. **John J. McGlone** is with the Bridge Operators Engineering and Inspection Bureau, Minneapolis. **Edward Laakson** is a reserve aviation cadet at Pennsacola.

Charles J. Pointer, December Chem. graduate, is now working for the Socony Vacuum Oil Co. of Augusta, Kansas; **Gordon Bendix,** Chem., is with the Continental Can Co. of Chicago; and **Charley Ender,** Chem. Engineer, is in Wilmington, Delaware, with the Hercules Powder Co.

...but the squirrels were disgusted

TELEPHONE engineers had to find a way to stop gray squirrels gnawing holes in the lead sheath of telephone cables. Even a tiny hole may let in moisture—short circuit the wires—and put a number of telephones out of service temporarily. ¶ Many ideas were tried, but the squirrels gnawed on. Finally the cables were painted with black asphaltum and sprinkled with sand. The gnawing stopped. ¶ Not a major engineering problem, to be sure. But thousands of strange *little* problems, too, have been solved in order to assure you the world's fastest and most reliable telephone service.

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BELL TELEPHONE SYSTEM

Four Student Prize Papers Presented at Electrical Meeting

After a dinner meeting at the Union on May fourth, the A. I. E. E. student branch and Minnesota section adjourned to the auditorium of the electrical engineering building for a presentation of four selected student papers. Each year the Minnesota section offers prizes for the winning papers, and this year offered four prizes of fifteen, ten and two of five dollars.

The first speaker was Russell Nielson, and his subject "Operating Characteristics of the Type 885 Tube." This paper was highly technical, but only occasional references were made to the paper during the thirty minutes he spoke. Charles Stienmetz next spoke on the "Factors to Consider in Designing Automobile Headlamps Today." The dissertation was illustrated by slides.

William Brastad, chairman of the student branch, and Albert Oswald coöperated in presenting the paper and slides on the "Telegraphone." This machine records sound on a steel tape by means of two magnets which magnetize the tape by means of change of potential through the microphone. It was invented by Valdemar Olson, in Denmark, and has recently been introduced into this country. To supplement the talk, they brought along one of the machines, and showed how it worked. The "Cathode-ray Oscillograph" was the title of the next article, presented by Hugh K. Liang. He illustrated by means of diagrams drawn on the board, and an oscillograph.

Presentation of the prizes was made immediately afterward, first prize of $15 going to R. Nielson, second to H. Liang, third to A. Oswald and W. Brastad, and fourth to Charles Stienmetz.

6 Students Elected To Eta Kappa Nu

The officers and members of Omicron Chaper of Eta Kappa Nu, honorary fraternity in electrical engineering, have pledged six new members, who will shortly be formally initiated into the fraternity. Five are members of the junior class in electrical engineering, who are to become active members; one a member of the faculty, who will become an associate member.

The pledges are: J. Dean Johnson, Robert S. Lind, Donald H. Raudenbush, Vincent N. Stewart, William C. Weist, and Professor L. C. Caverley, M.S. (E.E.).

Eta Kappa Nu fraternity holds meetings several times a month with the purpose of stimulating the interest of its members in electrical engineering. Election is on a basis of scholarship, character, and a manifest interest in the subject of electrical engineering.

Senior Mechanics Attend Convention

Thirty-three members of the senior mechanical class spent a week last month attending an A. S. M. E. convention and making inspection trips in Chicago and Milwaukee. Helge Victorsen presented his paper, "Journal Bearings," at the first session of the convention on Monday morning.

Glenn Seidel served as master of ceremonies at the banquet and entertainment in the evening. The group visited the Stewart-Warner, Illinois Steel, Elgin Watch, and the State Line Power companies in Chicago, and A. O. Smith and Allis-Chalmers companies in Milwaukee.

The A. S. M. E. annual picnic is being planned for Wednesday, May 27. William Becker and Tom Cooper have been appointed co-chairmen for the picnic.

