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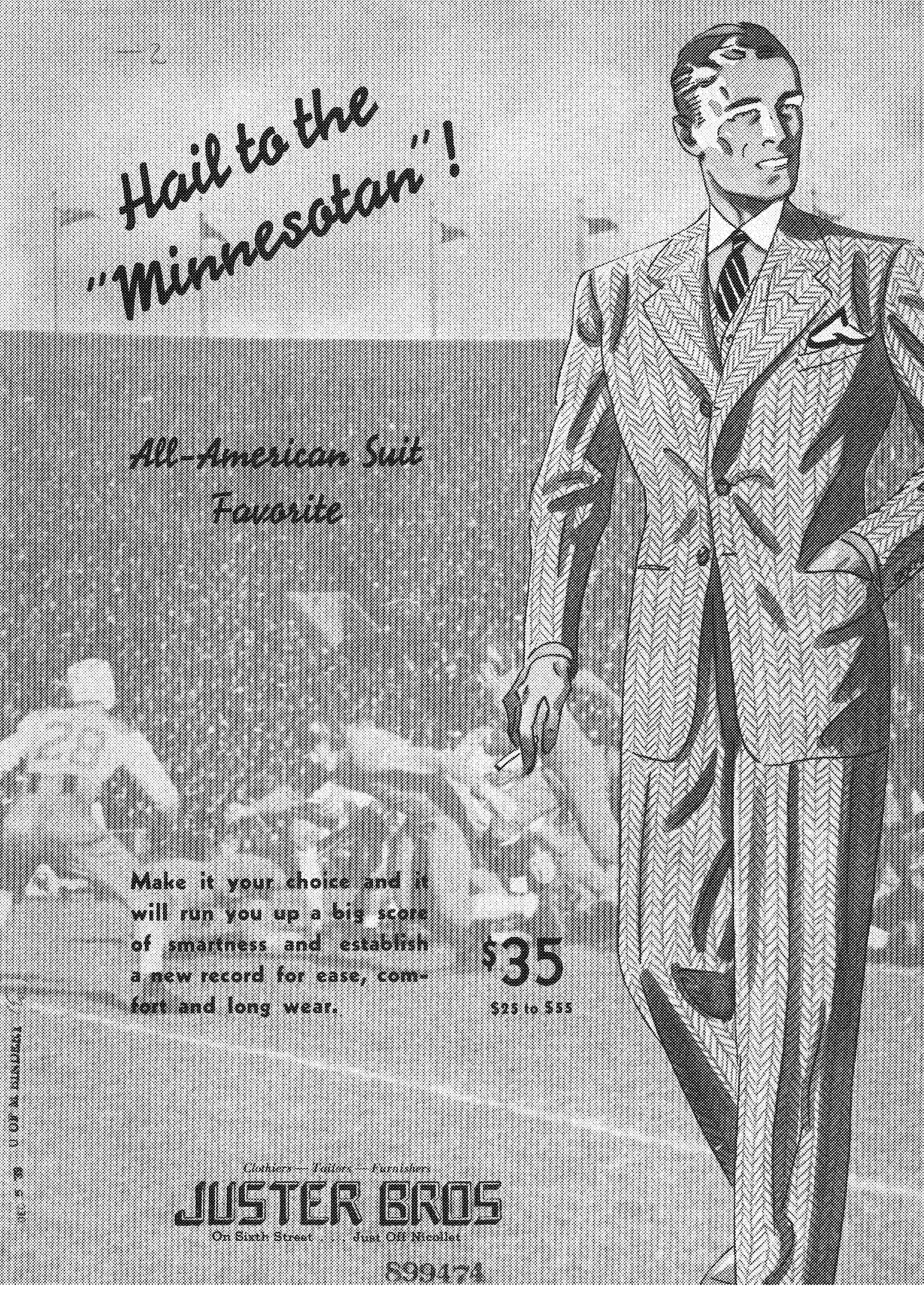
OCTOBER 1937

MINNESOTA TECHNO-LOG



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Minnesota Techno-Log

Volume XVIII 37 Electrical Engineering Building, University of Minnesota, Minneapolis Number 1

ERLING HELLAND, Managing Editor WARREN WALEEN, Business Manager

Published Monthly
from October to May

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This Month . . .

The cover photograph on this first issue of the new school year depicts an object familiar to Mississippi river navigators, the river channel guard. These signals, painted white and illuminated at night, stand about ten feet above water level along the shore and are placed so that straight lines connecting them lie along the course of designated channels. Each marker also bears a number indicating the mileage northward from Cairo, Illinois. The photograph, which we believe to be exceptionally good, was taken by Sig Jacobs, research assistant in chemical engineering.

The cover itself was designed by Francis Meisch, Arch. '38, Idell Hillman, A. '39, and Elaine Hanson, A. '39.

Elwood McGee spent the summer circulating between Edina and the St. Paul post office where he worked in the aerial photography division of the Minnesota Agricultural Conservation Commission. This month he writes the lead feature article, a description of the tremendous aerial mapping project that is being undertaken by the Federal government.

Of interest to engineers and laymen alike will be Ralph E. Flanders' 'The Engineer in a Changing World." Mr. Flanders has been active and well known in industry and in engineering and sociological organizations.

We suggest that not only freshmen, but all Technology students, read Dean Lind's welcome to the class of '41.

The University's high voltage laboratory, under construction behind the Physics building, and the research for which it will be used are described in "Tagged Atoms."

Other features that we feel will be of interest are the news items, Mr. Haga's ever-appreciated book review columns by B. H. T. L. and Bill Lowe, and an article describing developments in research and changes

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MEMBERS OF ENGINEERING COLLEGE MAGAZINES ASSOCIATED

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1937 E. C. M. A. Convention

Minnesota TECHNO-LOG Host to this Year's Conclave

"Member of Engineering College Magazines Associated"

You who have been reading the TECHNO-LOG for one or more years have undoubtedly wondered at, or at least noticed, this phrase on the contents page of your magazine. Perhaps very few of you who are not on the staff realize what this membership means, or are aware of the part it plays in bringing you each month of the school year a representative college magazine.

What is E. C. M. A.? How does it help to bring you a better student publication than you otherwise would have? Questions such as these will come more to the fore with the holding of the seventeenth annual convention of Engineering College Magazines Associated on our campus October 28 and 29.

E. C. M. A. is an association of engineering college magazines published in leading United States technical schools. Representation extends from the Atlantic to the Pacific coast, as you will find from an inspection of the membership roll printed on the contents page of this issue.

The association was organized shortly after the world war to improve the quality of engineering student journalism, to increase the amount of national advertising available to technical school publications, to bring about greater economies in advertising solicitation and handling, to provide a more convenient means of contact between the student publishers and the advertisers, and to serve as mechanism for the exchange of knowledge and experience between the staffs of the various magazines.

The association has been highly successful in all that it set out to do and is becoming more and more favorably recognized as a responsible and important publication group. It has brought about a needed standardization of page sizes, and it has helped hundreds of student editors and business managers in their efforts to produce purposeful, attractive magazines on sound financial footings. It has published and revised from time to time handbooks, stylebooks, and standards of practice for the use of student staffs.

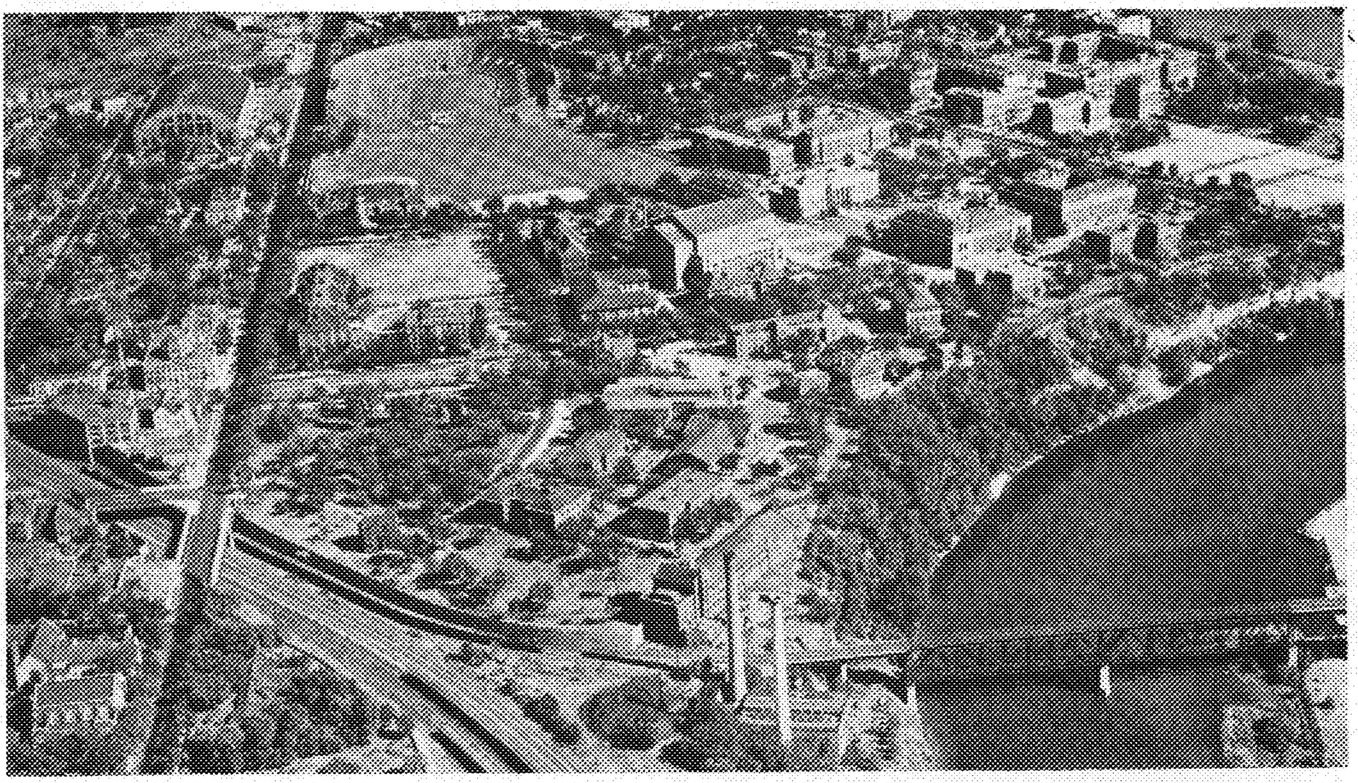
Each month, member publications receive expert criticism and ratings that enable staff officers to judge the success of their efforts and that serve to spur them on to still greater improvement.

Each year, delegates from the various magazines making up E. C. M. A. assemble on the campus of one of the member periodicals for a two-day convention to discuss current business and editorial problems, to listen to nationally known engineering journalists, to take care of routine organization business, and to make awards of merit to member magazines for outstanding work in a number of classifications, such as covers, editorials, and illustrations.

Because of the efforts of the Association and because of our membership in it we are able to bring you a better magazine at a lower cost than would otherwise be possible, and to offer engineering students better training in journalism and business.

When the delegates from other campuses arrive at Minnesota they will be identified by badges. Let all of us who are students in the Institute of Technology do our best to make our guests feel at home, to show them true Minnesota hospitality.

An aerial view of the University campus, scene of the seventeenth annual convention of Engineering College Magazines Associated.



From 14,000 Feet

By Elwood McGee, C. E. '38

The Rod and Chain men are taking to the air and snapping pictures, combining two more arts to give us as fine a map as we may ever hope to have. A series of pictures of the terrain below, blended together, accurately portray what transit and compass cannot, over flat and especially impassable regions.

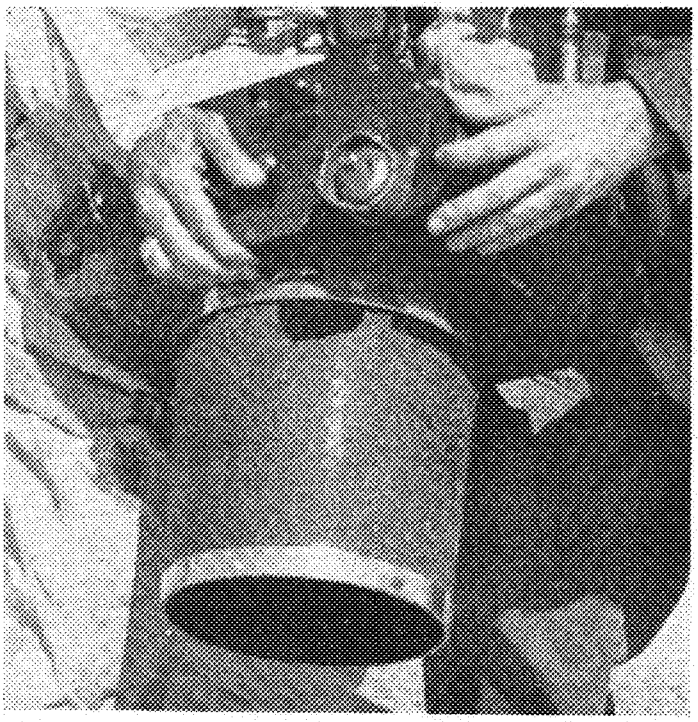
THE replacement of "old dobbin" by the streamlined automobile has always seemed logical; but when a bicycle wheel is chased into antiquity by an Eastman K-5 Aerial Camera—well, that is something. The aerial photography now being used to measure acreage of farm fields under Agricultural Adjustment Administration soil conservation contracts is both more accurate and less expensive than the old method of running bicycle wheels around the outside of the fields, determining the number of square bicycle wheels in each field and converting that into acres.

The aerial mapping program launched in the 48 states this summer by Uncle Sam under the Soil Conservation Act is the largest project of its kind ever attempted anywhere. This year airplanes will have flown over nearly 500,000 square miles of agricultural land in the United States. An equally large program is being planned for next year, and it is anticipated that within five years every field, farm dwelling, highway, and creek in the vast area of America's farm land will be recorded on photographic film.

Although no one has ever claimed that Jersey cows can be distinguished from Holstein cows from three miles in the air, the detail recorded on the 7x9 inch aerial print is amazing. Each field boundary, road, lake, and ditch is recorded in its exact position on the ground. Even underground tile lines can be traced at times. The camera cannot, of course, see underground. This accomplishment can be explained by the fact that the intensity of light reflected from the soil is affected appreciably by its moisture content. Super-sensitive panchromatic aerial film then records this variation in intensity of light reflection, and the line of moist soil appears on the print. While it is not possible to tell from the picture the kind of crop in each field, certain groups can be distinguished from others. Fields of corn, potatoes, millet, weeds and uncut alfalfa generally appear darker than fields of grain. Shocks of grain dotted across fields are readily distinguishable. Unusually interesting is the appearance of lakes and ponds. When the camera is on the same side of the lake as the sun, the water shows a deep black. When the light is reflected into the camera, a brilliant, streaky white appears to replace the inky black. If the hour of exposure is known, the aerial picture can be oriented by reference to the shadows of trees, barns, etc. To prevent elongated shadows, pictures are taken only in the interval from three hours after sunrise until three hours before sunset.

As the camera records everything between itself and the ground a perfectly cloudless day is needed. This requisite is one of the chief obstacles to an extensive aerial photography program. Minnesota averages approximately eight days of photographic weather per month. "Woolies" and small banks of cumulus are the photographer's pet peeves, as they often spoil an otherwise perfect day. A recent group of pictures taken over St. Paul included a group of streaky, thin clouds which spelled the name of a popular brand of gasoline. Haze does not present as serious a problem as would be expected, for it can be penetrated by different combinations of filters placed over the lens.

The demands of this project for precision, hitherto not realized in aerial work, has led to the development of new photographic equipment and supplies to meet the needs of this aerial program. The film being used has a special topographic base. This means that shrinkage during development is negligible. The Eastman Aero Mapping and Positype double-weight paper, upon which the prints are made, has a shrinkage factor of only a few hundredths of one per cent. Cameras must be accurate also. One of the newest types, a Kufman-Smith Precision Camera equipped with a Geortz f6.8 lens, has a cost of about $1800.



COURTESY THE FARMER

An aerial camera of the type being used to map the midwest from the skies.

Demanded too is greater exactness in flying and observing. When observation planes in the world war were sent on a photographic mission, a few exposures were taken hurriedly. Fifteen minutes after the plane grounded, prints were ready to be made into a mosaic. Neither accuracy nor scale were of any consideration. The comparison with the specifications of today's flying is slight.

Flying the planes while pictures are being taken requires such unusual accuracy and exactness that skilled pilots who have not worked under the specifications of this program experience difficulty. The area to be mapped is laid out in north and south flight lines parallel to each other at two mile intervals. The pilot must look down through the isinglass floor and follow the flight line, which may be a straight, distinct highway or may be nothing but a rough terrain. In case he finds himself drifting away from the line he must recover by skidding, as banking the plane would cause tilt to appear in the pictures.

The observer sits before his apparatus, a large aerial camera mounted over a hole cut in the floor and a view-finder, which is a large convex lens with cross-hairs marked on it. A 7 x 9 inch print covers an area of four square miles. To secure the required overlap of 65 per cent the shutter is clicked at three-quarter mile intervals. The film comes in 75-foot rolls of 100 exposures. Between each exposure the observer must release the pneumatic device which holds the film tight against the plate, roll up the film, and determine the time interval between shots. The interval varies with the ground speed of the plane and is secured by determining with a stop watch the time it takes some object on the ground to pass from the front cross-hair to the rear cross-hair of the view finder. Before each shot the observer levels the camera by means of two spirit levels mounted on its top. He must also keep the camera directly north and south even though the nose of the plane points into the wind. It can readily be seen that the observer and the pilot just couldn't sandwich in a game of pinochle from the time they take off until the moment the tail skid touches the ground again. However, they have the envy of you and me; for when it is a broiling 95 degrees on the ground, it is a mere 40 degrees at 1400 feet.

The contact prints for a county are delivered to the engineers of the State Agricultural Conservation Committee. Here they are checked to determine if specifications dealing with overlap, sidelap, and tilt are met. The overlap is such that approximately every other print is selected for enlargement. In order to determine the ratio of enlargement of the contact prints chosen, control points are selected. These are two clearly defined points on the print that can be found readily on the ground. The junction of two highways or a farm entrance leading onto a highway are typical examples. The distance between the points is chained on the ground and scaled on the print; the ratio between the two results gives the print scale. Sharp differences of elevation cause points on the ground to be displaced from their correct positions on the aerial picture. As differences of 20 feet or more between controls will tend to cause an inaccuracy in the scaling, care is taken in selecting controls. Whenever irregular fields, patches of trees, and rivers indicate rough terrain, overlapping prints are inspected with a stereoscope. It is surprising how sharply the relief stands out, how trees and buildings assume three dimensions. The scale of the small prints is dependent upon the altitude of the plane and varies between 1584 and 1750 feet to the inch. The gross errors in chaining are readily detected in the office, for consecutive prints of the same flight line have scales quite similar. The prints are all enlarged to a scale of 660 feet to the inch, so every print has a different enlargement ratio.

The films along with the enlargement data are sent to the central photographic laboratory in Washington, where the enlargements are made. When the enlargements are received in the state office, the names of towns, roads, lakes, counties, and townships are lettered on the prints. In the counties the field reporters take the 18 x 24 inch enlargements to each farm and identify the crop grown in each field by a certain symbol. The area of each field is measured with a planimeter, an instrument with two arms and a dial. One arm is traced around the outside of the field, the other remains fixed. The area in square inches is read directly on the dial. For a scale of 660 feet to the inch, one square inch represents 10 acres.

Aerial photographs have various uses in several engineering fields. The Forestry Service has for a number of years been using aerial photographs in mapping national forest areas. The Soil Conservation Service uses aerial photographs to study types of soil. Recently such photographs were used in Alaska to detect gold-bearing outcrops. Several State and County Highway Departments have already found views from the air valuable in routing and determining right of way areas. The Army will find their use very valuable. The Coast and Geodetic Survey will undoubtedly find the topographic information of the aerial pictures extremely useful.

A bit of south central Minnesota as seen from 14,000 feet. In addition to their use in crop control, these maps will be of great utility in a multitude of other governmental activities such as construction and defense.

COURTESY A.A.A.

The Engineer in a Changing World

By Ralph E. Flanders

Adapted for the Techno-Log by Sherman Finger, M.E., '38, from the article of the same title in Electrical Engineering, August, 1937.

THE world in which we live is changing in many ways, and those changes are rapid. The physical frontier has disappeared from this continent, and except for the antarctic regions, it has practically disappeared from the earth as a whole. With the occupation of the frontier has gone one of the powerful automatic stimuli to private enterprise and material progress.

Much of the progress we are making is so based upon elaborate research and requires such extensive and expensive provision of facilities that it is best carried out by large corporations or well-financed research groups, rather than by individual scientists, engineers, and inventors of the old type. This is another influence that tends to restrict the expansion of individual initiative and tends to throw the burden of further social progress onto aggregations of capital and of men.

A further element in our increasing socialization is the rapid sensitizing of the social conscience and a resulting expansion of social activity into fields of action which in past generations had been considered reserved for the individual or for small social groups. The severity of the depression was so great and the social responsibility for it seemed to be so definite that both our relief measures and our recovery measures have tended to be social and political rather than individual and philanthropic.

Finally, though without exhausting the list of recent developments, we have become aware of the fact that in our banking, credit money, and financial institutions, we have a useful but delicately balanced, and at times unbalanced, mechanism, difficult to control and tending to increase the violence of business fluctuations and economic distress, rather than to provide a dampening effect upon them. All these phenomena and others not mentioned present a new set of problems to the engineer.

World of Today a Product of the Engineer

The world we know has been made by the engineer so far as its physical aspects are concerned, and his influence has had no small part in determining its spiritual environment.

Our profession has filled the world with a profusion of comforts and luxuries which were denied to kings a short century ago but which are now enjoyed by the average citizen. Flowing water in the kitchen and bathroom, brightly lighted streets, and the radio are all ordinary conveniences for the ordinary citizen. They were nonexistent when Queen Victoria began her reign.

There is no need to multiply instances. Told and retold has been the story of the problems an engineering civilization has created to perplex its citizens. The perils of drought and pestilence have been exchanged for the mischances of technological unemployment. That unemployment may be transitory and a part of a process which history shows to be benevolent in its total results, but it is as yet a serious and sometimes unanswerable personal problem.

Worst of all, our engineering civilization proves to be less stable than the older forms based upon subsistence agriculture. It gives us more, but its gifts are more irregular. There are seasons of outpouring and seasons of withholding. Boom follows depression, and depression follows boom, and this relentless alternation leaves much human wreckage in its wake. What can and should we engineers do to remedy the situation we have created?

Engineers Should Not Intrude Into Alien Fields

It is not my intention to go into the details of this problem. I believe that the engineer's work has been healthy and constructive. I believe that the maladjustments have come from our narrow and selfish activities as industrialists, workers, farmers, and financiers, and from the imbecilities of our politics. In particular, I do not believe, as so many have urged, that the remedy lies in the intrusion of engineers with engineering methods into the alien fields of politics, economics, and finance. This subject will be discussed briefly because in popular opinion our profession alternately has been damned for causing all the ills of our era on the one hand, and on the other for not curing them by still more radical engineering activity.

This question was raised some months ago in an address by Walter Lippmann, and I take the liberty of quoting here in part from his criticisms and in part from a reply to them:

> There were several years, I should say roughly from the crash of 1929 to the end of 1933, from the breakdown of prosperity to the beginning of recovery, when the ideal of an engineered and planned economy had almost completely captured the imagination of the Western world. Every one who raised his voice—the Chamber of Commerce, the heads of big corporations as well as the New Dealers and the Progressives—talked about planning something. No doubt they had different ideas of how to plan and what to plan for, but the underling image dominated most minds. The notion finally reached its grand climax, and its *reductio ad absurdum*, in the vogue of technocracy.
>
> The point I wish to make is that the conception of government as a problem in engineering is a false and misleading conception, the image of the engineer

is not a true image of a statesman, and that society cannot be planned and engineered as if it were a building, a machine, or a ship. The reason why the engineering image is a bad image in politics, a bad working model for political thought, a bad pattern to have in mind when dealing with political issues, is a very simple one. The engineer deals with inanimate materials. The statesman deals with the behavior of persons.

The notion that society can be engineered, planned, fabricated, as if men were inanimate materials, becomes in its extremist manifestations a monstrous blasphemy against life itself.

These statements are a challenge to the engineer's training, his state of mind, and his usefulness to society. That challenge should be accepted and an answer given.