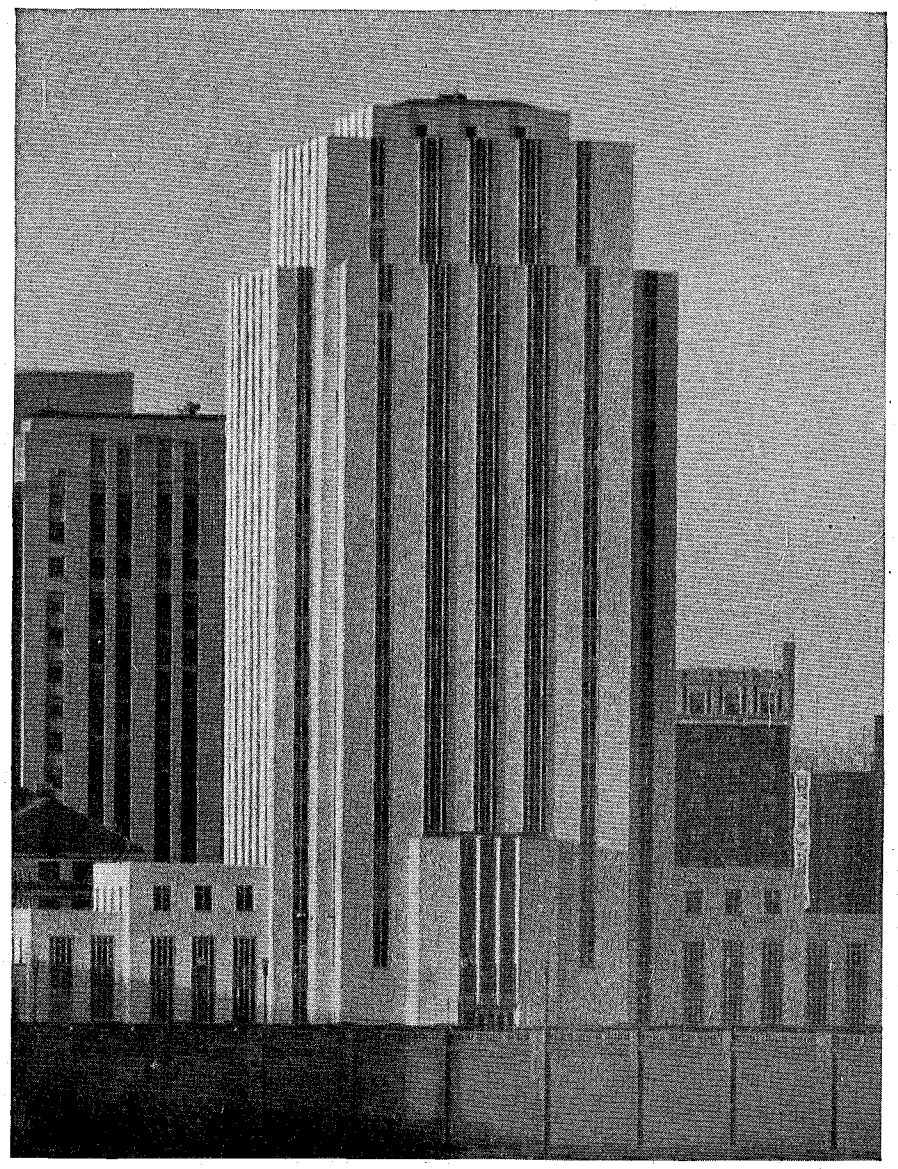
REVERBERATIONS of Engineers' Day—It was rumored that St. Pat rolled over in his grave a few times when he learned that the Andersons and Hansons were leading the parade in his honor. It is certain he will see that the reign of St. Pat returns again next year into the custody of the Civil Engineers where it belongs. There was one embarrassed engineer in the parade who accidentally lost his trousers when his float, the "Physics Lab," passed the Varsity Cafe with all the beautiful coeds in attendance. We have an idea that Pete Lohman might know something about the dummy that was found swaying in the breeze atop the Electrical Building's radio tower one morning. It was reported that almost every senior engineer voted in the election for St. Pat—even when a lot of them were away from school. Those Mechanicals certainly didn't miss anything when they went out to win the election.

It looks like John Lindstrom will be the last president of the Architectural Engineers' Last Man's Club, and to him will go the honor of opening the bottle of glue, symbol of the club, for sticking around after all the others have graduated. The janitors of the Main Egineering Building were the guests of the Civil Engineers at their beer party Engineers' Day, and it looks as if a tradition has been instituted for they all report that they will be first when the boys line up at the beer keg next year.