Engineers never have been convinced, in great numbers or for long, of the effectiveness of their technique as a main reliance of government. In fact, the clearest, most reasoned, most convincing demonstration of its inapplicability is the work of an engineer. Those interested will find a further discussion in an article by David Cushman Coyle entitled "The Twilight of National Planning," published in *Harper's Magazine* for October, 1935. In all this we are as one with Mr. Lippmann.

But it will not do to leave the matter in this negative state. The engineer has positive contributions to make to the processes of effective government. He cannot make them unless certain misconceptions expressed in Mr. Lippmann's address are removed, and the real nature of his contribution is revealed. There are two primary misconceptions: (1) The engineer cannot "dictate to nature." He is the humble disciple of nature, serving society by virtue of that discipleship. (2) His undertakings grow ever farther removed from the completely material realm, and must perforce deal more and more with the realization of human ends, whereby the completed structure or mechanism is a joint product of material science on the one hand and human desires, needs, and possibilities on the other. In no branch of engineering does this appear more clearly than in the modern forms of "scientific management," of which the foundation is a fundamental and sincere comprehension of the human and personal element. Engineering is science applied to human needs. It is both a science and an art. If it is not both, it is not engineering.

Another contribution of our profession is a certain knowledge, and a particular faith. The knowledge is that the physical requirements are now at hand for a material standard of living far higher than the human race ever before has enjoyed. There are no physical obstacles. The engineer has removed them. He has played his part. If fault there be, it lies at some other door than this.

With the knowledge goes a faith. He has faith that the complicated social and political problems involved in reaching our objective can be solved—not immediately nor completely, but in such wise and with such speed as may lead to a continuance of our old progress toward a higher and more widely distributed material prosperity. This knowledge and this faith we would share with others.

A Current Problem as the Engineer Sees It

It may be worth while to consider one of our current problems in the light of the engineer's knowledge and experience. We believe that the standard of living may be greatly raised for the mass of the population which is able and willing to work. We believe also that the increasing efficiency of machinery, processes, and management will permit the world's work to be done in shorter hours with more leisure for rational enjoyment. In a word we are sympathetic with and committed to the objectives of the present active labor movement in its endeavor to attain shorter hours and higher wages.

But the higher wages must be real wages, that is to say, they must be able to purchase more goods and services for the wage earner and his family. A mere increase in dollar wages will not do if there are no more goods and services to be bought and if prices advance as fast as or faster than wages do. When we see output restricted by shorter hours and the slowing up of the introduction of improved machinery, while wages are being raised, we are justified as engineers in applying elementary analysis to the problem. We must conclude on such analysis that it is hopeless to expect more goods for higher wages if less goods per worker are made. The hope for a better living under those circumstances is illusory and cruelly deceptive.

However, there is hope for a better living, and that better living can come only from better production as a preliminary to better distribution. For that better production—and particularly for better production in shorter hours—the world is now, and in the future will be, dependent on the engineer, as it has been in the past. If our hopes for better material conditions are to be realized, there will be work for the research engineer, for the process engineer, for the management engineer. And the sooner this is realized by the protagonists in our present social strife the better it will be for all concerned.

A Major Threat to Social Progress

It is in our experience and our present method of meeting these current problems that we find the engineer's responsibilities of today. By the pressure of attractive but impossible doctrine, his usefulness to society is threatened; and with the limiting of his usefulness, there is arising a major threat to the social progress we have been making hitherto. We cannot ignore this situation. We must exercise our responsibility more for the sake of society as a whole than for the sake of ourselves as individual engineers or for the private interests of the businesses with which we may be connected.

There is indeed danger in the fact that the material progress with which we are concerned is so closely associated with business interests that they may seem to be one and the same thing. They are not completely so. There is a large area of business as it has been pursued in past years that has not been socially constructive, but socially dangerous instead. Perhaps the largest single area of this harmful business activity has been found in the realm of security speculation and its allied enterprises.

Another danger that we must carefully avoid is that of running wild on the social and economic aspects of our profession and neglecting the technical foundation on which is built everything else that we say and do. The other serious danger, that we may be rash enough to carry our whole engineering point of view over into social planning, has already been discussed.

Whether or not as individuals or as a profession we attain to high reputation or only to humble usefulness, we know that our civilization depends on us. In the words of Spengler, though with more hopeful emphasis:

> The center of this artificial and complicated realm of the machine is the organizer and manager. The mind, not the hand, holds it together. But, for that very reason, to preserve the ever-endangered structure, one figure is even more important than all the energy of enterprising master-men that make cities to grow out of the ground and alter the picture of the landscape; it is a figure that is apt to be forgotten in this conflict of politics—the engineer, the priest of the machine, the man who knows it. Not merely the importance, but the very existence of the industry depends upon the existence of the hundred thousand talented, rigorously schooled brains that command the technique and develop it onward and onward. The quiet engineer it is who is the machine's master and destiny. His thought is as possibility what the machine is as actuality.

Those words are true! As individuals we may struggle, and succeed or fail; we may be rewarded beyond our deserts or miss a recognition that was richly our due. Whatever may happen, this at least we may hold to: that we lived in a glorious age, full of human possibilities; and that our daily work lay at the heart and center of that age.

As to our responsibilities, they are great. Perhaps the greatest of them lies in the understanding of the nature of the mechanisms and of the organizations on which depend the material interests of our generation. It is hard to say whether the greatest danger to them lies in their being perverted and frustrated by powerful selfish interests, or in being overthrown by the recklessness and ignorance of our fellow citizens—even by those moved by the best of intentions. Our material blessings do not come naturally, as fruit grows on a tree. They come because thousands of individuals, having engineering and organizing skill, devote themselves in large and small capacities to keeping the machinery of civilization in running order. It is an inescapable duty that we each make of ourselves centers of education and influence, to the end that our useful offices may continue, and our civilization fulfill its destiny of an ever-growing service to the needs of mankind.

The Engineer's Responsibilities to the Public

I am going to suggest the nature of our responsibilities to the general public. We are now engaged in a strenuous race, a race between education and the breakdown of democratic government. As one of its major resulting catastrophes the breakdown of democratic government would destroy the engineer's usefulness to society and put an end to all reasonable hope for a continuation of our old progress toward a higher standard of living for the mass of our fellow citizens. To forestall this disaster, widespread education of the voting public is necessary. The first step in this process is our own self-education. Perhaps we never have stopped to think that we may be in need of that, that some of the ideas we have held since our youth may need revision.

As engineers, it is incumbent upon us to distinguish between the device that flies in the face of nature and the device that makes a new application of natural law. With our own beliefs fresh and clear and in order, we face the task of making them broadly useful. I wish to stress our responsibility as an educational force counteracting the forces of social dissolution. In our personal appearances before groups, in our private conversations, in human contacts which we must learn to multiply and elaborate, in every way ingenuity can provide, with all the patience and wisdom at our command, we must speak and work for the continuance of an ordered society that moves forward to higher material possessions, more fruitful leisure, and deeper spiritual achievement.

Perhaps you will forgive me if I conclude with words that originally were addressed to a graduating class at commencement.

In the Declaration of Independence our forefathers demanded for the individual the right to "life, liberty, and the pursuit of happiness." When those words were written it was a new idea in the world that happiness might be attained. The ancients and those of medieval times had other aspirations. They sought honor, liberty, and salvation, and were not sure that happiness was consistent with these or even possible on any terms. May I suggest that there is a deeper, richer word than "happiness," and that is the word "satisfaction."

It is not too much to hope that we may attain satisfaction in the practice of our profession. In part it will come from the very fortunate fact that many of us as engineers see the idea in the mind finally embodied in the material machine, process, or structure, and actively serving the needs of mankind. But an even more powerful satisfaction will come to us if we see our profession in the aspects of history and of the evolving human drama. For those who see, and who act on the vision, the fullness of life is reserved. May that gift be ours!

Doctor Flanders began his career as a machinist, and lifted himself "by his bootstraps" to presidency of one of the large eastern machine companies. Former head of ASME, a vice president of the Am. Eng. Council, and extremely active in public utilities and economics, he is well qualified to write this fine article on the responsibility of the engineer in modern society.

'Tagged' Atoms

By George D. Montillon, M.E.'40
Jack Hyde, E.E.'39

Behind the Physics building is being built a 4,000,000 volt high tension laboratory. Many of the latest developments in electronics, physics, and medicine will be experimented with, one of the more interesting of which is that of the tagged atom. By correctly applying high voltage to some of our more common atoms, they become radio-active, and these, after being injected into the bloodstream, can be traced. Several millions of volts are no toy to play around with, so read also about the special construction of the building.

STUDENTS returning to the campus this fall have probably watched with interest the activity behind the Physics building. The curiously-shaped addition to the building is to be an "atom-buster" or atomic observatory. In such an observatory atoms and their nuclei are broken up into their component parts for experimental purposes.

Generator Develops High Potential

The two principal portions of the atom gun are the generating apparatus and the vacuum tube down which bombarding particles will be driven. A Van de Graaff generator operating under an air pressure of 100 pounds per square inch will be used to develop electric potentials as high as 4,000,000 volts. The vacuum tube, which will be about 20 feet long and 15 inches in diameter, will be made from porcelain segments in the physics shop.

The generating equipment and the vacuum tube will be enclosed by a cylindrical steel tank with hemispherical ends. The tank will be 36 feet high and 18 feet wide. Pressure-tight observation portals and a pressure-tight manhole, permitting adjustment and repair of the apparatus, will be constructed in the tank. Special glass will be used to cover the observation portals. The lower end of the steel tank will extend downward into an observation room.

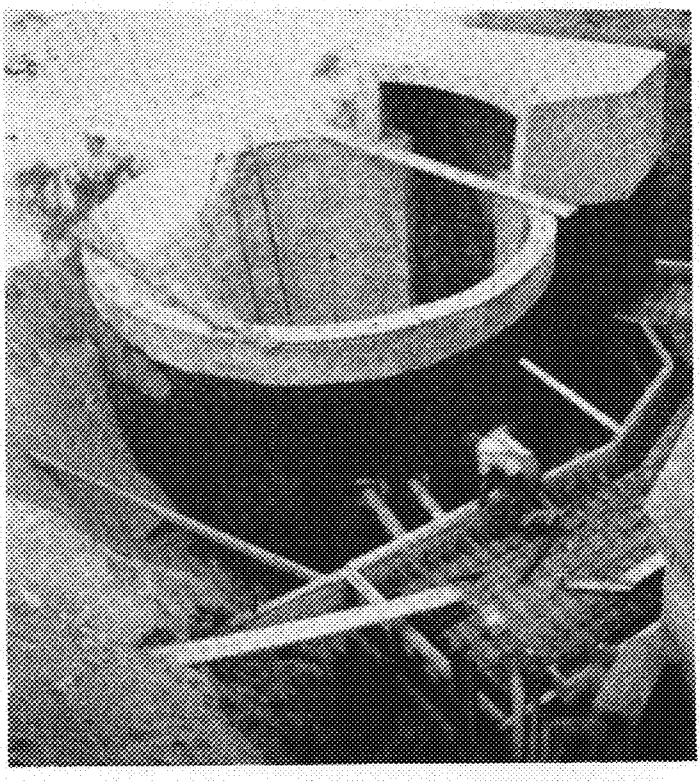
Contains Two Main Rooms

There will be two rooms, the control room and the observation room, in the concrete base of the atomic observatory. A passageway or ramp will connect the two rooms with one another and will connect the basement of the Physics building with the observatory. The control room, which is at the side of the observatory, will be separated from the tank enclosing the "atom-buster" by two feet of concrete and four feet of dirt. Such construction is necessary in order to protect the experimenter from the harmful effects upon the human body of the radiations from the atom gun. These radiations are absorbed by the wall of concrete and dirt. While operating the atom gun, the experimenter will remain in the control room; observing instruments will be placed at his disposal in the observing room. Indirect vision into the observatory tank from the control room will be made possible by the use of a telescope and a system of mirrors. The observation room will extend a short distance up one side of the tank.

Observing instruments that will be used in conjunction with the atom gun are "cloud chambers" and electric counters. In the "cloud chamber" the paths of motion of atomic particles may be seen and photographed because water vapor condenses along these paths as a visible fog. In the Geiger and Möller electric counter the presence of electrically charged particles is indicated by a discharge in a vacuum tube. The counter might be compared to a repeating trigger; after a charged particle has caused the counter to discharge and make known the presence of the particle, the counter is automatically reset. The discharging and resetting of the counter takes place in about 0.0001 of a second.

The less complex atoms of the lighter elements, such as hydrogen and helium, will be used in the atom gun to

A construction view of the lower portion of the laboratory showing the cylindrical base of the tower, the observatory beyond it, the ramp to the right, and the control room in the foreground.



bombard the other elements. High potentials will be generated and gradually applied to the bombarding atoms. The atoms will be accelerated down the large vacuum tube until they strike the atoms of the other elements and produce radio-active matter. The "atom-buster" eventually will be run with an air pressure of 100 pounds per square inch in the tank. This pressure will help prevent leakage of the charge from the generator, because air is a better insulator when under pressure.

Observatory to Aid Research

The atomic observatory will be an aid to research in many sciences. Not only will study of the atom be made possible, but also radio-active materials will be produced for use in several ways. Physicists will try to discover more information about the true nature of matter. Much is still unknown about the construction of the atom. Physicists will also investigate problems of electric insulation. This problem is of great importance to the engineer.

Research workers in the biological sciences will make use of radio-active salts, produced in the atom gun, to study the flow of blood and other substances through the veins and tissues of the body. "Tagged atoms," or atoms that have been exposed to radiation and are themselves temporarily radio-active, are the active agents in this research. Because "tagged atoms" may be easily detected by the use of the Geiger and Müller counter, they are well adapted to investigations of this nature.

Botanists, similarly, will use radio-active salts to study the life processes of plants. Chemists will use these salts to determine reaction rates of different substances and to study the formation of crystals. This research may result in control of the size and degree of perfection of crystals. Such control will have immediate practical application with regard to crystal formation on photographic film and in paints and pigments.

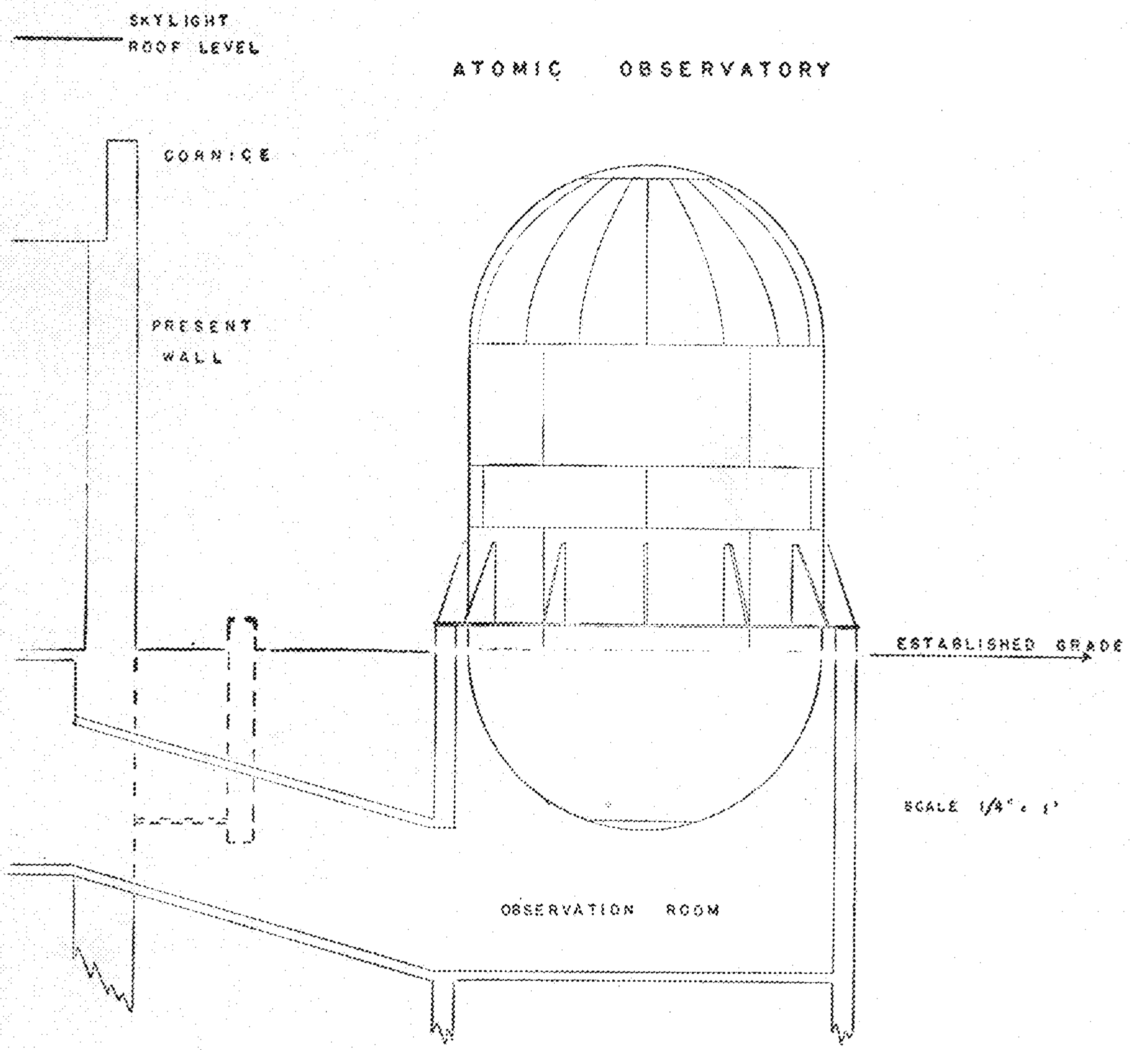
The observatory base and tank will be completed by about November 15. The "atom-buster" will be completely assembled and will be ready for operation at 1,000,000 volts under atmospheric pressure in about one year. The apparatus will be ready for operation at higher voltages under the contemplated pressure of 100 pounds per square inch in one to two years.

Rockefeller Foundation Assists

Funds for the construction of the atomic observatory have been secured from two sources. The University provided $10,000 for the structure. The Rockefeller foundation contributed $36,000, half of which is to be used for apparatus, and the remainder for experimental projects undertaken after completion of the atom gun.

Dr. J. H. Williams and Dr. L. H. Rumbaugh of the physics department are designing the high voltage generator under the supervision of Dr. J. T. Tate.

A drawing of the laboratory as it will appear when completed.



COURTESY MINNEAPOLIS JOURNAL

The Minnesota Techno-Log

OCTOBER, 1937

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WARREN WALEEN
Business Manager

EDITORIAL STAFF

Donald Erickson, Make-up Edr.
Herbert Gaustad, Copy Editor

BUSINESS STAFF

Wallace Wilcox, Adv. Rep.
Robert McDonald, Adv. Rep.

Other members of the staff of the Techno-Log will be announced in the mast head next month. New applicants will be considered for all posts as well as old staff members. Editorial staff positions will be frequently rotated. Prospective writers and other assistants should apply now.

A Unified Institute

The first reports of the fall registration, which indicate that this year there will be more than two thousand students in Minnesota's technical schools, impress on us once more the fact that the Institute of Technology is a large unit of a large University—and growing.

While the size of our enrollment may bring us a small measure of pride, it would also seem to emphasize the importance of fostering co-operation and a fraternal spirit among the many divisions of the Institute.

Our intensive vocational specialization and the distances separating the buildings housing the technology schools tend to weaken the feeling of unity that is engendered by the common study of fundamentals in the freshman year.

While at first glance it may appear that the erection of a social sciences building in the center of the engineering campus will still further isolate the various divisions of the Institute from one another, it may prove ultimately to play an important part in the reuniting of these schools through the medium of the combined course with business administration. Undoubtedly, to an even greater extent than in the past several years, will the miners, chemists, and engineers be brought into friendly and profitable contact with one another and with business and liberal arts students as classmates in the business portion of the new structure.

A second influence for bringing together students from all the Institute, but one that hasn't, perhaps, been made broad enough or inclusive enough to realize its potentialities, is that of fraternal organizations and clubs. The universality of the hobby of amateur photography should make the proposed Technology camera club very useful in this respect.

A third and very important avenue to contact with students in other departments is that offered by the TECHNO-LOG. Here, students of various vocational inclinations, of all classes, unite in coöperative effort to produce a monthly magazine for the whole body of technical students. You can take advantage of the opportunities offered by the TECHNO-LOG for broader contact with your fellow students.

We hope that this year will show continually wider use of these agencies for the development of firmer bonds of friendliness and understanding in the Institute of Technology.

LETTERS

Hello, Readers!

First, a word about last year's editor and business manager, Bob Teeter and Elwood McGee: They worked hard for you for eight long months last year, and they put out a good TECHNO-LOG. We hope that we shall be privileged and able to do as well.

You have undoubtedly noticed that this year's TECHNO-LOG has been changed in some respects and in other ways is similar to the magazine of last year. The cover is different, the contents page has been changed, some features have been added, others removed.

How do you, for whom the magazine is produced, like it in its new dress? Do you want Mental Tilts returned to its old place? Have you bouquets or brickbats for any feature or department? If you have, we hope you will make use of this column. You may question facts that we print or disagree with inferences. Or perhaps you may feel like writing about something else under the sun which might possibly concern technical students—and most everything does, nowadays.

If sufficient interest is expressed in this venture we will endeavor to print in each issue the two best letters that we receive previous to the first of the month of publication. Letters should be approximately 150 words in length, and, preferably, should be typed double-spaced. All letters must be signed and must be from students registered in the Institute of Technology. We reserve the right to refrain from printing libelous letters. Should you desire it, the letter may appear in print over your initials rather than your signature.

Here is an opportunity for you to express yourself in print to a large number of technical students, to promote the good of the Institute and of the student body, and to help us maintain a magazine of high quality.

Let us hear from you before the first of November. Write about anything you think may interest Technology students; the chance is good that it will be printed.

Cordially yours,
E. H.

Candid Camera Contest

THOSE of you who were in school last year will probably remember that the Candid Camera contest, which was scheduled to close May 4, was held open until November 1 because of the scarcity of entries. The first few weeks of this quarter have reassured us that there is interest in candid photography in the Institute, and a number of good pictures have been received. There is still time for you to enter. Here are the rules:

1. All pictures submitted will become the property of the TECHNO-LOG.

2. The contest will continue through November 1.

3. First prize will be $2.50, second $1.50, and third $1.00.

4. Entrants must be registered in the Institute of Technology.

5. Members of the TECHNO-LOG *staff will not be eligible for any of the prize money.*

6. Judges will be the editors of the TECHNO-LOG.

7. Pictures will be judged on subject matter and photographic excellence.

8. The area of the print must be at least 9 square inches.

NOW HERE'S A BOOK

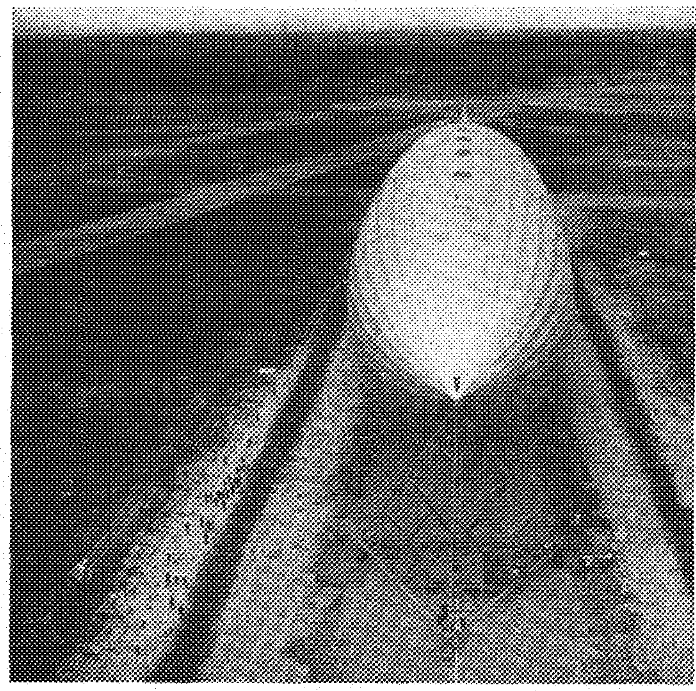
By C. I. Haga, Instructor in English

FEW of us will forget the news reel views of the burning of the Hindenburg. Sad though it is to remember that this tragic spectacle marked the death of 35 persons, one death in particular was the cause of a special sorrow among those to whom the Hindenburg was the symbol of nearly two score years of progress. That was the death of Captain Ernst Lehmann, for 25 years more intimately connected with the flying of dirigibles than anyone but Dr. Eckener.

In *Zeppelin,* recently added to the Engineering Library, we have Captain Lehmann's account of the progress from the first flight of the LZ 1 in July, 1900, to the success of the Hindenburg and the even more remarkable promise of the giant ships taking form in the Friedrichshaven drafting rooms. The statistics are in themselves astonishing: in 35 years the length of 425 feet had doubled, the cubic capacity had been multiplied by more than 16, and the 24 h.p. had been multiplied by *175.* The first flight lasted 18 minutes; the Hindenburg could have kept aloft for five days—perhaps even a week. In 35 years 129 airships had been built to effect that progress, yet the last giant was essentially the twin of that first tiny craft.

More remarkable than these statistics, however, is the story of men and events that Captain Lehmann learned to read from his post in the control cars of the nine ships he commanded in nearly 1100 commercial and military flights. Assigned in 1913 to assist Dr. Eckener in developing the dirigible as a naval weapon, Captain Lehmann flew five ships on raiding and scouting flights over the western theater of the World War. After the war his commands included four more ships in commercial service. No ship that he commanded was lost or failed to complete its task. Recognizing his talent for success, we read his words with a keener interest and appreciate the final judgment of the dirigible implied in his narrative—that it owed its success to four things: the sound idea of Count Zeppelin, the engineering genius of Dr. Dürr and Dr. Eckener, the technical ability of the fabricators, and the special skill and loyalty of trained crews under competent commanders.

The story is, therefore, partly the story of men and partly the story of materials. As Captain Lehmann tells it, the story of the men is given most emphasis. Since two-thirds of his flights were in war time, under conditions of forced draft compelling designers, builders, and commanders to cram 20 years' progress into four, it is natural that the greater part of the book recounts the raiding adventures over enemy territory. Yet it is the commercial, that is, peaceful, function of the dirigible which he succeeds in impressing on the reader's mind.



". . . it is the commercial, that is, the peaceful function of the dirigible . . ."

That fact is, I believe, one of the principal values of the book and one of the chief reasons for our accepting Captain Lehmann's words as authoritative.

Inviting though the story of the Zeppelins is to sensationalism, little of that quality is to be found in *Zeppelin.* It is, in fact, a calm book. That talent for success possessed by Captain Lehmann was, we feel, truly inherent in the man, and formed a sound basis for the authority and confidence with which he seems to be acting during those 25 years in which the ships he loved were going about their work. Even if we did not have the introduction and concluding chapter by Commander Rosendahl of the U. S. Navy, we would of our own accord feel impelled to share the American's confidence in the dirigible airships and consequently, since these ships owe such a large part of their efficiency to Captain Lehmann, to judge Lehmann as Rosendahl does: "The world is indebted to Ernst Lehmann; it owes and concedes him a place of honor."

YOU are members of the first class of '41 ever to enter the University of Minnesota. One hundred years ago there was no University, no State of Minnesota, and only two schools in the entire United States where engineering was taught. Civil engineering was then the only kind of engineering in existence.

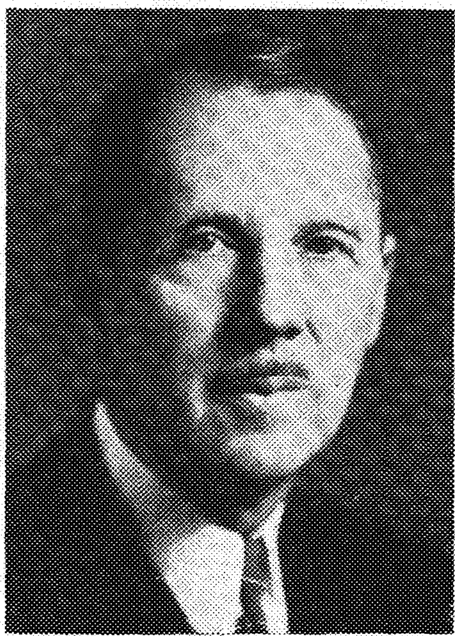
Today you may choose between a dozen fields of engineering with many more subdivisions and corresponding variance of curricula. There are now in the United States

A Greeting to the Class of 1941

By Dr. S. C. Lind

Dean of the Institute of Technology

about 160 engineering schools with a total enrollment of 80,000, and there are about one-quarter of a million professional engineers. Not only have technological education and the engineering profession grown miraculously, but the opportunities for, and responsibilities of, engineers have never been greater than today. All modern mechanization is dependent on the services of engineers. Modern methods of transportation are the direct contribution of engineers and scientists. The railways, the automotive industries, the airplane industry all depend on the services of mechanical, metallurgical, electrical, civil and chemical engineers. They are examples of the coöperation between engineering and sciences, such as mathematics, physics, chemistry and geology.



Dr. Lind

All engineering is but the application of scientific principles in one form or another. Hence the necessity for a thorough foundation in physics, chemistry, and mathematics. These subjects are vitally important to every branch of engineering. Other sciences also find applications. Specialization in the upper years of each engineering curriculum is, of course, essential. But if I understand rightly the trend of engineering education in the better schools, as well as the demands of the more intelligent employers, both are distinctly away from "practical" courses of highly specialized nature and limited application. With a proper grasp of the fundamentals you will be able to apply them in any desired direction. If you neglect them, no amount of specialization will be able to compensate you for this mistake. And in the later years it will be difficult, if not impossible, for you to retrieve the loss.

Again, unless I am in error, there is a growing demand for engineers with a better ability to write and speak good English. This, too, is something that should be acquired early. If the facility of spoken and written expression is not achieved early, one has the double problem not only of learning the new, but of forgetting the old. Perhaps you may have the impression that forgetting is one of the easiest things you do. But have you ever tried it on bad habits? Just because we all speak and write English does not mean that we can do so correctly. This requires much thought, practice, and instruction. Not to be able to use acceptable English, both in writing and speaking, is a serious handicap to any engineer who would otherwise be able to rise in his profession.

More engineers are also finding it a decided advantage to be able to speak well in public. This also requires practice and, preferably, instruction. Many engineering courses now make public speaking a requirement.

The professional engineer is sometimes criticized as lacking general culture, a knowledge of history, of literature, of art and music. There is probably much ground for discussion of the truth of this criticism. Certainly there are many outstanding exceptions. A recent survey showed that engineers in their maturer years are very prolific readers of cultural literature, probably the more so because they have had to neglect it in college.

Any student of engineering is fortunate who can also have one or two years of cultural subjects or even a full arts college course. But for those to whom such an opportunity is lacking there remains the possibility of electing subjects outside of their fields of specialization. At a university such as Minnesota a much broader selection is offered than would be available in institutions devoted more or less exclusively to engineering and the sciences. It is very highly recommended that more engineers avail themselves of the cultural opportunities within the University.

There is also a kind of engineering that may be learned but is seldom taught in school. It is often referred to as "human engineering." I will not call it the ability to "handle men," but rather the ability to get along with men. If you have this gift naturally, cherish it as one of your most valuable assets. If you feel you lack it, spare no effort to develop it. Cultivate good friendships. And above all let your dealings both in and out of college be fair and honorable. The engineering profession demands the highest degree of integrity. Maintain a high standard of honor and never demean yourself by lowering it. Remember that all forms of deceit or unethical methods but mask some type of cowardice—something unworthy of you and your chosen profession. Raise your standard high and keep it there. Everyone may not be a brilliant student, but everyone may make an honest effort. I wish all of the class of 1941 success in your worthy undertaking.

Day by Day with the Camping Civils

By Clark Hook, C.E. '38

Being a brief record of the doings and the thoughts of the boys who spent six weeks this summer amidst the pines of Cass Lake, working by day and playing by night.

Wednesday, August 11

Dear Diary,

No civil engineer graduates from the University of Minnesota without six weeks of summer surveying camp at Cass Lake, Minn. Today I start my six weeks' sentence.

We arrived at Cass Lake about 5:45 this evening and bummed a ride from an old timer in a model-T to get to the camp. A run through the big wooden entrance arch and down a narrow road brought us to two large wooden buildings, but not a student or a faculty member was in sight. On a blackboard before one of the buildings was lettered, "Report to Mr. Boon on arrival." We didn't have to wait long to find out where Mr. Boon was, because the cook announced from the door of one of the buildings that supper was on the table and rapidly disappearing. There they were, twenty-five students, three of the regular faculty and two others whom I did not know, laying into the first meal of camp.

There wasn't much chance to look over the place after supper because the tent had to be put up before dark. I didn't think I knew as little about tents as I found I did when we got started. It takes a real greenhorn to appreciate what a job it is to put a tent up and slap mosquitoes at the same time. These new homes of ours are 14 feet square; and so far we've been able to jam in four canvas cots, a table, stove, bench, chair, and two sets of shelves.

Sleep came easily after an hour's rehashing of first impressions. Twenty cigarettes going at one time in one tent makes quite a bit of smoke, but it sure kills all the mosquitoes.

Observation of the day: I wonder how many more nights I'll be in bed by ten o'clock with this bunch of hale fellows, raring to go.

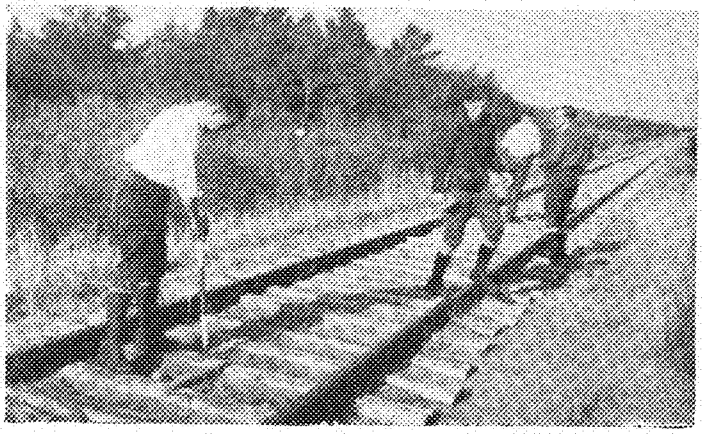
Thursday, August 12

Dear Diary,

Why didn't someone warn me about this gong business? It's murder to be knocked out of bed at 5:45 A. M. by the unearthly clanging of a crowbar against a 3 foot circular saw blade. No wonder it's tradition to steal the d—n thing every year. At 6:10 we heard more gong pounding, roll call and then to breakfast. It only takes one look at that table to teach a city fellow something new about breakfast.

At a lecture this morning we got the lowdown on how this camp is run and were presented with a copy of "Manual of Instructions for Summer Surveying Camp" or more appropriately "The How and Why of Everything a C. E. Should Know in 138 Mimeographed Pages." We are to be divided into parties on a rotating basis, one new man to a party each day. Work begins at 7:00 and continues until 12:00. Then a half hour for lunch, and we're back to work until 4:30. Supper is at 6:00, and, unless there are notes to copy or other evening work, from then on we are free. It doesn't sound so bad after all.

Today was pretty easy for me. All we had to do was to lay out a 3,500 foot baseline, which meant nailing a smooth board to the ties every hundred feet along the Soo line. I did learn that it would be no use trying to get back to camp early in the evening. We finished at 2:30; but when we got back we were blessed with a special problem in instrument adjustment. Thank you, Mr. Boon.



". . . the fellows have just about completed a map of the entire system of the Soo and Great Northern tracks . . ."

The water in Cass Lake must be good for building up an appetite. After a swim at 5:00 a fellow surely can do a lot of damage to supper even though the lunches that Erickson, the cook, puts up for noon in the field have plenty of bulk to them.

Today's observation: I always thought mosquitoes were insects, but now I know they are animals.

Saturday, August 14

Dear Diary,

This roll call business has its funny points. Although the first gong rings at 5:45, about two-thirds of the camp either can't or won't drag themselves out of bed until 6:00 or after. When the gong rings again at 6:10, there is a mad rush for the mess hall with shirt tails flying, boots unlaced, and a continual chorus of "heres." It's too bad Arnold's name starts with A because he has such a comfortable bed.

On the bulletin board this morning:

Bennetts }
Hook } Precise levels, B.M.'s 337 to Entrance to Palmer.
Kapernick } See Zelner

I must remember to warn next year's class about that. In precise leveling, readings are taken on three cross hairs at the exact moment when the reflections of the two ends of the level bubble appear to be together in the mirror. It sounds as though that explains it; but we worked all day, and our closure was 1.1 feet instead of the few thousandths that were expected. I'm sorry, diary, and

I'm sorry, Mr. Zelner, but that's what our notebook shows. Maybe by Monday I'll learn to add and subtract, and we'll do better.

Tonight, being Saturday, meant Bemidji to most of us. We made the mistake of going in without ties or coats. It's quite a blow to the pride of a C.E. to be mistaken for a C.C.C., but that is what happened. Are the girls in Bemidji high hats or just a bunch of gold diggers?

Today's bright spot: Bouquets to Olson, Bennetts, Sculley, and Arnold. They wore ties, and they had dates.

Friday, August 20

Dear Diary,

Now I know why spending a day in the office is so popular. First, when in camp, hot soup and nectar are added to the lunch bill of fare. Second, those letters from that certain person back home can be had at noon instead of at 4:30. It was my job to plot part of the Great Northern yard survey today. By now the fellows have just about completed a map of the entire system of the Soo and Great Northern tracks from several miles east of town to a mile and a half west. Since that includes a roundhouse and a seven track ladder on the Great Northern, it has meant computing a lot of traverses.

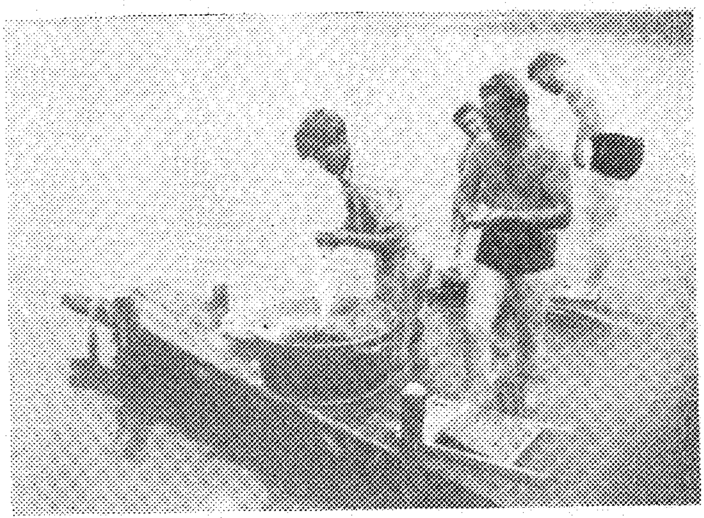
Oh yes, dear diary, there is one thing about being in the office that I don't enjoy. A half hour for lunch is at the best only one hour. In the field with a tired chief of party I've known a half hour to equal two and a half hours of sound sleep.

Observation of the day: Why does Kellum have to get scented letters on the day I get none at all?

Sunday, August 22

Dear Diary,

Another Sunday means another wash day. It's quite a sight to see the boys wade into the water with a washtub, washboard, soap, and a pile of socks, shirts, et cetera. It seems that there is always plenty to keep a fellow busy on



"Another Sunday means another wash day."

Sunday with washing to be done, a paper to read (the only one I see all week), letters to be written from 30 civil engineers to 30 one-and-onlys (how Sculley manages to write a letter every day, I can't understand), fishing, and maybe a ball game to be played. Then, of course, there are always those big heads from the night before.

Well, diary, this afternoon, with two boats and two motors, seven students, Mr. Boon, and Van Eschen shoved off for Star Island. It's quite a place, with towering Norway pines covering most of the island. A short hike down what may have, at one time, been a trail (at least, Mr. Boon seemed to know where we were going) brought us to a lake within an island, Lake Windigo. What a place to wrap up and take home for use on rainy weekends! On the way back, Mr. Boon suggested we stop and see a birch bark canoe at the Star Island Lodge. Thank you, Prof. Boon, for the idea, and thank you, Prof. Vaile, for having such a charming daughter.

Thought of the day: The boys are wondering why there are so many pin holes in tent number one. Kellum really should tell them.

Saturday, August 28

Dear Diary,

Well, well, after five days of triangulation we finally closed the doggone quadrilateral. Transit No. 33 surely is a fine instrument. It's so precise it ought to be put in a glass case on display where it couldn't fall into the hands of unsuspecting embryo civils. Some of the shots on this quadrilateral were about three miles long, and trying to close the horizon with a ten second instrument is worse than keeping free of mosquitoes for ten minutes at a stretch.

Tonight, some of us dropped in to see where Herb has been spending his noon hours and evenings. Nice going, Brown, may good luck always attend your goings on.

Observation of the day: Rumor has it that today's baseline party used the precise three-pin-at-a-time method of measurement.

Friday, September 3

Dear Diary,

"Select Deluxe" to all our faculty for being broad-minded. Getting off tonight for the Labor Day weekend surely means a lot to a bunch of C.E.'s with writer's cramp. The extra work will be worth it. As Bud says, "Ain't they never been in love?"

Observation of the day: It will be great to sleep in a real bed for a change, without having half a dozen poker players keeping you awake.

Wednesday, September 8

Dear Diary,

Back in camp yesterday and out to run in a crossover between the Great Northern and Soo, east of town. After sitting on the Soo tracks and computing all yesterday morning, we couldn't get the thing to close. A day's checking and rechecking and MacKenzie's accurate work as rear flagman finally closed it late this afternoon.

Posters all over town announce a "championship basketball series" between the Cass Lake Independents and the U. of M. Engineers. We hope—, but after all we'd better just play for the fun of it.

Observation of the day: Bob Andres says Mac's bar is the longest in town by accurate measurement with a 100 foot steel tape.

(Concluded on Page 18)

Thursday, September 9

Dear Diary,

Big celebration tonight, because we won the first game 30 to 20. The town team isn't as good as we thought, and though I hate to brag, diary, the C. E.'s looked good, especially Paul (Swish) Martinson. It should be a cinch to take this so-called championship in two games.

Incidentally, diary, although tonight it isn't important, we started a big topographic survey for the Forest Service today. It will cover a good sized area on the south end of Pike Bay. I wouldn't be suprised if the mosquitoes will be pretty bad there, since it's all thick brush, second growth, and swamp. Speaking of mosquitoes, a forester said that they were the worst he has seen them in years. He's telling us!

Monday, September 13

Dear Diary,

I was camp assistant today; and in between wood-chopping, water-carrying, and gage-reading, I had a chance to absorb some statistics. The average temperature is well above last year, yet today is the coldest day in two years of camp. According to the latest stream measurements, the Mississippi is taking more water out of Cass Lake right now than at any other time in camp records. The cook says the cold weather makes us eat more. Yah, yah, yah, yah, you bet!

The after supper horseshoe pitching season is just about over. Bob (Easy Swing) Erickson and John (He Blows in the Pinches) Ellison have beaten Mark (Ringer) Olson and "Boy am I good" MacDonald for the doubles championship. Sculley and Davies are still playing off the singles championship of the universe. Ah, well, it keeps the two of them out of other people's way.

Tonight, being the last Friday in camp, is Engineers' night, as the town and its spots should know by now. Hats off to that communistic chicken (Ellison may leave his hat on to cover the bandage). Today's very late observation: To quote J. C., "There will never be another night like this one!"

Wednesday, September 15

Dear Diary,

We lost 27 to 17, but I guess it was an off night. We'll take them the next game.

Friday, September 17

Dear Diary,

Cass Lake	44
C. E.'s	17

Tuesday, September 21

Dear Diary,

Time to recapitulate, for this is the last day of camp. I have gained:

(1) Practical experience in base line measurement, railroad surveying, stream measurement, trangulation, leveling, and topographic surveying.
(2) Closer contact with our faculty.
(3) A better understanding and the friendship of 29 great guys.
(4) Seventeen pounds on Erickson's cooking.

Tents were down before the last gong rang for supper, and then all equipment was packed away and the camp cleaned before dark. Let the poison ivy grow and the mosquitoes hum. We are on our way back to civilization.

Final daily observation: I don't suppose our names, written on the wall of the mess hall with those of other classes, will mean much to the class of '39, but after all, they are our names.

LINDQUISITION

By Bertil H. T. Lindquist

Hello and Howaryah! A new skool year—new pheasant season (15 hours of it)—new profs (here and there)—new business building (well, it's started)—new resolutions to "really study this year" (meaningless as ever)—a few new coeds (misogynic cynics assert: "Nothing new about them—they're old the day they're born")—but the same old claptrap columnist (about due for a pension) . . .

The Gamma Phi Betas realize full well the importance of an impressive array of boy friends when rushing time rolls around and this fall the ingenious Gamma Phis really had a brainstorm. With the ranks of their army of male escorts sadly thinned, they hit upon the sure-fire system of enticing young blood into their circle by putting the following series of signs and invitations in front of their house during Freshman Week:

FRESHMEN MEN—PHYSICAL EXAMINATIONS HERE
THIS WAY FOR REGISTRATION
FRESHMAN BUTTONS SOLD HERE
FRESHMAN WEEK HEADQUARTERS

You 1500 or more Math students will soon have to start looking for a new sweetheart. Your current heart-throb, Miss Evelyn Paulson (she's the brunette who waves the mailed fist in genial Prof. Brooke's office) has finally decided that a quiet and peaceful life spent arguing with just one man is more desirable than dynamic, ephemeral, fleeting romances with the entire student body. She embarks on her new career of connubial bliss about the end of October and your old chronicler is just as heart-broken as the rest of you boys. . . . Never thought that you'd do that to us, Evie. . . .

Have you boys lamped the hat that Donald "Kutie-puss" Raudenbush is affecting? Our unprejudiced opinion is that if his ears should ever get tired, he couldn't see where he was going—the old chapeau would be down over his eyes. . . .

Aeronautical Engineering's eminent Dr. Piccard, visiting in New York City, heard about a check room attendant with the phenomenal faculty for remembering faces. He never gave a check for a coat, yet always returned the right coat to the right person. Dr. Piccard gave the attendant his overcoat, waited a good long time, and then returned for it. He was immediately given his coat and the good doctor, always searching for the answer to the inexplicable, questioned, "You have never seen me before—how do you know that this is my coat?" After a moment of thoughtful scrutiny of the renowned stratosphericist (hey, there's a word), the check roomer answered bravely, "I don't know it's your coat—all I know is that you brought it in."

When you get something for nothing it's generally worth it . . . .

Institute Announces Curricula Changes, Laboratory Expansion

By Mary Ann Benson

THERE'S nothing like being in the dog house these days. Especially when the dog house is one of Professor Rowley's air-conditioned specials. Application for admittance should be made at the Oak Street laboratories at the corner of Oak and University. Over $200,000 was spent by the Works Progress Administration to make the laboratory ready for University use. It contains two low temperature rooms in which Professor Rowley carries on his work. One of the rooms has a 30 x 30 foot floor and is 25 feet high. It is filled with small houses of standard construction, with insulation and air-conditioning. The room has been designed so that temperatures as low as 20 or 30 degrees Fahrenheit below zero may be maintained for long periods of time. The rigors of a Minnesota winter are duplicated as nearly as possible, and the amounts of moisture and ice accumulated in the wall insulation are determined. Professor Rowley is keeping his weather eye open to determine the accurate amount of insulation needed for Minnesota winters. There is another low temperature room large enough to accommodate a freight car, in which the problems of railway refrigeration will be studied.

Wind Tunnel, Gas Research, Planned

A separate laboratory, as yet incomplete, will contain a wind tunnel for aeronautical engineering research. The Northwest Research Institute has built a plant for obtaining water gas from North Dakota lignite preparatory to the production of pure hydrogen.

According to Dean Lind, the building of new laboratories and the fostering of research are only part of the general plan for the development of the Institute of Technology. New courses are being introduced into the curricula, and a revision of many of the old courses has been made.

Geophysics Course Inaugurated

The new course leading to the degree of Bachelor of Geophysics is a combination of separate courses offered in geology, physics, and mines. The work will be done primarily under the supervision of W. W. Wetzel of the School of Mines. Classes, of which there will be three, are scheduled to begin winter quarter. One class is for undergraduates only and is intended for those students to whom a general knowledge of the subject would be beneficial, but who lack the necessary mathematical preparation for the more advanced, technical courses.