Our nominations for the winter quarter's scholastic hall of fame are the following boys, the only ones who received all A grades in the Engineering College. Arnold Matthies, Albert Oswald, seniors; Orville Becklund, Robert Lind, Juniors; Howard Daniels, sophomore; and Kenneth Sorenson, freshman. Deep in the recesses of the Electrical Building we uncovered this bit of a tale about one Sid Schulz of the Electricals, who it seems two years ago was a boy that any mother could be proud of. Today the notorious reputation of his dead ancestors completely dominates him. His reputation is not, however, as some nurses would like to suppose, confined to the Nurses' Home alone. In fact, Sidney has earned many nicknames, among his latest being "Two-Timer." This he earned last Valentine's Day when he sent each of two members of the fair sex a candy heart and enclosed a card in each upon which he had written "To my one and only." The receivers of the candy hearts were completely convinced by Sidney's winning smile and soothing voice. His phenomenal success led him to broaden his scope and a third party entered into his life. But his success was not to last; his continually worrying about the triple life he was leading resulted in one of his lady friends missing her train home. But Sidney being a man of the world soon forgot about this and within a week's time he was found conversing on the phone with another girl in south Minneapolis.

Swan song—all bad things must come to an end, so we take our leave with the best of memories and a couple of libel suits for having overstepped our limits. We have appreciated all the contributions and criticisms and hope that you received as much enjoyment reading our column as we had in writing it.

—Neil Herman.



The Twin Cities and the Great Northwest

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G-E Campus News

"DON'T TALK BACK"

YOU can't argue with an officer. One G-E engineer learned the truth of this modern proverb when he was detained by Panama Canal authorities and the radio tubes he carried were impounded. The officers were convinced that the unfamiliar objects were bombs. And when an officer has made up his mind, that settles it. The tubes were carted away.

Some years ago, I. R. Weir, of the General Electric Radio Engineering Department, was en route to Tegucigalpa, capital of Honduras, Central America, to install a radio transmitter. He carried with him two of the first large, part-metal radio transmitting tubes which had been developed by General Electric.

"Upon arriving at the Panama Canal," he relates, "I was surprised to find that I was detained for investigation on suspicion of carrying bombs. After much argument it was decided that I should have to leave my radio vacuum tubes in the ammunition dump during my stay in the Canal Zone."

CLEAN DIRT

SOAP and water will still be needed to clean Junior's face and hands, but if Junior's father is a florist he will welcome this clean dirt.

Florists and specialty growers wage a never-ending battle against weeds, insects, and plant parasites which flourish in greenhouse soil. But reinforcements have arrived. Clean dirt may now be economically obtained by means of electric equipment developed by General Electric scientists.

Electric heating units, arranged in a wooden bin, heat a quantity of soil to a temperature of 160-180 F. Heating sterilizes the soil by a process which resembles the pasteurization of milk, and weed seeds, insects, and fungi which are dormant in the soil are killed during the sterilization process. In the resulting germless dirt, plants can attain a vigorous, uniform growth, free from the competition of weeds and the inroads of other plant enemies.

"AH, WATSON, AN INDUSTRIAL CRIME"

THE "corpus delicti"—a broken resistance wire; the suspect—a defect in the wire; the detective—a microchemist. With microscope and analytical apparatus of incredibly small dimensions this industrial superdetective finds tiny crystals of sulphate near the break. The trail leads to a nearby furnace giving off sulphurous fumes. Thus the wire is cleared of suspicion of having been defective, and the criminal fumes are eliminated.

This analysis is typical of many industrial "micro-mysteries" that have been solved in the Research Laboratory of General Electric. A development from methods devised in the fields of biology and medicine, microchemistry has become an indispensable servant to industry, with accomplishments as great as the quantities with which it deals are small.

With thimble-sized beakers, and test tubes as small as 1/50 of an inch in diameter, the microchemist analyzes quantities of material 17,000 times lighter than a drop of water. He has defined a new unit of mass, the gamma, one millionth of a gram. A streak of dirt, a smudge, a minute pit mark—all these can be taken into the laboratory with a reasonable assurance that the microchemist will be able to provide the answer to the problem.

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