Probably the best known practical application of geophysics is petroleum prospecting. Two other branches of prospecting are included in the courses, mineral prospecting, and prospecting for gravel beds, of particular importance and significance in Minnesota.

An extensive revision has taken place in the School of Mines curriculum. A course of freshman English has been included in the requirements for graduation, and courses in mathematics and physics are no longer to be taught in the Mines School. Students now registered in mines will be required to take these courses with the other engineering students.

Physics Degree Now Offered

The course in applied physics leading to the degree of Bachelor of Physics was included last year in the general curriculum. This was done at about the same time that the American Institute of Physicists started a pamphlet campaign to educate the captains of industry to the belief that men basically trained in physics and particularly trained in the schools maintained by the companies are more valuable to industry than the men without that foundation but with a superficial training in engineering.

Minnesota Ranks High

A committee appointed to inspect and rate all engineering schools in the United States conducted an investigation of the University of Minnesota Institute of Technology last spring as a part of a general investigation of midwestern schools. The results for the eastern schools have been published, but the rating of the midwestern schools has not as yet been made public. This rating will include either a credit or a non-credit for each course leading to a different degree, and will not be a ranking of the schools in order of preference. Dean Lind anticipates no great shock from the report of the committee, and he expects that Minnesota will fare better than some of the schools in the Big Ten which give degrees in courses in which less than twenty students are enrolled. He states that the analytical chemistry department of the University is outstanding in the United States, and that the chemical engineering course ranks among the five foremost in the country.

Business Combination Gains

One of the most important degrees bestowed by the University is that of Engineering combined with Business Administration. The registration in the combined courses for fall 1937 totals 171, or almost double last year's total.

Library Adds Books

More than twenty-four new reference books have been added to the Main Engineering library this fall to bring its collection up to date in the various sciences. The increased enrollment and advanced courses in the Institute have increased the demand for more reference material.

TECH NEWS

By Charles Strom

A. I. E. E. Plans Active Year

Under the chairmanship of Don Erickson, the A.I.E.E. has made plans for an active year for its members. The student branch has set as its aim 100 per cent membership this year.

At the first meeting, Professor Bryant, head of the Department of Electrical Engineering, stressed the importance of student activities; and Professor Kuhlman gave a brief outline of the local and national activities. Chairman Erickson made a report on the A.I.E.E. convention in Milwaukee which he attended with Professor Kuhlman during the past summer.

The year's activities will include inspection trips and student talks, with prizes given to those who, in the opinion of the members, give the best talks.

Meeting to Consider Personnel Leaflets

The Institute of Technology's personnel leaflet service will be described by Assistant Professor Alex Levens, head of the Institute's placement division, at a meeting to be held at 11:30, Thursday, October 21, in the Chemistry auditorium. Mr. Levens strongly urges all senior students in the Institute to attend.

ALUMNOTES

'32

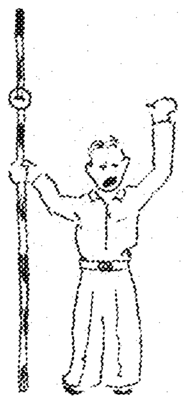
Laurence E. Hendrickson, E.E., '32, of Cokato, Minn., was recently awarded a fellowship to Harvard University by its Street Traffic Bureau. The fellowship is for a year's graduate study of traffic and highway problems and includes $1,200 for general expenses and $200 for travel. Hendrickson is one of 15 engineers to be awarded the fellowship this year.

'33

Laddy Markus, Techno-Log editor, '32-'33, lives at 2032 Belmont Road, N. W., in Washington, D. C. He is working with the National Radio Institute as technical editor. Laddy shyly admits that he has been married for two years. Both he and his wife are quite proud of a spotted dog which romps around the house. On his vacation, this summer, he drove to Toronto and then on to Callander to see the "quints." Driving through Canada gave Laddy a chance to inspect the Trans-Canadian Highway as far as Sault St. Marie. He said he is still very much interested in the Techno-Log.

'36

Wedding bells rang, September 18, for Bob Dixon and Mary Jane Kenny. Bob, as you will recall, was business manager of the Techno-Log for the school year of '35-'36. He is working for duPont in Charleston, West Virginia, at laboratory control. Working with Bob are Grant Sedwick, '36, and Gordon Custer, '37.



LOWE-LIFE

By Bill Lowe

It's always nice to come back to school; that is, if you were graduated the year before, and you come back just to see a football game.

* * *

However, we'll give fall quarter credit for making us appreciate spring quarter when all the begrimed, unkempt miners were away at camp. But now they're back, and their dirty old banner made of women's silk "easy breezies" is to be seen floating proudly from its customary third-story window of the mines mortuary. Will Rogers said, "What this country needs is dirtier finger nails and cleaner minds." But then there are exceptions to all rules. The question is, what miner ever was able to acquire such apparel?

* * *

The civils are also back from camp!!! The stories to be heard around the civil room indicate that extracurricular activities set an all time maximum this year. However, Mr. Zeiner says, "This year's boys were the *nicest* boys yet." Woo, Woo!

* * *

It seems, though, that Johnny Barber was the champion dissipater of camp. Stories we are not allowed to print may be secured, with pencil diagrams, from "Ohman the Agitator" in book form titled *The Scarlet Letter, or How Johnny Won His A.* "Gollee," John.

* * *

This month's award for bravery, one small hopper of Ottawa sand, goes to MacKenzie. We based our decision on the following incident, which took place at camp:

Mac: Mr. Boone, will you referee our horseshoe game?

Mr. Boone: No thanks, I'm deaf, dumb, and blind.

Mac: I don't know about your hearing, and your eyes look all right, but——(censored).

This month's problem: What grade did Mac get for civil camp?

* * *

At this time we pause for a moment of silence to show our appreciation to that ideal professor of C.E. 137 who found it necessary to leave town on the opening day of duck season.

* * *

This year we will foster a "back to school" movement for Mechanicals. Did you ever see students spend less time in school than they do? Unprejudiced or prejudiced opinions on this question will be welcomed.

* * *

A thought to ponder over: You have to be dumb to get started in the engineering school, but it takes a darn smart guy to get out.

MAGAZINE REVIEWS

By Woolsey Motl

CITY MANAGEMENT

A new profession is being born, that of the city manager. Of the men in this profession, drawn from many walks of life, over 46 per cent are either practicing engineers or men with previous engineering training. Next come business men with a mere 12 per cent.

The city manager is hired by the city council and given complete executive control of the city. He does not enter into the political life of the city in any way. Cities adopting this form of government find it very efficient and economical. City management promises to develop into one of the most highly respected and best paid branches of the engeering profession. It will certainly bear further investigation.

"City Management, an Engineer's Profession," by Evelyn E. Brackett, from *Civil Engineering*, Sept., 1937, pp. 625-6.

AIR CONDITIONING

Not content with having made our theaters and restaurants summertime havens of comfort, the air conditioning engineers continue their research. At the present time it is estimated that over two thousand persons are engaged in investigating nearly two hundred and fifty subjects directly related to air conditioning.

These scientists are in search of such varied things as the cause and cure of stale air and drafts, the best temperature and humidity for the average person, and the use of water as an insulating medium.

The final aim of this research is to produce equipment sufficiently cheap and effective that every home may enjoy "perfect weather" all the time.

"Health Aspects of Air Conditioning" by Brewster S. Beach, from *Scientific American*, Sept., 1937, p. 152.

CHEMICAL ENGINEERING

Have you noticed that air of superiority about the Chemical Engineers this fall? It's all because of a factual summary of their industry that was recently published.

Reading it we find that chemical industry annually employs 106,000 men and pays them a total of $127,500,000, that it buys $7,000,000,000 worth of raw materials and $880,000,000 worth of fuel each year, and that it spends more money for research than any other industry. The total assets of the industry are nearly $11,000,000,000, the annual sales are $6,284,000,000 and the annual tax bill is $2,000,000,000.

With facts like these to back him up, who can blame the Chemical Engineer for sticking out his chest?

"Facts and Figures of the American Chemical Industry," edited by S. D. Kirkpatrick, from *Chemical and Metallurgical Engineering*, Part II, Sept., 1937, pp. 521-584.

THE PERFECT ENGINEER

What does industry want in its "perfect engineer"? A recently conducted survey shows that the most important quality, that characteristic most desired by employers, is the ability to present one's technical knowledge in such a way as to obtain a maximum of coöperation. This is important because the changing social attitude towards labor has made the old type of "bossy" superintendent obsolete. Other factors include technical knowledge, good health, honesty, sincerity, diplomacy, and judgment. Furthermore, the engineer in charge of other men should play no favorites, hire no relatives, nor be a "yes man," and should readily admit that he is not infallible. With standards like these, is it any wonder that even "good" engineers are hard to find?

"Requirements for an Engineer," by John M. Drabelle, from *National Engineer*, Sept., 1937, pp. 522-3.

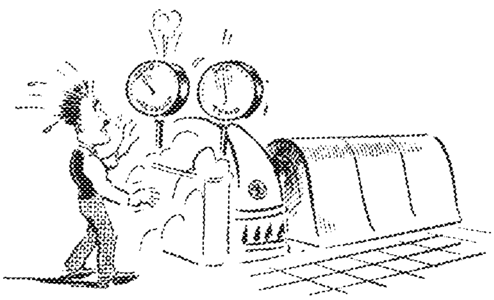
EDUCATION AND ENGINEERS

Though the engineer has built our modern civilization, he has left the job of governing it to lawyers and economists, many of whom are obviously incompetent. To alleviate this difficulty, Dr. R. E. Doherty, President of Carnegie Institute of Technology, has recommended that one-fourth to one-third of the engineer's course be made up of cultural subjects of such a nature as to develop his initiative and to incite in him the desire to attack social problems and the ability to solve them.

His program achieves this end through extensive and well directed reading together with classroom discussion and seminar courses. Experiments with a course of this type at Carnegie Tech have demonstrated its feasibility.

"Engineering Education and Democracy," by Dr. R. E. Doherty, from *Electrical Engineering*, Sept., 1937, pp. 1073-1076.

G-E *Campus News*

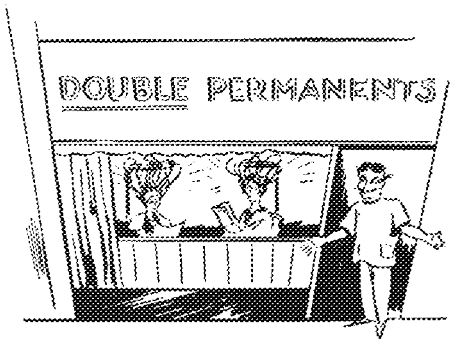


IT'S THE "TOPS"

A turbine-generator set now being built at the Schenectady Works of the General Electric Company will operate at a pressure of 2500 pounds and at a temperature of 940 F. This pressure is nearly 1000 pounds more than that used for any other commercial unit now in service, and the temperature is higher.

It represents the work of many men. Experts in mechanical design have solved unique problems—for the shell of the turbine will have to withstand pressures equal to those more than half a mile below the surface of the sea. When the unit is completed, electrical and chemical engineers, metallurgists, and research workers will have contributed knowledge and experience to it.

The design and construction of turbine-generators such as this is largely the work of college graduates—many of whom entered G-E Test only a few years ago. Thousands of other Test men are engaged in the design, manufacture, and sale of these and hundreds of other electric products that are used in industry today.

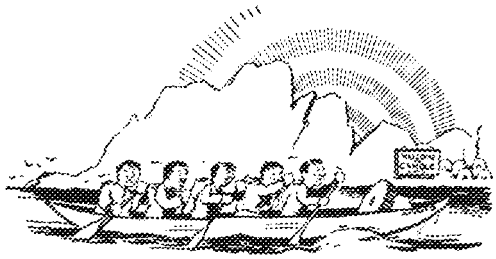


TWO PERMANENT WAVES AT ONCE

Co-eds preparing for a dance are not the only subjects for permanent waving—there is the tungsten wire used in General Electric lamps.

This wire, 19/10,000 inch in diameter, is first tightly wound, 335 turns to the inch, with the coils 1/1000 inch apart. After the wire receives this first "permanent wave," it is coiled once more, 70 turns to the inch, with 7/1000 inch between the turns. This reduces the original 20 inches of wire to a coil 5/8 inch long and having an outside diameter of 310/10,000 inch.

These permanent waves pay real dividends in increased efficiency because tungsten wire becomes more brilliant as it is more closely compacted. This new process is only one of many developments made by G-E engineers in the field of illumination—a field which offers many opportunities for technically trained men.



WELDING IN THE ARCTIC

A broken gear wheel recently threatened to shorten the 100-day working season of a group of miners on the Alaskan tundra, above the Arctic Circle. No time could be lost, for in early September the ground would be frozen solid.

There was but one chance to save the season's work. The gear wheel was loaded in an *umiak*—a native boat made of skins—and for five days an Eskimo crew paddled to the settlement of Candle, where the Arctic Circle Exploration Company had a General Electric gasoline-driven arc-welding set. Three hours after their arrival, the Eskimos were ready to return with the repaired wheel. Instead of the ruinous loss of a season's work, the interruption lasted only two weeks.

Opportunities for G-E products to be of service to industry occur in all parts of the world, and General Electric has built up an extensive international organization to meet those needs.

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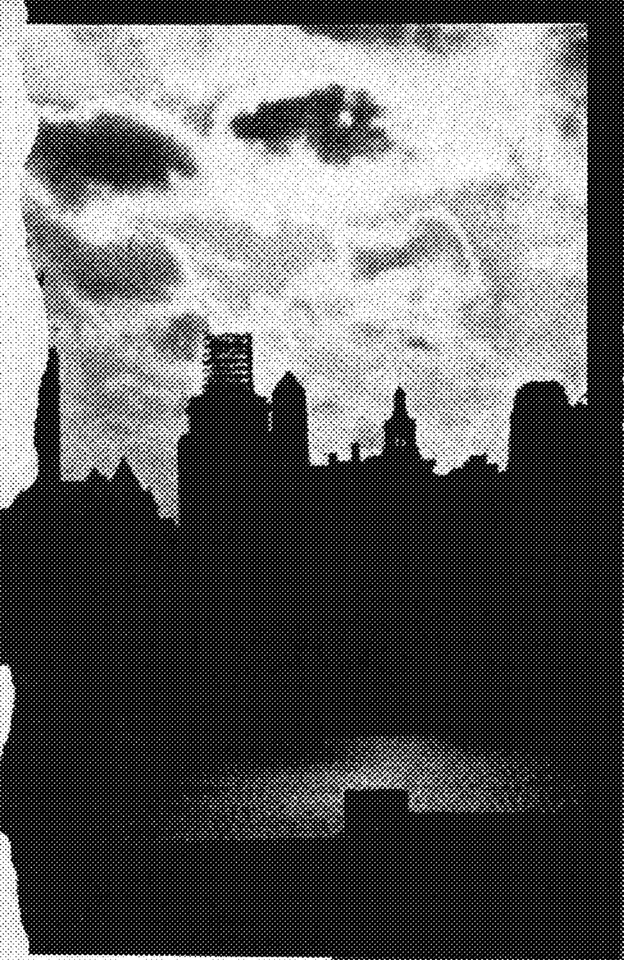
GENERAL ELECTRIC



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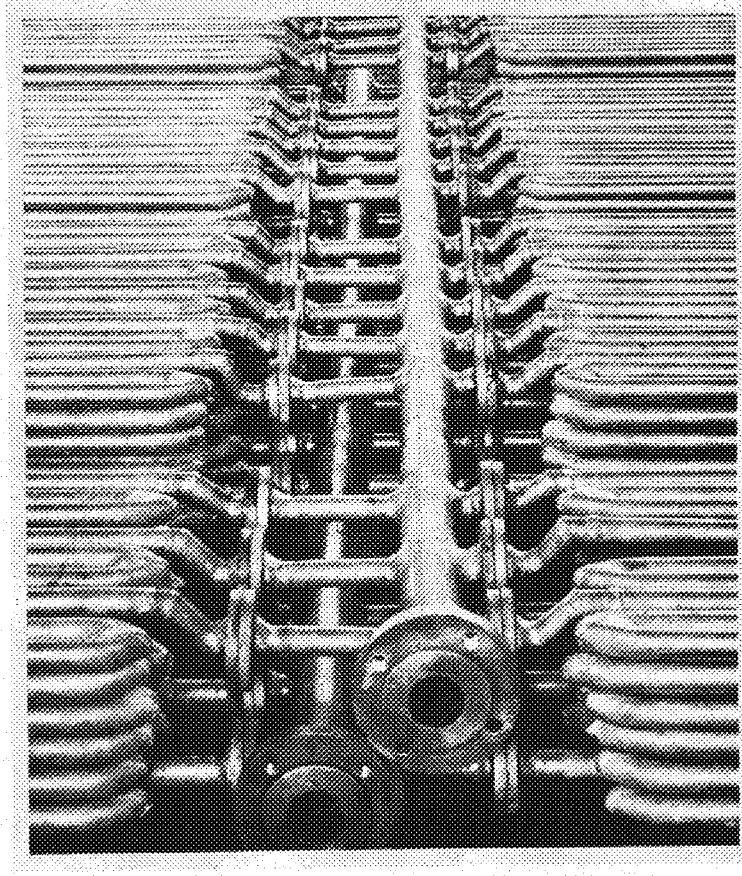
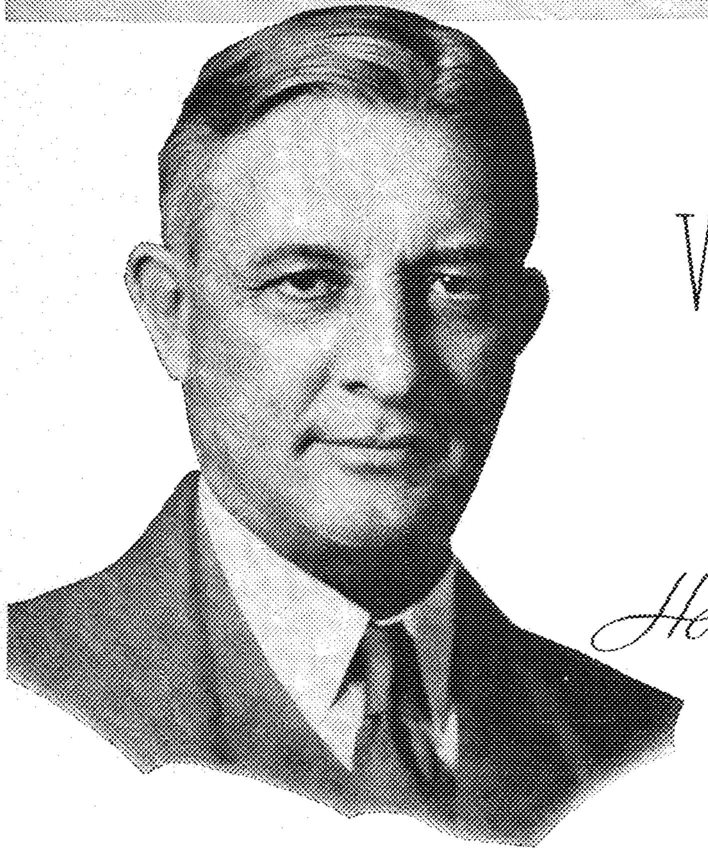
NOVEMBE 1937

MINNESOTA TECHNO-LOG

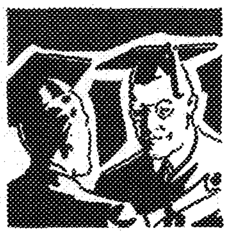




WILLIS H. CARRIER . . . ENGINEER

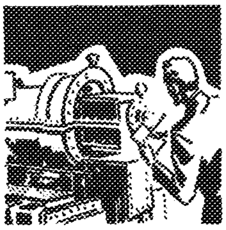
He Established the Art of Air Conditioning

AS an undergraduate at Cornell, Willis H. Carrier dreamed of the science now known as air conditioning. And in 1902, within a year after graduation, his dreams had become realities — through his installation of equipment to control troublesome humidity and temperature in a Brooklyn lithography plant.

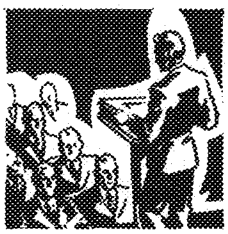


Years passed — years devoted to experimentation, to designing new equipment, and developing new methods of installation. Then, in 1911 Mr. Carrier disclosed his now-famous Rational Psychrometric Formulae to the American Society of Mechanical Engineers — and *true* air conditioning was born.

Overnight, a new industry came into being — an industry spreading health and prosperity throughout the world — and opening new and unlimited opportunities for engineers. And these opportunities have steadily increased — just as the demand for air conditioning itself has steadily increased. New men, *young* men are needed — men with the vision, the determination, and the ability to study and carry on the principles established by Willis H. Carrier and his pioneering associates.



To such men Carrier offers a wide variety of careers — ranging from laboratory research, machine design, sales and installation, to work in the far corners of the earth — the 99 countries of the world which today know the benefits of Carrier Air Conditioning. Youth is welcomed at Carrier, its capabilities fostered — the young engineer gains recognition in keeping with his accomplishments — not with age alone — for Carrier realizes that its future development, its future expansion depends upon its engineers.



During this year, Carrier has trained 300 recent graduates from leading engineering schools in every section of the country. Carrier needs more men. If you had a good school record, and are interested in the world's most fascinating, fastest-growing industry, write us.

Carrier Air Conditioning

CARRIER CORPORATION, SYRACUSE, N. Y.

AN ORGANIZATION OF ENGINEERS

Minnesota Techno-Log

Volume XVIII | 37 Electrical Engineering Building, University of Minnesota, Minneapolis | Number 2

ERLING HELLAND, Managing Editor

WARREN WALEEN, Business Manager

Published Monthly
from October to May

☆ ☆ ☆

This Month . . .

How do you like November's cover? You will recognize in the photograph the familiar skyline of Minneapolis. It was taken from the east bank of the Mississippi by Sig Jacobs.

The ground work of Dr. Piccard's balloon flight of last July is described in the first article by Roger Parkbill, a member of the ground crew, while in the second feature Dr. Piccard himself writes of his plans for future stratospheric exploration with manned balloon clusters.

Of especial interest to the Civils and Chemicals will be Leslie Anderson's story of the Twin Cities' new sewage disposal plant, now rapidly nearing completion on Pig's Eye Island.

What is geophysics? For what is it used? What are its methods? These are a few of the questions answered by W. W. Wetzel, assistant professor of geophysics, in the first of a series of articles describing new Institute courses.

Mr. Haga gives us look into a humorous book this month; you'll be sure to get a good laugh from his review.

The seeds sowed by last month's issue have brought a harvest of columns for this month; November's gossip mongers are Harry Larson, Millard Troxell, Leo Funke, old reliable B.H.T.L., and possibly one or two more.

How do last June's graduates compare in the point of employment with those of previous years? You will find the answer in a concise tabulation in the news pages.

A last word. We would especially like to have you read the column entitled *Letters* on the editorial page. And don't miss the editorial.

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MEMBERS OF ENGINEERING COLLEGE MAGAZINES ASSOCIATED

Chairman: PROF. RICHARD W. BECKMAN, Iowa State College, Ames, Iowa

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Colorado Engineer
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MECHANICAL ENGINEERING

"Man and Machine are One"

Dr. Piccard's Flight With Multiple Balloons

Here is a first-hand report of the work of the ground crew which assisted at the take-off of Dr. Piccard's craft, the "Pleiades" from Rochester this summer, written by a member of the group of Technology students who aided in the inflating and maneuvering of the balloons.

By Roger Parkhill, Aero. E. '40

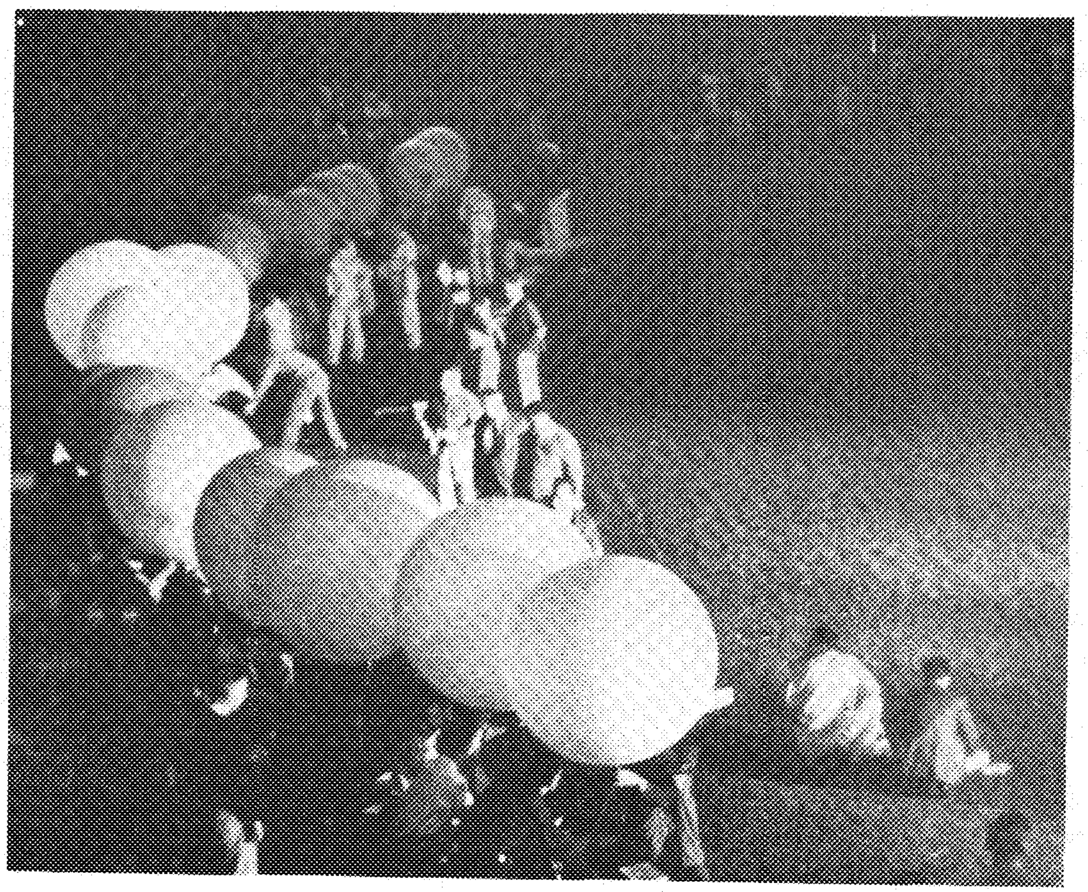
AWARE that something unusual was happening on the night of July 17, Saturday night crowds were unusually large on the main street of Rochester, Minnesota, the home of the famous Mayo Clinic. As early as 7:00 P. M. groups of people began gathering outside the high wire fence surrounding Rochester's recreation ground, Soldier's Field. As the crowd gradually grew, a feeling of suppressed excitement filled the air for the newspapers had announced, after days of waiting, that Dr. Jean Piccard, the University of Minnesota's famous stratosphere expert, that night would attempt the experimental balloon ascension for which he had been preparing for months. He would attempt to ascend two miles or more in a duraluminum gondola lifted by 90 balloons of the type used by meteorologists for carrying instruments to great heights to obtain data for weather forecasts. Spectators were frankly skeptical.

For several hours, Dr. Piccard was uncertain whether the flight could be made. Although the city was in the center of a high-pressure area, an overcast sky and dangers of thunderstorms threatened to cause postponement of the flight. Final decision was withheld until later in the evening when the clouds would clear away, and conditions be more suitable for the ascension. After several hours of delay, the crowd, now increased to over 6,000 spectators, was becoming restless and, in some cases, unruly. But, at 10:30 P. M. the clouds had cleared away, leaving a clear sky; and, at 11:03 P. M., Mrs. Piccard gave the long-awaited signal to commence inflating the 98 pure-rubber sounding balloons.

By 12:08 90 sounding balloons, inflated to slightly over four feet each, had been attached in two clusters, 50 feet apart, to the gondola; and the "Pleiades," as the craft was called, slowly rose as Dr. Piccard cast off ballast and re-

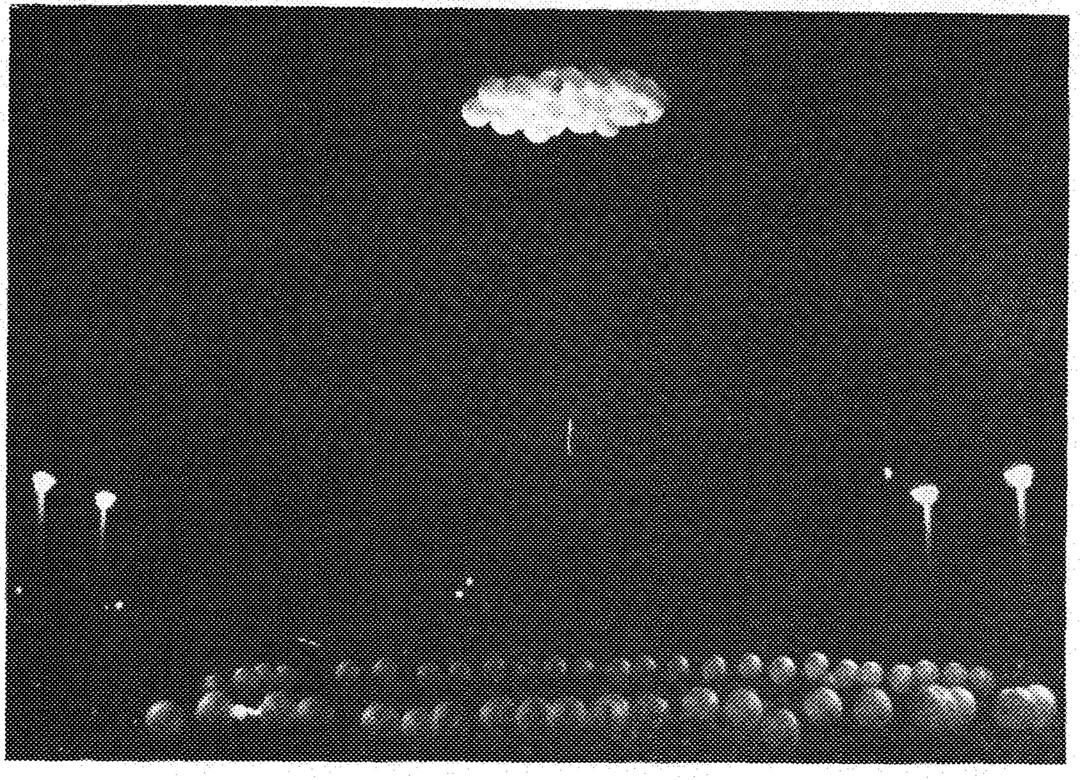
The ground crew inflating the balloons shortly after Mrs. Piccard gave the signal to prepare for ascension into the stratosphere.

HARLAND NASVIK



leased the four cardinal ropes holding the gondola to the ground.

For two and one-half hours Dr. Piccard maintained communication with Mrs. Piccard through the short wave radio with which the gondola was equipped. At 4,000 feet Dr. Piccard reported he had begun to feel the cold, and at 11,200 feet he released the first balloon in order to stop ascent. The craft stayed in the air about six hours and finally, after an exciting landing, came to rest in a ravine near the Mississippi River not far from Lansing, Iowa, 110 miles southeast of Rochester.


HARLAND NASVIK

Ready to rise toward the stars are the 45 balloons which comprise the upper cluster.

At dawn, in order to lessen the lift and try for a landing, Prof. Piccard had begun cutting loose balloons from the lower cluster. On being released, these balloons floated upward and snagged beneath the upper cluster, so the professor tried pulling balloons down by their individual strings and stabbing them with a knife. This method also proved too slow, as the "Pleiades" was fast drifting towards the Mississippi River, so he burst several individual balloons with the pistol he carried for that purpose. After guiding the gondola through the branches of the trees to a safe landing on the ground, Prof. Piccard closed the switch which exploded the TNT charge designed to cut loose the strings holding the upper cluster. The strings parted, and the balloons floated upward, but the excelsior packed around the TNT caught fire and, in the still morning air, fell downward into the gondola. In the resulting conflagration the gondola, with its radio and other instruments, was entirely destroyed.

One of the outsanding features of the entire flight was the speed and efficiency with which the ground crew operated, under the leadership of Mrs. Piccard. The main crew of some 130 men were recruited from among Rochester business men; while the reserve crews were one of 16 University of Minnesota engineering students and the other of 12 Rochester firemen. There were 49 hydrogen tanks, four tanks to a group with three men delegated to each tank. Two men each were assigned to handle and inflate a balloon, while a third man operated the valve of the tank. Three minutes were required to inflate each balloon to the point where it would lift a six-pound sandbag. The upper cluster of balloons was attached first, and allowed to rise to a height of 50 feet, five balloons being accidentally lost in the process. The lower cluster was then attached to rise to a height of 50 feet. The efficiency with which the whole operation was carried out speaks well for the ability and interest of Mrs. Jeannette Piccard.

Much credit for the success of the flight should be given to the Kiwanis Club of Rochester, whose interest and financial backing made the flight possible; to the Aeronautical students and technicians of the University of Minnesota, who constructed the duraluminum gondola and fixtures; to Dr. Erwin Strassman, former German World War Ace; and to Dr. Satler of the Mayo Clinic, who, with Commander Whitehead, was in charge of the central crew.

Although his instruments were destroyed by fire, Dr. Piccard regards his flight as entirely successful, proving the practicability of the use of multiple balloons to obtain static flight. Throughout the fall of 1937 and the spring of 1938 he is planning to send up clusters carrying instruments into the stratosphere in order to determine the behavior of the four-foot sounding balloons at high altitudes. If the results are entirely satisfactory, Dr. and Mrs. Piccard are planning an ascent into the stratosphere next summer using clusters totaling 2,000 balloons of similar design. At present the lack of backers to furnish the $100,000 to finance the attempt is the only serious drawback to the Piccards' stratosphere plans.

Having been a member of the University of Minnesota's ground crew on the experimental ascent, I feel certain that the task of filling and handling 2,000 balloons of the four-foot variety with hydrogen will present new and serious difficulties for any ground crew, no matter how efficiently organized or directed. On the first ascent difficulty was experienced in getting the balloons assembled in clusters of 45 each, and several balloons broke loose and were lost. How, then, will it be possible to assemble 2,000 such balloons in clusters? No doubt Dr. Piccard, with his scientific knowledge and amazing intellect, has already evolved a solution for this and many other problems with which he will be confronted on his next attempt to extract the secrets of the stratosphere.

Why We Explore the Stratosphere

By Dr. Jean Piccard

Lecturer in Aeronautical Engineering

THERE are several reasons why the exploration of the stratosphere must go on, will go on. Among the many secrets which the scientists want to wrest from the stratosphere the most fascinating one is, *at this time*, the nature of cosmic rays.

Old fashioned physics has taught us that matter is made from molecules. It has then shown us the behavior of these molecules. Chemistry has taught us that molecules are made from atoms. It has then shown us how atoms behave. Modern physics is teaching us that atoms are made from electrons, positrons, protons, and so forth. It is showing us now how these minute particles of matter behave. In this investigation alpha rays, beta rays, x-rays, gamma rays, and cosmic rays are our tools. By far the most powerful of these rays are the cosmic rays, but unfortunately we are utterly unable to produce them artificially in our laboratory. If we sit on the earth's surface waiting for them to come down to us, we are using a very inefficient method because they come to us altered by a long trip through the atmosphere; and most of them never reach us at all. This is why Auguste Piccard invented the stratosphere balloon. This is why physicists all over the world want to send their apparatus into the stratosphere.

The investigation of the stratosphere has been done by sounding balloons, radio balloons, and by the great, manned stratosphere balloons. These three devices are not competitors; they are each one doing their share which, as a rule, the others could not do at all or could not do as well. For the very greatest altitude the sounding balloon and the radio balloon have distinct advantages. They ascend five to ten miles higher than the manned balloons. When, on the other hand, we had to handle 800 lbs. of lead shields inside our stratosphere gondola, we did it without much difficulty; but the sounding balloon, which could have done this job automatically, had not yet been invented.

As to the possibility of a manned stratosphere flight being organized from our campus, it is, to say the least, a very attractive possibility. How will this flight be made? What kind of balloon should be used? How high would we want to go? In our work with sounding balloons we have already learned much about their possibilities and we have discovered that these small balloons can well be used to lift not only small instruments but man himself. Our flight from Rochester, Minn., sponsored by the Rochester Kiwanis Club, has given definite proof that the new craft can be piloted into the sky, and that neither start, flight, nor landing presents any unsurmountable difficulties.

While I was floating through the night under the starlit sky, I felt well at home in my little aluminum gondola, and I was only sorry that I had no air-tight gondola. If I had not started cutting loose some balloons when I was two miles up, I would have gone higher and higher; and, sure as death, I would have reached the cold stratosphere, but I would have been unable to report the exploration.

Now as to my future plans. We shall go on investigating the stratosphere with more sounding balloons. This investigation will give us added information about the behavior of these small rubber balloons. Then the problem of a new starting plan must be squarely faced. It will no longer be possible to carry the individual balloons toward the gondola. There is not enough space around the gondola for 2,000 men to bring the balloons, even if each man makes two or three trips. The method of inflation, as planned now, will not allow the use of two clusters. The operation will be largely automatic, demanding a smaller ground crew. The method of landing will set very specific requirements on the whole craft. For the ordinary free balloon the landing is not very difficult: a good pull on the rip cord, and the gas escapes through a wide hole in the fabric of the balloon. For the great stratosphere balloon the operation is more difficult, because more than one pull is required to produce a hole of sufficient dimensions to allow a rapid deflation. If the deflation is too slow, the delay means a dangerous dragging along the ground. With a craft of the "Pleiades" type the difficulty is obvious, and one must replace the ripping by an instantaneous release of a great part of the remaining balloons.

HARLAND NASVIK

Dr. Jean Piccard

There is another reason why the exploration of the stratosphere must go on. The great mechanical improvements of the passenger airplane have not prevented several bad accidents in the last few years. These accidents, by their very nature, could not have happened if the planes had flown in the cloudless stratosphere. In the future, our passenger planes must go provided with an air-tight cabin, and they must fly through the stratosphere. The sooner this is done, the more lives will be saved. The free balloon is showing the way to the stratosphere and for this reason it is of very great value to mankind. The more we know about the stratosphere, the sooner we can *demand* that passenger planes fly in the region of eternal fair weather high above treacherous mountain peaks and dark clouds. Then the safety of air travel will be greatly improved.

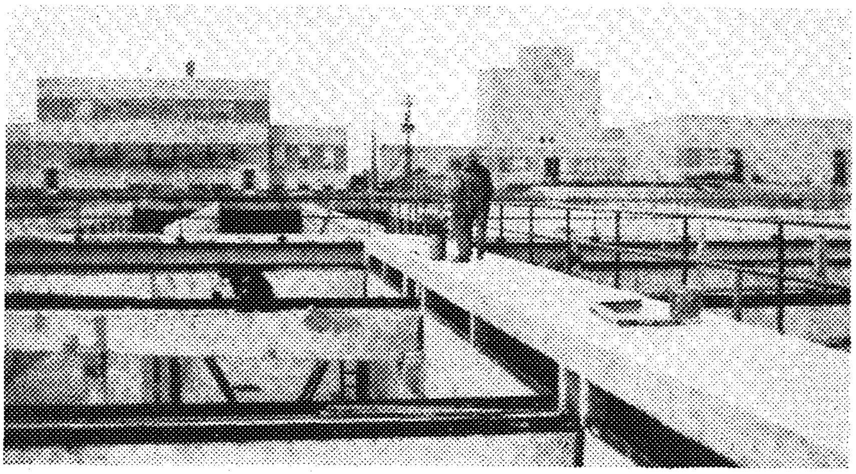


PHOTO BY AUTHOR

A general view of the plant showing settling tanks and chemical tower

134 Million Gallons Daily

A description of the Twin Cities' new sewage disposal plant now nearing completion.

By Leslie Anderson, C.E. '39

RAPIDLY nearing completion is a local engineering project of the first magnitude—the Twin City sewage disposal plant. Covering 15 acres of Pig's Eye Island in the Mississippi south of Saint Paul, it will have a capacity of 610 million gallons of sewage per day. The 53-mile network of intercepting sewers leading to the plant is designed to serve an expected tributary population of 910,000 by 1945.

Although the polluted condition of the Mississippi River had received casual attention in years before, official action by the Minnesota Department of Health in 1923 was the first definite step taken to solve the problem. Then, in 1926, after action by the state legislature, the United States Public Health Service conducted an investigation of the situation. After a thorough study by that body and by the subsequently formed Metropolitan Drainage Commission, the Minneapolis-St. Paul Sanitary District was organized in 1933. The next step was the beginning of construction of the intercepting sewers in 1934. The construction of the plant itself began in 1935.

Inasmuch as it is chiefly during very low river stages that the pollution load in the river is such as to require chemical treatment, and in view of the wide variation in river conditions, it was necessary to devise a method of treatment which would be both elastic and economical. Accordingly, the treatment plant is being constructed to function primarily as a sedimentation and effluent filtration process, with provisions being made for chemical treatment when river conditions warrant it.

A fairly definite idea of the size and efficient plan of the plant may be obtained from the sketch of the layout. The sewage treatment plant consists of screen and grit chambers, combined flocculation and settling tanks, and downward flow filters. The sludge disposal process will be carried out by means of concentration tanks, vacuum filters, and incinerators. To permit elasticity in operation and to provide a method of making comparative tests of different processes and chemical treatments, both the sewage and the sludge will be run through two distinct and separate divisions of the plant.

The sewage will be divided in the double barrel intercepting sewer leading to the plant from the north (from the right in sketch). From each barrel the sewage passes through the two separate, though similar, batteries of the screen and grit chambers. The screen chambers house two hand-raked, coarse bar racks and four finer, automatic bar screens. The partially screened sewage then passes through eight grit chambers, where the grit is removed by scrapers, washed, elevated by a screw conveyor, and discharged onto a belt conveyor.

Both the coarser screenings and the grit are transported by separate conveyors to an adjacent service room, where the screenings are discharged into a small hopper, feeding two screening shredders. Disposal of the shredded screenings will be to one of several points: to a centrifuge, back to the sewage passing through the chambers, to the conditioning tanks, or to the sludge concentration tanks. The grit can be discharged from its conveyor either to a storage hopper or directly into trucks or freight cars below.

Directly above the screen and grit chambers is located the chemical control building, in which are housed the dry chemical feeders, chlorinators, pneumatic conveying equipment, and storage bins. No definite choice of chemicals to be used has been made as yet, since actual tests under various conditions cannot be made until the plant begins operation. Because of the periodic and relatively unimportant nature of the chemical treatment, suffice it to say that lime, iron salts, and chlorine constitute the chemicals commonly used in sewage treatment. The extent of their use in this plant will be ruled by future conditions.

From the grit chambers the sewage flows through two Venturi meters to the settling tanks. Each Venturi meter is designed for a flow of from 43 to 350 m. g. d. (million gallons per day). Other measuring, recording, and totalizing instruments are located in the pump and blower building, the administration building, and the screen and grit chamber building.

The settling process is accomplished in the combination flocculating and settling tanks and in the settling tanks. The flocculating tanks are so designed that in the absence of chemical treatment they may be used as common settling tanks, but when used in this way they add 0.4 of an hour to the sedimentation period (at the expected average flow of 134 m. g. d.). These tanks consist chiefly of two units, one adjoining each battery of settling tanks. Each unit is composed of "two passes each 17 ft. 9 in. wide at the widest point and 290 ft. long with an average water depth of 15 ft. 6 in." Louvre gates at the front and back end of the center wall divide the two passes in each tank and provide for various sewage routings.

Similar to the combination tanks are the settling tanks. "Each of the two batteries of settling tanks consists of three units, each 56 x 290 ft., with an average water depth of 15 ft. 6 in." Each tank has three passes 18 ft. wide. At an average flow of 134 m. g. d. the sewage is detained in the settling tanks for two hours. All of the tanks are provided with sludge removal and skimming mechanisms. As in the combination tanks, the sludge is removed by conveyor type mechanisms traveling at a speed of two feet per minute to the cross collector channel. "The cross collectors, traveling at a speed of four feet per minute, transport the sludge to a hopper in each tank for removal by the sludge pumps," which pump the sludge to the sludge concentration tanks.

The skimming mechanisms, which are driven by the sludge collector flights, carry mechanically to a scum trough the skimmings conveyed to them by the return run of the sludge conveyors. From the trough the scum is discharged to pumps through pipes. Final disposal is accomplished by pumping either to the sludge disposal building or to an area south of the plant where it is either burned or buried. A comprehensive system of both longitudinal and transverse outflowing weirs provides 0.047 m. g. per foot of weir length at the average flow. To control and route the flow between tanks, 74 sluice gates are provided, varying in size from 36 x 36 in. to 72 x 84 in.

The pump and blower building, located between and north of the settling tanks, houses the pumps and blowers for various purposes. In addition to the pipes, the subbasement contains sump-drainage, under-drainage, and scum pumps. The basement has displacement and centrifugal sludge pumps and one tank dewatering pump. The main floor contains three blowers of different capacities, the control switchboard, and miscellaneous control equipment.

The effluent filters, eight in number and divided into two batteries, are of the downward flow, magnetite sand type. Each filter bed is 16 ft. wide and 244 ft. long, providing in all a total filter area of 31,200 sq. ft. with a filter rate of three gal./sq. ft./min. at the average sewage flow. Utilizing the magnetic property of the magnetite sand, a mechanically operated solenoid, on rollers, passes over and cleans the filter bed. The wash water is pumped into wash water troughs depressed to prevent freezing, from there into sumps, and then to the filter service building. The effluent which passes through the filters discharges into a double barrel, outfall sewer, each barrel being 10 ft. square in cross-section. Sluice gates prevent back-up from the river during high water stages.

The filter service building, located between the two batteries of settling tanks, houses the various pumps for the effluent filter process.

As stated before, the sludge removed from the settling tanks is pumped to the sludge concentration tanks. After the proper concentration the sludge is conducted to conditioning tanks, then to vacuum filters, and finally to the incinerators.

The quantity of sludge is expected to vary from an average of 155,000 pounds of dry solids in 360,000 gal./day to a maximum of 587,000 pounds of dry solids in 2,135,000 gal./day.

The two sludge concentration tanks, each with an effective capacity of 41,000 cu. ft., are provided with sludge collector mechanisms and scum skimmers, all completely covered. The sludge from the concentration tanks is conveyed by pipes to two sumps, or drainage reservoirs, in the filtration and incineration building. These sumps feed two bucket elevators of maximum capacity of 480 gal./min., the elevators discharging into two air-agitated conditioning tanks, each of 2,000 gal. capacity. The sludge then falls into six vacuum filters arranged in two batteries of three units each, each filter having an effective filter area of 500 sq. ft. The filtrate returns to a point ahead of the settling tanks, the filter cake being automatically discharged onto 24 in. reversible conveyor belts, which carry the cake to either of two main belts, and thence, after weighing, to the incinerators.

The three 8 hearth incinerators have a capacity of 60 tons of dry solids per hearth. The ash from the incinerator is put into hoppers and, after sluicing, is pumped to the area south of the plant.

The chemical treatment of the sludge utilizes lime with either chlorinated copperas, ferric sulphate, or ferric chloride, depending on future tests and material prices.

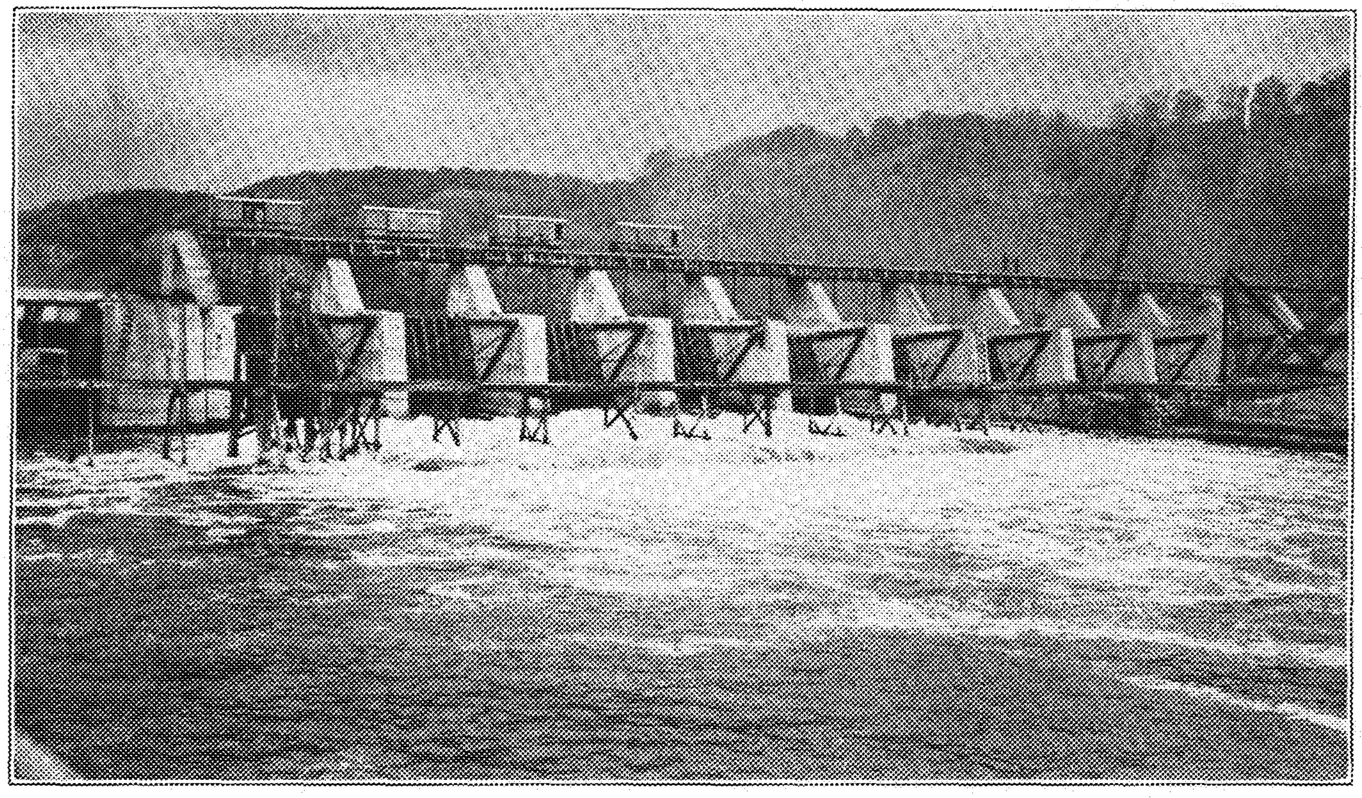
This explanation of the mechanical features and operation of the plant is necessarily limited in detail and therefore in clearness, chiefly because of the enormity of the process. One may, nevertheless, achieve some sort of understanding of the process in general if not in minute detail. Taken as a complete unit, perhaps the most unusual feature of the plant is its compact arrangement. This feature aids greatly in simplifying the operation and in reducing the cost.

The architectural student will find the simple modern architecture of the various buildings interesting. This, together with the planned landscaping of the grounds, will create a layout not only of practicability and ef-

One of the present Twin City sewage outfalls. After May, 1938, we will rarely see untreated sewage flowing directly into the river.
MINNEAPOLIS-ST. PAUL SANITARY DISTRICT

ficiency, but also of beauty. The modern equipment and furnishings within the various buildings also serve to carry out the general plan of utility and efficiency, combined with simplicity and beauty.

Perhaps the most attractive building of the group is the modern administration building, which contains the engineering and administrative offices and the various laboratories. The building is equipped throughout, either with air conditioning or, as in the case of the chemical laboratories, with an adequate separate ventilation system. A garage, a dining room, a locker and shower room, and an equipment room occupy the remainder of the space. The modern laboratory, consisting of six rooms and an office, covers an area of 2,050 sq. ft.



MINNEAPOLIS-ST. PAUL SANITARY DISTRICT

A construction view of the Hastings dam. Sludge has accumulated to considerable depths in the pools behind this and the Twin City (Ford) dam.

To protect the plant from possible flood waters in the future, a brush-mattressed, and rip-rapped dike about three feet higher than the plant floor has been constructed along the south and west sides of the river. The treatment process itself will remain in operation until the river reaches an elevation of 696.0 feet. Higher flows can be taken care of by means of by-passing the downward flow filters. When this is done, the settling tanks may be operated until the river stage exceeds 698.0 feet.

A general survey of the entire plant reveals a total number of 45 pumps varying in capacity up to 3,000 gal./min, and 350 motors ranging up to 75 h. p.

The construction of the treatment plant began in September, 1935. Present estimates indicate that it will be completed by next spring.

Although it is difficult to determine the construction cost of the plant as yet, the total of the bid prices on contracts already awarded is $3,425,797.48. This, together with the estimated remaining construction cost of $139,944.28 and a 5 per cent allowance for emergencies, omissions, and so forth, is expected to bring the total construction costs alone to $3,750,000.00, or $28,000 per million gallons of sewage in the average day.

This cost will probably be approximately divided between the units as follows: screen and grit chambers and chemical tower with accessories, $540,000; settling tanks, downward flow filters and accessories, $1,630,000; filtration and incineration building and equipment, $1,240,000; laboratory and administration building, $175,000; and miscellaneous, $160,000.

Perhaps more than one reader has begun to wonder how this huge project, together with the tunnel and intercepting sewer system, is to be financed. The present plan is to assess Minneapolis and St. Paul according to the property valuation of each city. Such a method would place a uniform charge upon the entire area within the Sanitary District.

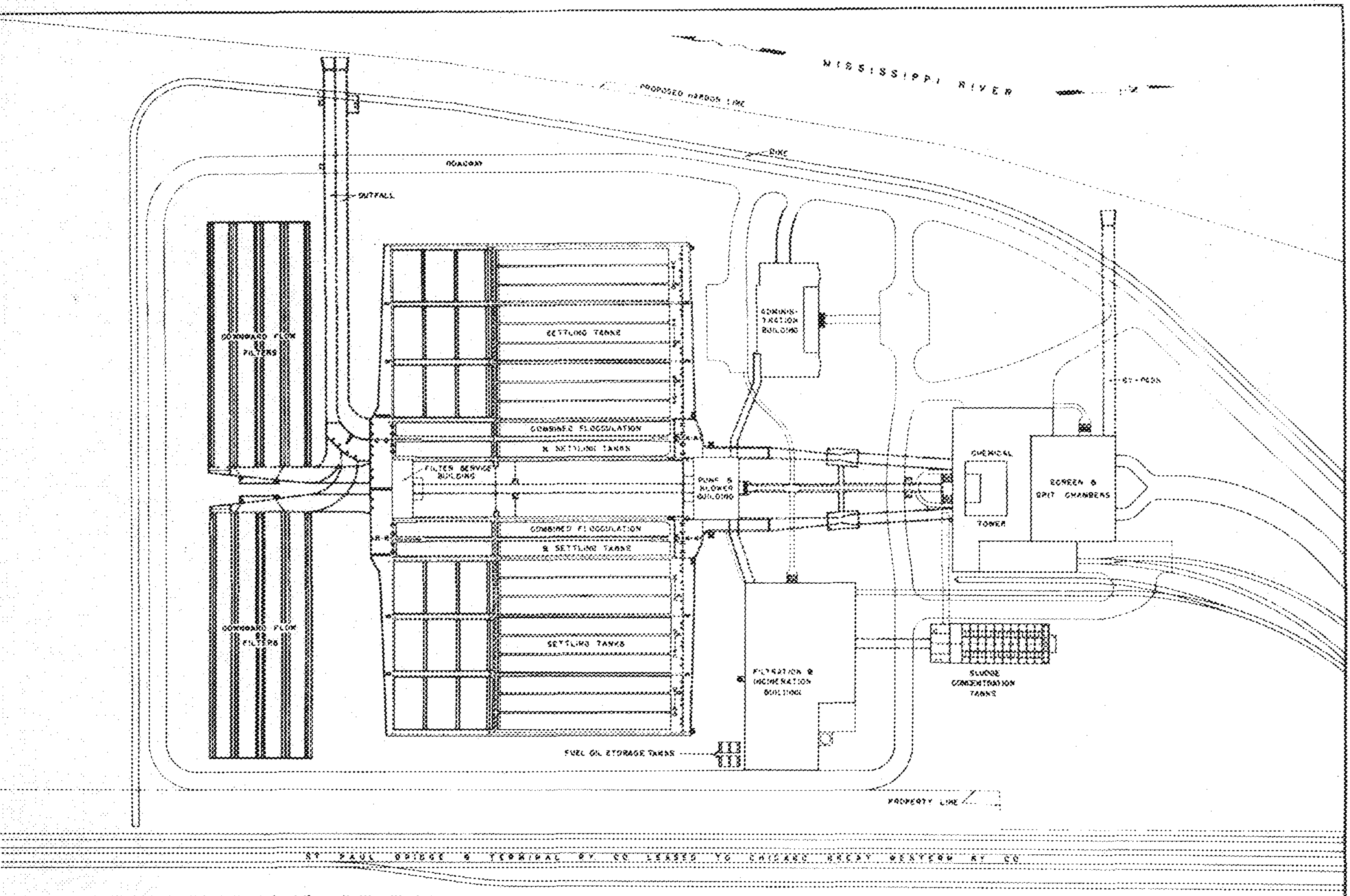
The subsequent costs of operation and maintenance will probably be distributed proportionally in each city on the basis of the total volume of sewage contributed by the city. In the case of Minneapolis and St. Paul, this ratio is approximately two to one.

Within each city the method of assessment is a matter of choice. Direct assessment according to the volume of sewage taken care of for the property owners and the various industries may be employed. Other methods take into consideration the assessed valuation of private property, the type of industry, the volume of water used, and the type of sewage discharged. Probably the rental charge will finally assume a form not unlike the ordinary water bill.

An interesting sidelight on the actual building of the plant concerns the method of handling the concrete construction. To facilitate the process, a concrete mixing plant was set up on the grounds. The aggregate was transported to the treatment plant by freight car or truck, dumped, and conveyed up an inclined runway to a small mixer and weigher. After being mixed in the proper proportions, the fresh concrete was loaded into cars which run on a narrow gauge track on an improvised runway. In this manner the fresh concrete was quickly and conveniently transported to the point of use.

The Minneapolis-St. Paul Sanitary District's system of intercepting sewers was described in the December, 1935, issue of the Techno-Log ("37½ Miles of Tunnels," by Lloyd Bredvold).

The author is indebted to Mr. George W. Schroepfer, assistant chief engineer of the Sanitary District, for his assistance and for his permission to draw on the report Mr. Schroepfer presented last month at the annual convention of the Central States Sewage Works Association. This article is largely adapted from his report.



MINNEAPOLIS-ST. PAUL SANITARY DISTRICT TREATMENT PLANT LAYOUT

MINNEAPOLIS-ST. PAUL SANITARY DISTRICT

Sewage will enter the plant from the right through a double-barreled sewer; effluent will flow to the river through the outfalls in the upper left.

Last winter some concrete placing was carried on under heated tent shelters which kept the concrete from freezing and provided more desirable working conditions for the employees.

The construction of the plant is being done under a total of 33 contracts. In general the furnishing and installation of the most important equipment was contracted for separately, to insure a definite placement of responsibility and a guarantee of performance and suitable workmanship.

"The Minneapolis-Saint Paul Sanitary District is under the direction of a Board of Trustees composed of three members, one from each of the Twin Cities and one from the State at large. C. C. Wilbur is Chief Engineer of the District, and William N. Carey is Project Engineer for the Federal Emergency Administration of Public Works."

The Minnesota Techno-Log

NOVEMBER, 1937

Again—Specialization?

We, as future engineers, hear a great deal of talk about specialization. We have often heard the modern engineer referred to as a "victim" of specialization. Since we are preparing to become engineers, it is important that we consider this question, in regard to both our present education and our future occupation.

In our society the sociological aspects of technology are becoming increasingly important. Society is calling upon the engineer to take a greater part in regulating the civilization he has created, and it is up to us as future engineers to prepare ourselves to take this part. This situation makes it necessary to appraise critically the trend towards specialized education. To take his proper place in the society of the future, the engineer will have to have a working knowledge of both economics and sociology in addition to his engineering training. The best possible place to obtain this knowledge is in college.

Viewing the question from a practical standpoint, it might be asked, "Does the broadening of the engineer's education meet with the approval of industrial leaders, the men who employ engineers?" The answer to this question may be found in the results of an investigation carried out by the Society for the Promotion of Engineering Education. The survey indicated that industrial employers prefer the more widely educated man to the specialist in nearly every case. Industry takes the view that a man with a basic knowledge in many fields can adapt himself readily to any particular one, whereas a specialist finds it very difficult to work in any but his chosen field. Furthermore, a specialist often lacks the breadth of vision that comes with more varied knowledge and which is so necessary in modern, interdependent society.

The conclusion to be drawn is that specialized college training is not the road to success. It should be the aim of the engineering student to obtain training in the sciences and the humanities so that he will be capable of becoming a specialist in any field if his job in life requires it. At the same time, he will be able to direct the results of his concentrated knowledge along channels which will be of the greatest benefit to society.

LETTERS

Hello, Readers!

This column was inaugurated last month for two purposes. The first was to give those of you who otherwise would not have a part in the publication of the TECHNO-LOG an opportunity to express yourself in print before your 2,000 fellow students.

The second purpose was to enable us to find out how you like the magazine and to learn what we may do to improve it.

We have been a little disappointed in your response thus far, but we have decided to write you a letter (sort of an informal editorial) every month we don't hear from you.

Perhaps you wonder what there is that you can write about. The answer is simple—write about anything you feel may be interesting to any considerable number of Technology students or faculty. Express your opinions on education, college curricula, student activities, politics, athletics, organizations. Possibly you don't like the way St. Pat is selected each spring; you may feel that it would be better to have Engineers' Day at some other time, that engineering dramatics should be revived. There are any number of such questions that would be suitable topics for letters.

Then, you might also write us if you think that we are printing too many columns or that our feature articles are not of sufficient all-Institute interest or that your division has not been adequately represented.

Are there any activities which you feel we have slighted or to which we have given too much space? Would you like more or less alumni news? It will take only a few minutes of your time to write us a brief letter. Why not take advantage of this opportunity to express your feelings effectively on these things?

This is your magazine. We are your employees and we want to do our best to serve you. You can aid us and yourselves a great deal by making this column yours. May we hear from you by the first of December?

Cordially yours,

E. H.

WILLIAM CZARNOWSKI

"Chem Lab"

Candid Camera Contest Winners

Here they are—the winners of the TECHNO-LOG's candid camera contest:

First Place........William F. Czarnowski, '40
Second Place...........Winston Granger, '38
Third Place..................C. R. Morse, '39

Many admirable entries were received, making difficult the job of selecting the best photographs.

The prizes are available for the winners at the business office of the TECHNO-LOG.

NOW HERE'S A BOOK

By C. I. Haga, Instructor in English

WHEN a college student writes in a theme, "the dog bounded down the street, emitting whelps at every bound," we only smile, knowing that such a slip of the pen is not properly in the class of great humor. When a foreign-born student writes, "people no longer take such ideas for granite," or "the experimental method has displaced the old method of trial on air," we laugh more heartily because the error is more complex. And when a Swedish-Nebraska housewife asks the storekeeper for "a syrup pitcher that will not run after when I go to hell," then we have good reason for loud laughter. As when a northern Minnesota Finnish farmer criticizes a neighbor, "he don't understand himself for botato gulture," or bitterly judges another's incompetence, "he ain't no any kottani koot for nothing," we know we are hearing something at once more serious and more comical than a mere slip of the tongue. Consequently, when we meet Hyman Kaplan of "459 E. 3 Str. N. Y., New York," and find him in his night-school eagerness conjugating the verb "to fail": "fail, failed, bankropt," we know we are making the acquaintance of a genius in the art of unconscious, jovial error.

I make no apology for urging you to get *The Education of Hyman Kaplan*, by Leonard Q. Ross. I am convinced that you should laugh as well as work and, although the Engineering Library has no copy of the book, you may read it with a clear conscience. In fact, Dean Ford himself has by implication praised the book, for in the Freshman Convocation he mentioned "my new-found friend, Hyman Kaplan." I go further than hinting at the excellence of the book; I go so far as to call it the funniest book of the last twelve months.

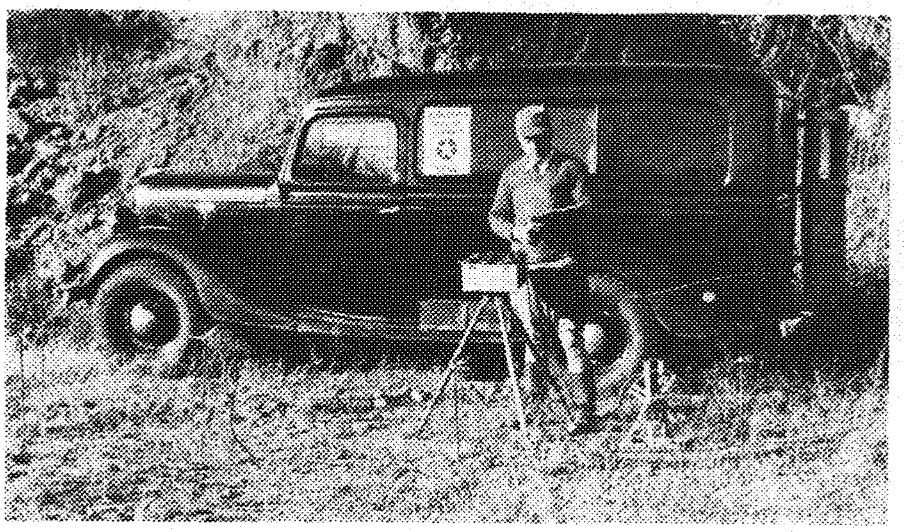
Let me give you a taste of Hyman Kaplan's genius for misfortune in using the English language. To him the plural of "library" is "Public Library," of "cat," "Katz." The adjective "bad" gives the comparative "worse" and the superlative "rotten." His "hobo" is biking, "hiking in de voods, or on de heels, or op de montains—all kinds biking." When corrected, he generously accepts criticism with a genial "Hau Kay!" His wife is a fit mate for him; in his words, "Avery morniuk she got op six o'clock, no matter vat time it vas!"

But Hyman Kaplan, funny as he is by himself, shines with a greater effect in his setting of "the beginners' grade of the American Night Preparatory School for Adults (English—Americanization—Civics—Preparation for Naturalization)," a company made up of Mrs. Moskowitz, Mr. Norman Bloom, Mr. Sam Pinsky, Mrs. Tomasic, Miss Caravello, and others under the sympathetic and worried tutelage of Mr. Parkhill. These other students may gradually lose their glory in a tame subjection to the petrifying rules of English grammar and pronunciation, but not Mr. Kaplan. He may approve of progress and praise it—as when he admired Mr. Bloom's correction of a Kaplan error. "Honist to Gott, Bloom, you soitinly improvink in your English to seeink all dese mistakes!"—but when you lay the book aside, you know that Kaplan will still be Kaplan, a patriotic American and a terror in our language. His spirited encomium on "Abram Lincohen" might, with very few changes, stand as his own monument: "Vat a sveet man! Vat a fine cherecter. Vat a hot—like *gold!* Look on his face! Look his ice, so sad mit feeliuk. Look his mot, so full goodness. Look de high forehat—dar's showink smotness, brains! Look de honest axpression! I esk, is it a vunder dey was callink him 'Honest Abie'?"

Fall Quarter Registration Institute of Technology

Course	1937	1936	1935
Aeronautical Engineering	280	235	202
Agricultural Engineering	25	21	24
Architecture	91	90	88
Arch. Engineering (Disc.)	..	1	6
Civil Engineering	188	192	163
Chemistry	139	157	125
Chemical Engineering	437	380	269
Electrical Engineering	310	298	254
Interior Architecture	12	8	8
Mechanical Engineering	356	284	229
School of Mines (Unclassified)	91	93	124
Eng'r of Mines (Mining Seq.)	25	31	30
Eng'r of Mines (Geology)	14	13	10
Eng'r of Mines (Metallurgy)	22	16	19
Eng'r of Mines (Petroleum)	8	7	7
Physics	10	7	..
Pre-Business	46	44	33
Unclassified Freshmen	72	77	..
Special Student	..	1	..
Unclassified Students	..	13	..
Total	2,127	1,977	1,590

Statistics are from the Institute of Technology office, the School of Mines office, and TECHNO-LOG records.



One of the latest additions to the curricula of the Institute of Technology is the geophysical sequence, of which the first courses will be offered this winter quarter. Designed to prepare the student for geophysical prospecting and exploration, the sequence will require four years of study. Mr. Wetzel, who will direct the sequence, is a graduate of the University of Minnesota and has done research work here and at Massachusetts Institute of Technology. He is a member of Sigma Xi and the Society of Exploration Geophysicists.

Left. The Minnesota state highway department utilizes geophysical methods for locating gravel deposits and investigating sub-soil conditions.

"Looking Underground" with the Young Science of Geophysics

By W. W. Wetzel

Assistant Professor of Geophysics

FOR some time I have been searching for a short description of what geophysics does, in order to answer the questions I hear so frequently: "Just what is geophysics?" The other day a friend made the usual inquiry and then supplied the definition for which I had been looking. I told him it was the science of exploring subsurface geologic structures by physical measurements made at the surface of the earth.

"Oh," he replied, "you mean it's x-raying the earth."

That is a good analogy and the more I consider it the better it seems. Not so many years ago, when two-year-old James Jr. was suspected of having swallowed a missing safety pin the family physician was confronted with a

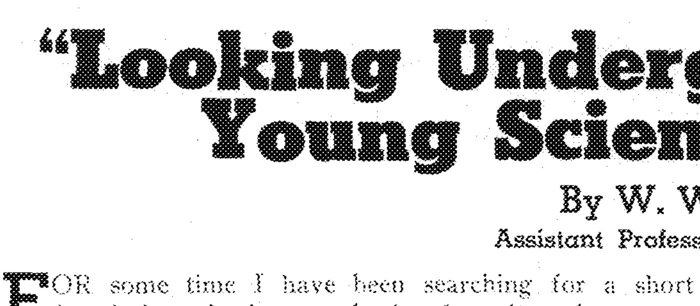


Fig. 1. Here is illustrated an electric circuit for determining earth resistivities.

difficult diagnostic problem. Today an x-ray photograph would be used to assist in relieving the young fellow either of the pin or of unfounded suspicions. Not so long ago our conception of subsurface earth structures depended to a large extent upon the geologist's diagnosis of surface symptoms. Now with the aid of geophysical methods we may "look" with considerable certainty into depths of a mile or two of crustal material. Like x-ray technique, geophysical manipulations are made outside the body being explored; both methods are used to supplement knowledge gained from surface symptoms and both depend for their successful operation on a contrast between the physical properties of the object sought and its surroundings. We know it would be useless to look on an x-ray plate for evidence of the egg little James ate for breakfast although the pin will show up nicely. It would be equally useless to explore geophysically for hidden earth structures which do *not* present some contrast with the surrounding in such physical properties as density, elasticity, conductivity and magnetic susceptibility. It is by playing upon these contrasts that the geophysicist is able to get his "look."

"Can't a geologist diagnose earth structure from surface indications alone?" some one asks. Indeed he can if sufficient surface evidence exists but only about 1 per cent of the evidence is exposed while the other 99 per cent is hidden by a mantle of unconsolidated soil or by unconformably laid sedimentary rocks. New information may be had from the hidden 99 per cent of the clues if drill holes are put through the soil blanket but frequently this is too expensive a process. The whole point of geophysical prospecting is that it provides an economical aid to the geologist in his search for hidden structures. To drill a single test well to a depth of 5,000 feet will cost about the same as a reflection seismic survey covering half a dozen townships where the exploration may reach downward 10,000 feet. Although the present cost of geophysical prospecting in the world's petroleum fields is counted in tens of millions of dollars each year, the discovery of a single good producing oil field may easily result in profits sufficient to cover the bills for all the geophysical prospecting which has been done since 1937 B. C. To have drilled thoroughly the area which has already been explored geophysically would cost more than the total profits from all the petroleum which has ever been discovered.

The outstanding success of applied geophysics in the exploration for petroleum and in prospecting for certain types of ore bodies is relatively well recognized while the less spectacular but equally successful applications of geophysics to some civil engineering problems have received little attention. It is not generally known that bedrock depths, overburden classification, and water table position can often be determined simply and inexpensively by geophysical means. I should like, therefore, to describe two common geophysical methods which are being applied with increasing frequency to these shallow depth exploration problems.

Resistivity Surveys

Principally because of the low cost of the necessary instruments the resistivity method has been most frequently used by engineers. It depends on the contrasting resistances to the flow of electric current presented by different earth materials. The resistance of unmineralized rocks and soil is a function of two variables, the amount of water the material holds and the concentration of soluable salts in the water. Conduction of the current is almost entirely electrolytic. Clays have an intermediate porosity but a low resistance due to the presence of capillary water with a high salt content. Sands and gravels have high porosity but since the water they contain is usually fresh the resistance is high. By far the highest resistances are presented by massive rocks of low porosity. Although the resistivity really depends on the electrolytic content it happens to increase with the size of the material particles which make up the deposit.

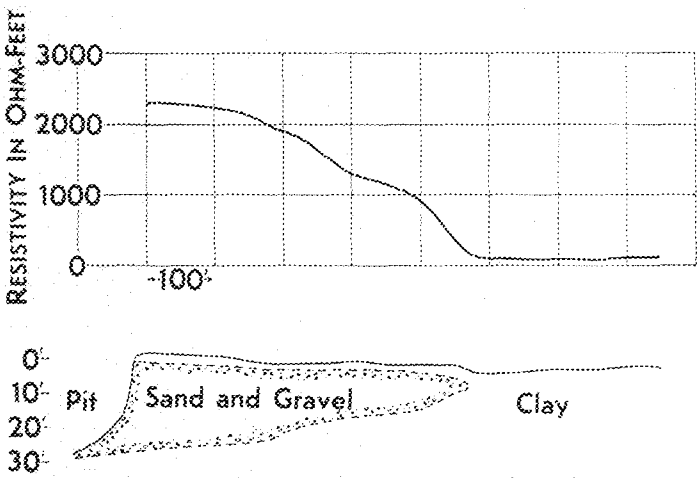


Fig. 2. Showing the effect of a gravel deposit on the resistivity.

The simplest possible form of apparatus for measuring the resistivity of a section of the ground is illustrated in Fig. 1. A measured current A from a battery is passed into the ground through two outer electrodes and the potential difference P developed between the two inner electrodes is read on a potentiometer. The resistivity R of the ground is then given by the equation $R = 2\Pi a\ A/P$ where a is the electrode separation measured in feet. In practice, the circuit is made slightly more complicated to avoid the effects of stray earth currents and the polarization of the electrodes.

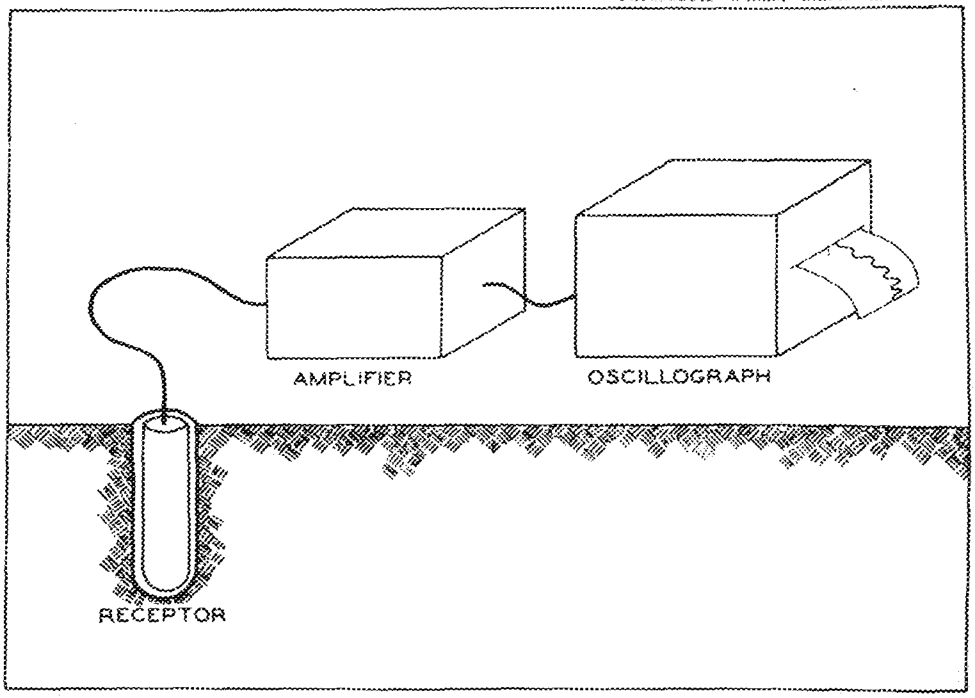
Resistivity surveys may be carried out in two fashions. Since the effective depth to which current penetrates the ground may be increased by increasing the electrode separation it is possible to measure the contribution which is due to increasingly deep deposits. This process is known as "electric drilling." The center of the electrode configuration is kept fixed and the results obtained are attributed to a vertical section of the earth directly below the fixed point. Curves of R plotted against a may then be compared with families of standard curves calculated for a variety of possible situations and an interpretation of the hidden structure made through this matching process.

This process has been used variously to determine the depth to bedrock in preliminary surveys for bridge and dam foundations. It can be used to detect the presence of solid rock in a proposed road cut, the depth of overburden on gravel deposits, the depth to water table and, in fact, depths to any type of shallow vertical resistance discontinuity.

The second type of survey is designed to detect horizontal discontinuities of resistance. This is done by keeping the electrode separation constant but advancing the electrode configuration along the surface of the ground. These surveys are called "resistivity profiles." As long as conditions under the electrodes remain constant the value of R will not change and a discontinuity of materials is easily detected by a change in R. Fig. 2 illustrates the use of such a survey to locate the edge of a gravel deposit. The resistivity drops abruptly as the electrodes cross the edge of the gravel. Such surveys are used to locate the edge of rock ledges, faults and buried river channels. The Minnesota State Highway Department has found that a useful application of the resistivity profile method is in the elimination of negative gravel prospects. Readings below 500 ohm-feet definitely indicate the lack of a work-

Detector used in refraction seismic surveys.

PETROLEUM WORLD, KISSER LABORATORY

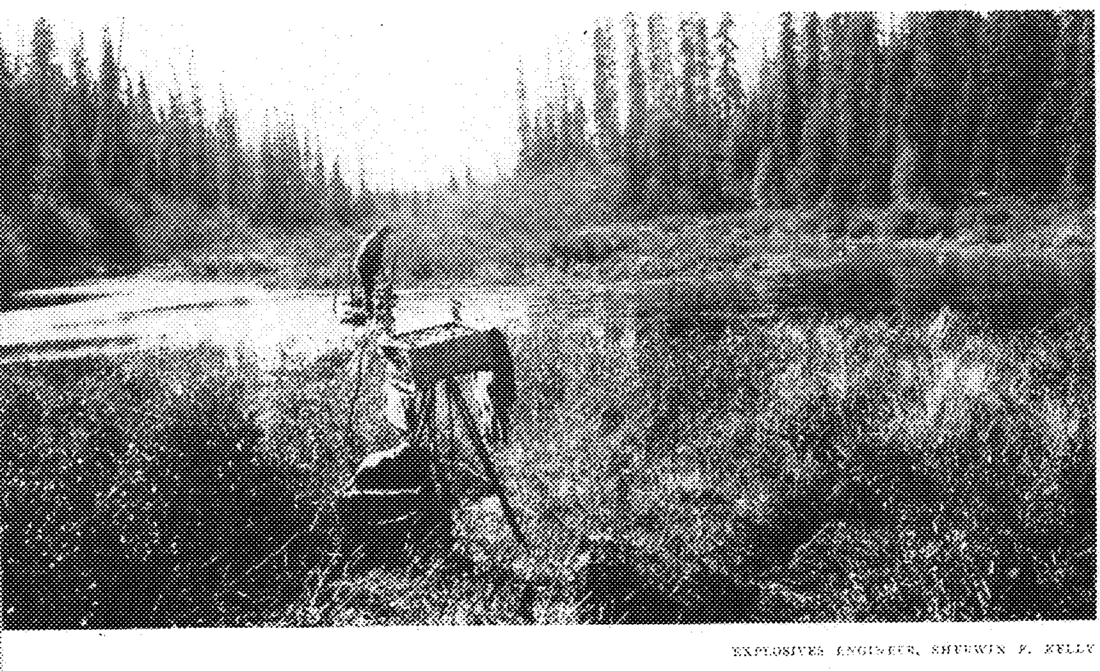


able deposit. Thirty minutes are necessary for the two men on a resistivity crew to run a 500 foot profile across a suspected deposit and where low resistivities are found will provide enough evidence to condemn the prospect. Test pitting over the same profile might well occupy a crew of ten men for a day.

Refraction Seismic Surveys

The refraction seismic method consists simply of measurements on the time taken for an elastic wave to travel from a source to a receiving point. The varying speeds with which these sound waves pass through different materials furnishes the contrast upon which the method depends. The more consolidated rocks have the highest speeds while loose soil has the lowest speed of sound propagation. The source of sound waves is usually a dynamite blast, although in some shallow exploration work a sledge hammer blow can give sufficient energy. A more elaborate set of equipment is needed for measuring the propagation time of the sound than is necessary for resistivity work. A detector sensitive to ground motion is required to pick up the first pulse of the incoming energy. A mass within the detector supported by springs tends to remain at rest when the case of the instrument is moved by the ground vibrations and the relative motion between the case and the mass is used to generate an electric pulse. One method is to allow a coil of wire attached to the mass to move through the field of magnets attached to the case. The pulse is passed through an amplifier and the output of the amplifier used to drive a galvanometer. A light beam reflected from the galvanometer traces a line on a moving strip of photographic paper. The instant the dynamite is fired is recorded on the moving paper by a second galvanometer whose circuit contains a battery and a loop of wire wound about the dynamite cap. Time marks are photographed on the film by some optical arrangement actuated by a tuning fork. The travel time of the elastic wave is read from the developed photographic paper by counting the number of tuning fork vibrations between the deflection of the shot instant galvanometer and that of the detector galvanometer. In practice not one but as many as twelve detectors each with its amplification channel and galvanometer are recording simultaneously and in this way the travel times to several points may be determined with a single shot.

Geophysical exploration for a Canadian dam-site.



EXPLOSIVES ENGINEER, SHERWIN F. KELLY

Fig. 3 shows how the first energy from the shot point *S* reaches each detector. Only the nearest detectors receive their first motion by waves traveling directly through the low velocity overburden on direct paths of the type marked *a*. The refraction method derives its name from the fact that the detectors remote from the shot point receive their first pulse of energy through waves of type *b* which are refracted by the higher velocity bedrock.

The process of interpretation involves plotting the time of first arrival at the several detectors against the distance

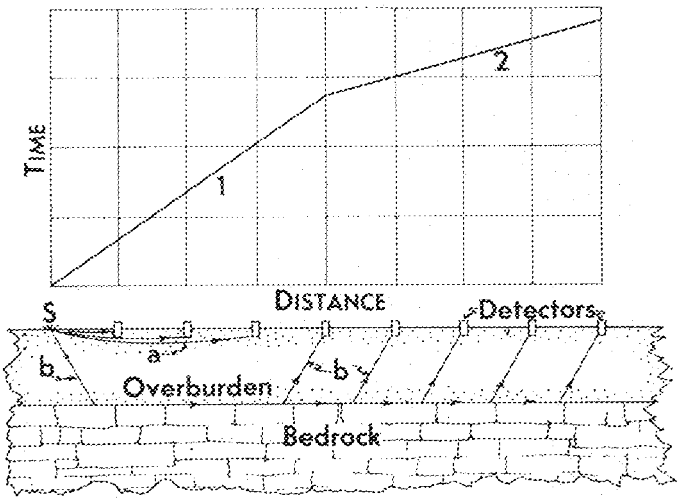


Fig. 3. Showing the path of the first elastic energy from an explosion at S to the detectors and the variation in time of energy arrival with the distance from the shot.

of each detector from the shot. Such a graph is illustrated in the upper part of Fig. 3. Several facts may be deduced from the graph. The inverse slope of sections *1* and *2* of the curve equal respectively the velocity of sound in the overburden and the bedrock. The point of intersection of the two sections is a function of the depth to the interface between the formations. In this manner the depth to velocity discontinuities may be determined with a considerable degree of accuracy and frequently, because of the characteristic velocities of different materials, the materials themselves may be identified.

In unconsolidated dry earth materials the velocity of sound ranges from 1,000 to 3,000 per second. In water saturated unconsolidated earth it is nearer 5,000 feet per second. Water table in an unconsolidated material is, therefore, capable of refracting the sound waves and its depth may be found in the same manner as the procedure used for bedrock. Furthermore, by a more elaborate setup the depths to the high speed beds under each detector may be measured and the refraction method used to outline a variety of distortions in the bedrock.

Although the present use of geophysical methods in civil engineering practice is confined almost entirely to state and federal projects, there is no doubt that an increased familiarity on the part of the engineers with geophysics will lead to its increased use in private practice.

TECH NEWS

By Charles Strom, E.E. '40

A. I. E. E. Attends Demonstrations

Electrostatic filtration of air and stroboscopic analysis of moving objects were just two of the many spectacular demonstrations given by Dr. Phillip Thomas, research engineer from Western Electric Laboratories, in a recent address to electrical engineering students and A.I.E.E. members. Speaking on "Adventures in Electricity," Dr. Thomas presented some of the problems that have recently confronted research engineers, together with their solutions.

Three student speakers addressed the A.I.E.E. at its third branch meeting. Bob Anderson spoke on sound recording; Bob Saunders gave a talk on fuses; and Lloyd English told of his work with the Ingersoll-Rand Co. Moving pictures of the ROTC camp were shown by George Culbertson.

"A Night at the Circus" to be Theme of Beaux Arts Ball

Students who let their consciences be their guides may find themselves the happy winners of prizes at the Architectural Society's annual Beaux Arts Ball, Nov. 19. Francis Meisch, general arrangements chairman, revealed that the committee plans to award prizes for the best costumes. The theme for the Ball is "A Night at the Circus" and, for the first time, is open to all University students (in costume—with tickets). In addition to the orchestra and dinner a special floor show will be presented.

Prof. Zelner Named to S. P. E. E. Committee

Word has been received from the Society for the Promotion of Engineering Education that O. S. Zelner, associate professor of surveying, has been appointed to the society's committee on Orientation of Freshmen for 1937-38.

A.S.C.E. Sponsors Joint Meeting

The A.S.C.E. is sponsoring plans for a joint society meeting Nov. 26 at which pictures of the Minnesota football games will be shown. A general smoker and get-together will follow the pictures.

Two meetings have been held by the A.S.C.E. this quarter. Early in the fall the chapter sponsored a smoker to get acquainted with the freshmen Civils. On Nov. 4, the annual bean feed was held in the Union.

Dean Lind Addresses Chicago Alumni Group

At their annual fall banquet, Minnesota alumni in Chicago were addressed by Dean S. C. Lind on the development of the Minnesota Institute of Technology. He described the research work that the Institute has undertaken on the Dakota lignite deposits and the low grade iron ore deposits of Minnesota.

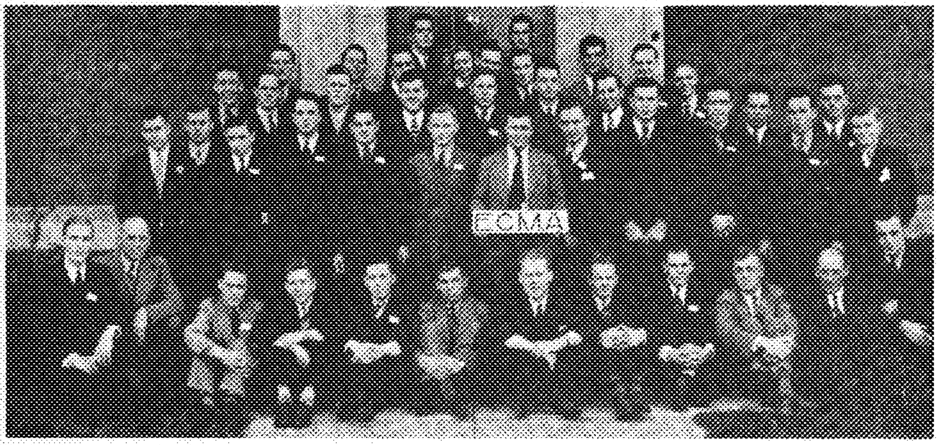
Employment Continues to Gain

Employment of Minnesota technical graduates continues, in 1937, to show the upward trend that characterized the past three years, according to statistics released by Prof. Alex Levens, head of the Institute's employment service.

The following summarization shows the size of each of the June graduating classes, the number that were known to be employed or in graduate work by November 1, 1934, 1935, and 1937, and November 30, 1936, together with the percentage employed.

	Nov. 1937			Nov. 1936			Nov. 1935			Nov. 1934		
	Number in Class	Number Employed	Per Cent Employed	Number in Class	Number Employed	Per Cent Employed	Number in Class	Number Employed	Per Cent Employed	Number in Class	Number Employed	Per Cent Employed
Aeronautical Engineering	21	18	86	16	14	88	22	17	77	31	11	35
Agricultural Engineering	..	..	..	2	2	100	4	3	75	2	2	100
Civil Engineering	31	31	100	18	18	100	33	29	88	37	29	78
Electrical Engineering	46	42	91	42	32	76	58	41	70	54	18	33
Mechanical Engineering	35	31	89	43	38	88	29	24	83	42	25	59
Architectural Engineering	..	..	..	4	3	75	7	3	43	11	6	54
Architecture	12	11	92	6	6	100	14	10	71	17	10	59
Interior Architecture	..	..	..	1	1	100	3	2	66	2	2	100
Chemistry	18	10	56	16	8	50	20	6	30	16	4	25
Chemical Engineering	40	33	82	38	27	71	32	23	72	27	14	52
*Geology (Mines)	5	4	80	..	..	..	3	2	67	1	1	100
*Metallurgical Engineering	7	7	100	8	8	100	7	7	100	12	10	83
*Mining Engineering	8	8	100	9	9	100	14	9	64	9	7	78
*Petroleum Engineering	2	1	50	2	2	100	2	1	50	3	2	67
	225	196	87	205	168	82	248	177	71	264	141	53

*The various divisions of the School of Mines were not considered as part of the Engineering group until 1936. The figures given for these departments in 1934 and 1935 were obtained from the School of Mines office. The remainder of the statistics were obtained from the employment service of the Institute and TECHNO-LOG records.



BERTIL LINDQUIST

Delegates to the seventeenth E.C.M.A. convention

E.C.M.A. Convenes for Two Days at Minnesota Campus

Representatives of 13 college magazines were guests of the Minnesota TECHNO-LOG at the seventeenth annual E.C.M.A. convention, Oct. 28-29.

During the first day problems in advertising were discussed in a round table session led by Tom Rogers, eastern vice chairman. Business managers from the various magazines exchanged ideas on how to secure more and better "ads." This session was followed by a presentation of new business matters.

The second day of the convention was devoted to editorial matters and election of officers. The magazines represented were criticised and the better features pointed out. Methods were discussed for making the magazines more appealing to the average technical student.

Following the resignation of M. I. Evinger as western vice chairman, Harlow C. Richardson, of the engineering English department, was nominated as one of the candidates to fill the vacancy. R. W. Beckman and Tom Rogers were re-elected chairman and eastern vice chairman, respectively.

Mentioned as one of the best student-written articles of the past year was Don H. Erickson's "TVA—the All Engineering Project," which appeared in the Nov., 1936, TECHNO-LOG.

A.I.Ch.E. Sponsors Field Trip, Address

Taking advantage of Minnesota's open football date, the A.I.Ch.E. chartered a bus to Chaska and inspected a sugar beet factory.

At a later meeting of the society, Dr. E. R. Weidlein, president of the American Chemical Society, addressed the group on chemistry's part in paving the way for progress in industry, business and living conditions. Both meetings were well attended.

Mines Society Elects Officers

Meetings of the School of Mines Society have been held weekly since the beginning of the quarter. Some of the meetings have featured outside speakers while others have featured student speakers or business meetings. The following men have been elected to offices in the society for the year: George S. Neuberg, president; Kenneth Bickford, vice president; Ward Simmons, secretary-treasurer. Donald Scott was elected as Mines representative on the TECHNO-LOG board.

PICK AND PAN

By M. A. Troxell, M. '39, and H. A. Larson, M. '39

At last the Miners have decided to take advantage of the opportunity offered them by the TECHNO-LOG. *This column has been introduced to acquaint the rest of the Institute with the viewpoints and the activities of the engineers in the School of Mines. We are sincere in our wish to "bury the hatchet"—may our relations with the other engineers continue to be pleasant and mutually profitable.*

That man is adit again, claiming that Miners are just drifters and will stope at nothing. I'll bed this is just a dig because he can't be on the level talking in that vein. Only a dip would strike at us this way. He who blasts at us is rilly an awful bore and never winze. If the Miners gangue up and chute him, his future prospects ore full of Lowe dredgery. Only a lode-down sill with a fault in his thick stull would outcrop with a tailing like this. Garnet all, our mines are galena than his pyrites. (The uninitiated may refer to a mining dictionary.)

Here's one on M. A. T., the columnist. The present Junior class of the School of Mines practically collapsed in gales of laughter at his expense, so we might as well pass it along for the Institute to enjoy. On the field trip there was a day devoted to solar observations. The night before the observations there was seething activity at the Park Hotel in Crosby. It seemed as though all were hunting for flashlights—necessary for all solar observations. This startling information was revealed in utmost secrecy to M. A. T. by Donald Berkner, guano expert extraordinary, who said that cross hairs on the transit could only be revealed by artificial light in the daytime. Strangely enough, M. A. T. was the only one who didn't see anything funny as that bright and shiny flashlight was solemnly laid by the transit in readiness for solar observations.

Steve Purcell found *the* little woman at Crosby. She was a school teacher and of the best according to Steve. He subsided very suddenly, while extolling her virtues, when Kenneth Bickford inadvertently remarked, "Why, she taught me the fundamentals when I was in grade school." I see she gave "Bicky" a good start.

Charles Walton lost a turning point while running levels in the Pennington pit; after vainly trying to find the thing he made some lame excuse. His partner looked at him—looked back over the hard course that they had travelled and which they would retrace before picking up the bench mark at the bottom of the pit and caustically remarked, "It doesn't matter, it wasn't important anyway!"

I wonder which Miner it is that believes in the saying, "All the great men are dead, and I don't feel so well myself." He has written it after his name in the metallography lab in the Mines building. Can it be the prize metallurgist?

Inconsequential fact: Did the Civil Engineers know that most of the engineers who worked on Boulder Dam were mining engineers? This startling fact is now issued for publication for the first time.

Priscilla Wrenn, the only lonesome (?) woman on the Techno-log staff, had a hard time at the recent E.C.M.A. convention here. She was escorted to lunch one of the days by forty loyal men of the magazines.

Two of the still green Freshmen were examining a nail the other day. One picked the nail up in his hand, placed it head end against the wall, and vainly tried to hammer it in. He gave up in disgust, looked at a fellow Freshman, and exclaimed, "The *?!!?--*?! They have manufactured this nail backwards." His fellowman bent a knowing look on the nail and brightly replied, "No, you're wrong—it belongs in the opposite wall."

Now you've read the first Mines column. We hope you have liked it and that you'll be looking for us in December. In the meanwhile won't you tell us what you think of our humble efforts?

ALUMNOTES

By John Murray, E.E. '38

'27

Honolulu, Hawaii, is the address of **John C. Marcroft**, C.E., who is in charge of the engineering division of the U. S. Engineer's office there. John proudly reports that he and Mrs. Marcroft (Mildred Gustafson, Ex '29) are raising a "budding 'M' man and Engineer."

'31

S. S. Watkins, C.E., is a soils engineer in the Minnesota Highway Department's soils division and has been located in Duluth since last spring. Other Civils in the Department are **Reshenbossel**, **Stan Ekern**, and **Roy Olson**.

'37

Gerry Mitchell, M.E., was married in July to Miss Marcia Thorpe of St. Paul. For their honeymoon they motored through northern Michigan and Canada to New Kensington, Pennsylvania, where they make their home at 1624 Leishman Ave. Gerry is in the central office of the Alcoa Aluminum Products during the day, and studies for his master's degree in production engineering at the University of Pittsburgh during the evening. Working with Gerry on their masters in Pittsburgh are **Marvin Lee** and **Pete Lohman**.

The M.E.'s have **Arlo Jordan**, **Joe Lightowler**, and **Wally Andeen** located in Barberton, Ohio. **Wes Webb** is in Detroit with the American Blower Company. **Dick Mollander** is with the Carnegie Illinois Steel Company. **Ted Mitchell** is in Chicago with the Deluxe Check Printers, **Bill Hanson** is in Africa, and **George Winn** is in Duluth. **Jack Melvin** is in the laboratory division of Alcoa Aluminum.

Mines School graduates who have reported include **Richard Sherman**, stationed in Duluth as technical representative for the Du Pont Powder Company; **Don Kugler**, with the Shell Company in Kilgor, Texas, and **Bill Kaiser**, who is in Freeport, Texas, with the Freeport Sulphur Co.

The Assistant Road Master for the Great Northern Railroad in Willmar is **E. Franzen**, E.E. Mr. Franzen has been with the Great Northern since July 1, 1937.

MAGAZINE REVIEWS

By Robert McEnary, C.E. '40

EFFICIENT BURNING OF COAL

Efficiency in the burning of coal follows the fundamental rule of combustion: "Establish the correct ratio between air and coal and maintain it." Such efficiency depends on a number of factors, such as the distribution of coal over the fire bed, the condition of the grates or stoker, and the size of the furnace, together with the application of the fundamental principles of combustion.

The method of applying coal to a fire by hand firing is important. It is good practice to fire by the so-called "strip method." In this method half of the coals are kept uncovered so the volatile matter present in the furnace will burn. Most causes of low efficiency by hand firing can be traced to human operation, and this condition can be remedied by properly instructing the fireman in the practical rules of combustion.

The spreader type of stoker sprinkles coal evenly over the grates by means of rotating blades, steam, or air jets, causing the fine pieces of coal to burn in suspension while the larger pieces fall to the grates.

It is unfortunate, but an actual fact, that at the present time the installation of second-hand boilers and stokers takes place even in new plants where fuel savings using new equipment would well repay the cost.

"Burning Coal Efficiently," by C. F. Hardy, from *National Engineer*, October, 1937, pp. 560-561.

EMPLOYEE EDUCATION ADVANCES

How does industry feel toward supplementing their employees' education by further part time schooling?

It is becoming the practice of leading chemical and engineering concerns to give their employees opportunity for further part time education. A firm which merely maintains its present status is sure to find itself behind those firms which are forever looking ahead and experimenting, therefore many concerns share in the expense of night school training of their employees. Such firms often share in the school expense on a ratio of the grades obtained by the employee. Often companies will stand the total cost, if a man maintains an A average in his classes.

The system is advantageous to both the employer and his employee. With a knowledge of the needs of the company, the employee can apply his new training to problems of the company. The advantage to himself is the fact that he is obtaining an income, learning at the same time, and making himself of greater value to his firm, thereby increasing his chances for promotion.

"Industrial Contributions to Employee Education," by W. L. Abramowitz, from *Chemical & Metallurgical Engineering*, October, 1937, p. 592.

SHAVING SCIENTIFICALLY

Even shaving has its technical side, which has been described in a recent article written from data obtained by five years of careful and technical experimentation. These experiments have brought to light many facts of direct interest to the safety razor user.

The selection of a razor is fundamental in achieving a "perfect" shave. It has been found that a razor with a tangent angle of approximately 28 to 30 degrees appears to be the most suitable for the largest number of men. Perhaps the most important factor in the process of shaving is the preparation of the skin. No agent has a greater softening value than plain warm water, which penetrates the hair and reduces its strength and hardness some 60 per cent, and its elastic properties nearly 90 per cent. Soaking the whiskers for longer than two minutes will also increase the efficiency of a single shave. Shavers should look first to their method of preparation before blaming their razors for poor results.

"Science Turns to Shaving," by Elbridge J. Casselman, from *Scientific American*, November, 1937, pp. 261-264.

EXPRESS HIGHWAYS FOR U. S.?

Will the United States develop "express highways" as other countries, such as Germany and Italy, are doing?

These so called "express highways" are becoming known as a forward step toward safety and economy. This system of highways eliminates grade crossings, steep grades and sharp curves, and incorporates wide paving, grades not to exceed 3 per cent, and clear visibility on curves. The plan also contemplates elimination of trucks and buses on these highways, which is an important step toward speed with safety. The superhighways in Italy and Germany by-pass the towns but make every effort to preserve the beauty of the surrounding landscape.

Of course it can readily be surmised that these countries are building these highways not only for peace time, but also for use in time of war. It was found during the World War that our system of roads was very inadequate for fast transportation of trucks for overseas duty, and from this we should take our lesson.

Today, use of the highways for rapid travel is ever increasing; the longer we wait to build such a system, the greater will be the expense incurred when it is done.

"The Express Road and the Highway System," by John S. Crandell, from *Civil Engineering*, October, 1937, pp. 690-693.

LINDQUISITION

By Bertil H. T. Lindquist, Aero.E. '38

This is the first (Ed.: "and last") of an authoritative series of articles on the Man's sport of hunting and fishing by a well-known *shooter*.

They row you out to rat nest in the middle of a boggy swamp and leave you there to shoot your fill of ducks. They return in three hours to find the rat nest sunk, icy water over your knees, ducks flying around your head as thick as bees—and you completely out of shells.*

Your first duck of the season bursts in upon your little firmament with the explosive abruptness of an earthquake—seemingly almost knocking you out of your blind. You swing your scatter-gun wildly, cursing, praying, and jerking the trigger simultaneously, and the bird does a half-roll and folds up, plummeting to earth and you exhale noisily, proud of your marksmanship—(and miss the next ten ducks who drift lazily by, right over your head).*

You're after pheasants in a drizzle and you're wet to the skin. You climb a low, single-wire, barb-wire fence, and, astraddle it, inadvertently come in contact with it to realize with ghastly suddenness that the wire is charged with high potential juice to keep cattle (and hunters!) from crossing—And that thing ain't no lightning rod!*

*A pheasant whirrs from under your feet with a roar like a twin-row Wasp headed for ceiling. You're caught off balance and shoot too quickly. The cannon picks up a lot of momentum, upsets your equilibrium, and you find yourself with two handfuls, a scalful, and a gunful of mud—and no pheasant.**

You're driving home on a narrow country road after a day in the field with absolutely no luck (skunked, in other words). You sight a flight approaching over the fields; you stop your car, jerk your gun out of its case, and blaze away. A big bird drops from the flock and flutters down into the field across the road. You start after it gleefully—and a game warden steps out of the bushes directly in front of you and says quietly, but with unmistakable finality, "Sorry, Buddy, but that's a State Game Refuge."*

Mary had a little Homecoming button,
But she knew not how to sell;
So she used her feministic wiles,
And, Oh did she do swell.

* !?-,()-|*':|)

This Month's Gem of Advice: "Always spit to leeward."

We worked this summer as a designing engineer of well machinery—talk about a swell job! All we had to do was design the stuff and that old genius, Prof. Boehnlein, would come around and make the thing work. Learned a few things about well drillers, too. A short time ago two of our biggest drilling companies were feuding and spent considerable time doing each other dirt. One misguided fellow who wasn't well versed in the finer points of well driller's feuds was unfortunate enough to stick his tools and then break his cable trying to jar them out. He needed a "slip-socket"—a cylindrical gadget with wedges on the inside which grip the pipe—and he borrowed one at the rig of a rival company. He used it only a short time and returned it in excellent condition, but the next day his company received a bill for "slip-socket rent" that ran in excess of the purchase price of the socket—several hundred dollars, in fact. . . .

The art and science of well drilling requires as fine a touch in its field as does concert violining and such stuff. And the degree and quality of touch varies with the depth of the well and the kind of material in which the drill is working. A short while ago, Mr. Jack Keys, one of our better drillers, took a man off a shallow well on which he was working and put him on a deep one. The fellow drilled all day and Jack went to see how he was doing. The driller complained that it was impossible to make footage—that the ground was so hard that the drill wouldn't go down. Jack took the controls and let the drill down to the bottom of the stroke to see if it was hitting properly, but the drill didn't hit. He let it down a few feet more and it still didn't hit. He gradually paid out cable into the hole for what seemed an interminable time and eventually found that his man had been drilling all day with the drill bit twenty feet from the bottom of the well!

THE IONIZER

By Beta, Ch.E. '39, and Sigma Ch.E. '39

We finally figured out how those physicists (ingenious people) are going to split an atom. It's simple. All they have to do is drop that 1.12749386048005673968 ton steel sphere on one.

We don't like to bring up debatable matters, but we've been told that the order of intelligence of professional men is this:

1. *Certified public accountants, a very select group who work chiefly for the government in the Income Tax bureau.*
2. *Chemical Engineers. (Ahem!)*
3. *Lawyers.*

Someone should tell that fellow who had that ad on the P. O. bulletin board offering rides to and from school at .05 cents a ride that he would have to get 100 people per day to take in a nickel.

The Du Pont scout has already made an appearance at the Chemistry building, interviewing some 20 Chemists and Chemical Engineers. This is an unusually early start and may be indicative (we hope) of a prosperous year for the graduating class.

After reading this column over we suddenly realized why the majority of the people are against columnism.

LOWE-LIFE

By Leo. Funke, M.E. '38

There's going to be one very disappointed freshman Civil this month. He's the fellow who was overheard saying, "Gosh, we have to pay $36.40 tuition. I don't know what the $36.00 is for, but the 40 cents pays for what Bill Lowe has to say about the miners."

As for Bill, he'll be gone for a while, kiddies. He's been a very naughty boy, and teacher says he can't come out and play.

Russ Powers, frosh Electrical, has a habit we like. He rattles the milk bottles when he comes home so his folks think he's the milkman.

POME

In this life of love and laughter
I have learned a lesson of yore.
Better to have had a morning after
Than never to have had a night before.

Most of you who went to the Notre Dame game no doubt noticed what a tough time our "All-American cheer-puller" had in climbing the goal post for his between-the-halves "show-off." Few besides our espionage agent, the cheer leaders, and the junior civils know that the posts were greased. How come the junior civils were wised up? You didn't think they'd keep a secret did you, George?

Oh, yes, George, this month's cabbage leaf goes to your girl—the one from out of town, I mean. You see, fellows, George's girl was invited up for the Notre Dame game and showed up on Tuesday. Wonder what Mr. and Mrs. Mowry thought of that.

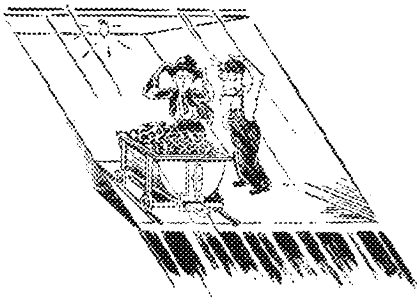
With television around the corner it will soon be "Why don'cha call me up and see me some time?" Heh! heh!

Much as we dislike literary columns we gotta use some poetry to fill this page.

Lips that touch whiskey,
Lips that touch brew,
Are always the first lips
To say "I love you."

—Shakespeare.

G-E Campus News

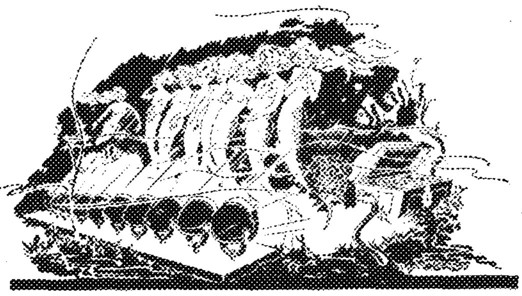


A 40-MILE-AN-HOUR MINE HOIST

The problem of hauling a 25-ton load up a steep mine shaft at a speed of 3,600 feet per minute, or approximately 41 miles an hour, was recently undertaken by the General Electric Company for a Southeastern coal company. Upon completion, this mine hoist will be the largest and fastest in this country.

More than 6000 feet of wire rope wound around an 18-foot drum will hoist an unbalanced load of 50,800 pounds to the surface. The driving power for this tremendous weight will be a 2500-hp G-E hoist motor with dynamic braking as a safety factor to reduce the speed when men are being carried.

For the last 40 years the General Electric Company has been engaged in the manufacture of electric mining equipment. Much of the new design and development in this field has been contributed by college-trained men who were on Test.

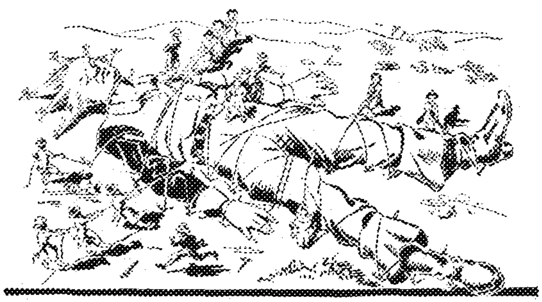


FLOODLIGHTING DAVY JONES' LOCKER

When Capt. John D. Craig, deep-sea diver and photographer, descends to the black depths of the Irish Channel to photograph the salvage operations of the Lusitania, Davy Jones' Locker will be floodlighted for the first time in history.

The hulk of the ill-fated Lusitania lies buried in shifting sand at a depth of approximately 300 feet, with a treasure in her coffers valued at between $4,000,000 and $15,000,000. To illuminate the wreck for filming, the General Electric Laboratories in Nela Park, Cleveland, Ohio developed a 5000-watt lamp, built to withstand a pressure of 500 pounds to the square inch—more than three times the pressure believed to be around the vessel. Capt. Craig will use a battery of 12 of these lamps mounted on a submarine stage to floodlight the inky depths.

So widespread are the uses of electricity that the development of an underwater lamp merely illustrates the problems encountered by G-E engineers. Many of these men were on the college campus but a few years ago.



MODERN LILLIPUT

Wire, three thousandths of an inch in diameter, flattened between two polished rollers to a thickness of nine ten-thousandths of an inch; pivots ground to a point and then rounded to a radius half the diameter of a human hair, yet still sharper than the sharpest needle; sapphires not as large as the head of a pin. Such Lilliputian parts are to be found in the West Lynn plant of the General Electric Company.

A pivot with a point two thousandths of an inch in diameter, yet it supports a pressure of many thousands of pounds to the square inch. Hundreds of such parts are assembled to produce instruments—instruments that measure small flows of current, great flows of current, light, sound, vibration, strain, and time. These instruments are so sensitive that they measure the smallest quantities, yet sturdy enough to withstand the severe vibrations of a locomotive cab or an airplane dashboard.

The design and manufacture of precision instruments is but one of the many fields which are open to technically trained men in the General Electric Company.

GENERAL ELECTRIC

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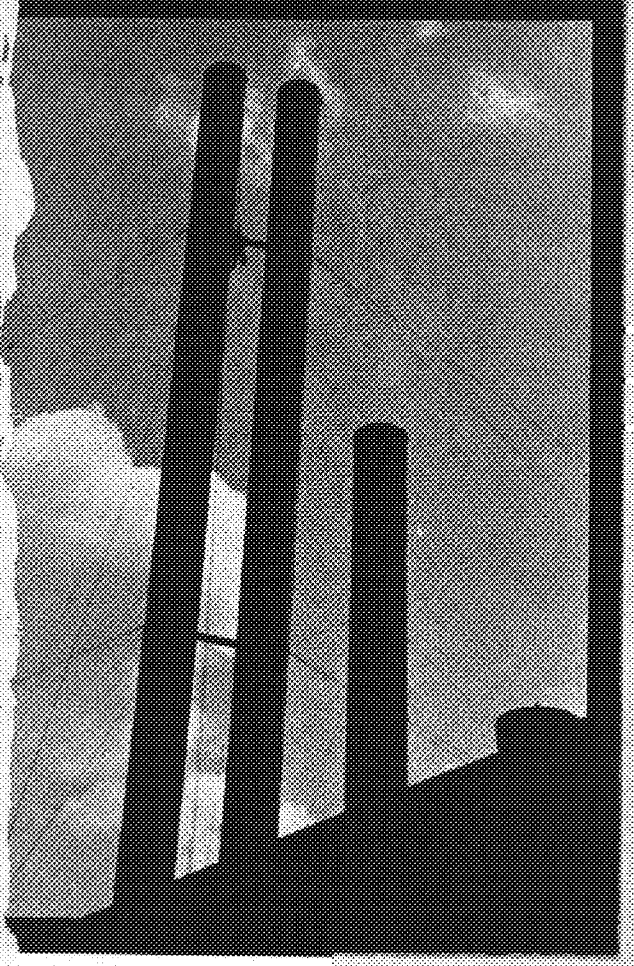

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DECEMBE

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MINNESOTA TECHNO-LOG

Minnesota Techno-Log

Volume XVIII — 37 Electrical Engineering Building, University of Minnesota, Minneapolis — Number 3

ERLING HELLAND, Managing Editor — WARREN WALEEN, Business Manager

Published Monthly
from October to May

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This Month . . .

The purpose of this column is not, as has been suggested, a repetition of the table of contents but rather a brief paragraph picture of each feature in the magazine. The objective we have in mind is to call attention to particular details which otherwise might be missed.

The cover photograph depicts a group of power plant smokestacks; it was taken by Sig Jacobs.

Professor Rowley's presentation of research developments and plans heads the list of articles this month. He briefly describes the Institute's plans for making research much more important here than it has been heretofore. By the way, how many of us have ever seen the interior of the Oak Street laboratories?

Jobs! Jobs! Jobs! They loom more and more important as we proceed through school and approach graduation. Professor Levens steps forth this month with the first complete discussion of the workings of the employment service of the Institute; you will want to read his article.

Incidentally, you will get a kick out of checking up on yourself with the rating scale on page 59.

For light reading (it's informative, too) we present the junior Miners' field trip, by one of the Mines school's most irrepressible punsters. You may tear your hair, but just the same you'll enjoy your trip to the Range.

Letters break out in adverse criticism of our policy, but we're not sorry. We want criticism whether it's good or bad. Remember, however, that we want letters pertaining to everything that may be of interest to Technology students.

We hope we'll see you all again next quarter. Until then: Merry Christmas and a Happy New Year!

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MEMBERS OF ENGINEERING COLLEGE MAGAZINES ASSOCIATED

Chairman: PROF. RICHARD W. BECKMAN, Iowa State College, Ames, Iowa

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Institute Expands Its Facilities for Research

By Frank B. Rowley
Director, Engineering Experiment Station

WITH the completion of two new laboratories, the Oak Street and Hydraulics Laboratories, the Engineering Experiment Station of the University of Minnesota will afford facilities for the development of technical and industrial problems which will be second to those of no other university in the country. This does not mean, however, that prior to this time technical research at the University has been minimized. In the various laboratories of the Institute of Technology men have been supervising and conducting researches for many years. Research is a necessary part of the growth of any institution, and with the reorganization of the various technical units into the Institute of Technology under the direction of Dean S. C. Lind, the scope and enthusiasm for scientific investigation has been greatly increased.

Oak Street Laboratories

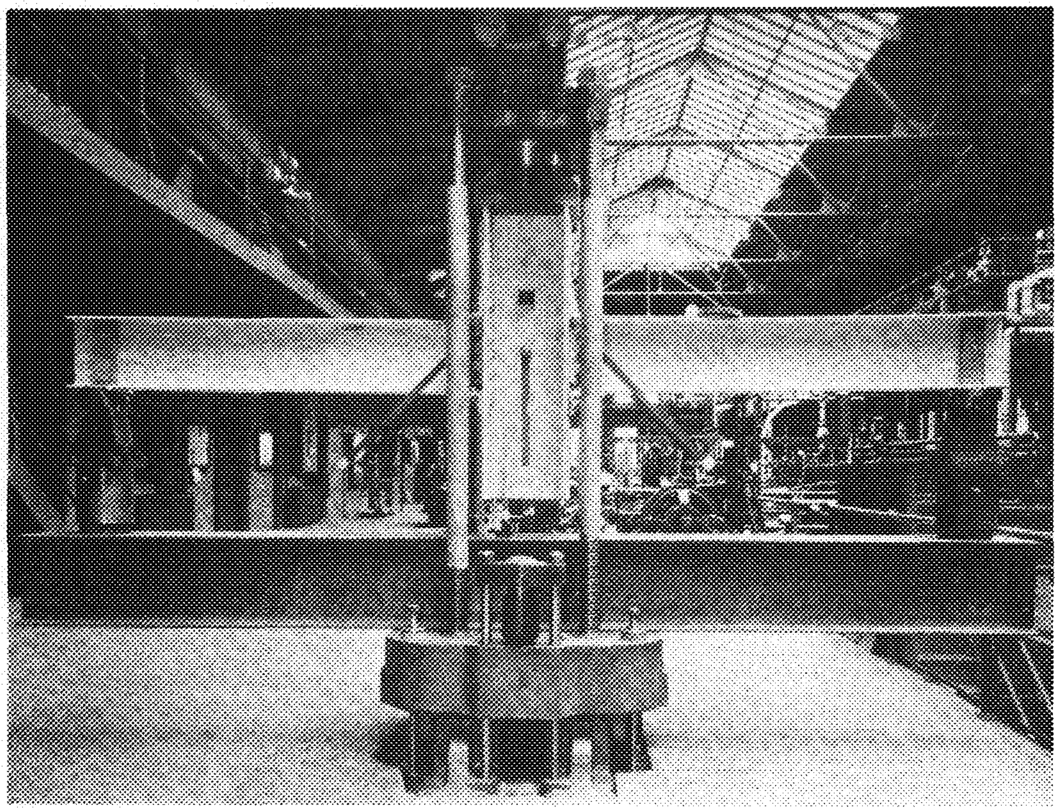
These laboratories have been built at a cost of $120,000 by remodeling two industrial buildings formerly occupied by the Caterpillar Tractor Company. This development has largely been made possible by the assistance given by WPA funds. The larger of the two buildings has an area of 165 feet by 185 feet, with two floors and a full basement. A freight elevator, railroad tracks, and a 7½ ton traveling crane over a large central section provide means for transportation within the building. The other building has a floor area of 125 feet by 65 feet with two floors and no basement. The combined floor area of these two buildings is 77,000 square feet, exclusive of the basement. They provide laboratories, offices, and conference rooms for many types of experimental work carried on by a large staff of research workers. They are being especially equipped for industrial problems in the field of chemistry, cement and concrete work, aeronautical engineering, materials and structures, and heating, ventilating and air conditioning.

These problems, in specific, have already given rise to research on the development of methods of manufacturing hydrogen gas from lignite in commercial quantities, and experiments with magnesite ore. These projects are under the supervision of Dr. Lloyd H. Reyerson and are financed by the Northwest Research Foundation. With the millions of tons of lignite available in the Northwest this project promises to have future significance.

Studies on the effects of moisture condensation within building walls are under way. Mr. Clarence E. Lund is being employed as research engineer on this project, liberally financed by the National Rock and Slag Wool Association. For these studies a cold room 30 feet square and 28 feet high whose temperature can be reduced to 30 degrees below zero has been constructed. Small test houses placed inside this room are built up of test walls of different types of construction and containing various insulating materials. These are taken apart periodically and examined for moisture conditions. This cold room will eventually house a small bungalow for test purposes.

A railway car test room 20 feet wide, 20 feet high, and 90 feet long has been constructed with railway tracks for the purpose of testing refrigerator cars or air conditioned passenger cars. The room is insulated with 6 inches of Rock Wool, and provisions will be made to vary the temperature from 125 degrees above zero to 30 degrees below zero. A large removable door at one end will permit the entrance of the largest size railway car, and a smaller door at the other end will take in an automobile or a large sized truck. Arrangements are made for partitioning the room when one end of it is used for automobile test work. This is the only room of its kind in the country.

This will give you some idea of the size of the cold room of the new Oak Street laboratories. Here will be carried on experiments with moisture condensation in the walls of air-conditioned houses.



An interior view of the present experimental laboratories. Much of the Institute's undergraduate work will be carried on here.

Two wind tunnels are provided for the work in aeronautics under the direction of Professor John D. Akerman. A small tunnel with a 4 foot square "throat" and equipped with a 50 horse power motor and 4 blade propeller is being moved over from the present laboratories. This tunnel will have a wind velocity of approximately 100 miles per hour. A large new tunnel with a "throat" 7 feet high and 10 feet wide, designed by Professor Charles Boehnlein, will have a wind velocity of approximately 125 miles per hour, and for the present the propeller will be driven by a 400 horse power gasoline engine. These wind tunnels will be used for testing airplane models, streamlined automobiles and so forth.

There will be four airplane engine test rooms, constructed of reinforced walls with other protective features to prevent damage from the breaking of propeller blades or from other possible accidents. All the controls will be taken to the outside of these rooms so that it will not be necessary for the operator to be in the test rooms while dangerous experiments are being carried out.

A "dynamometer" for the testing of automobiles will be constructed and will consist essentially of a moving platform or belt which will support the car and be driven by the car. With this machine it will be possible to make a complete road test of an automobile, and, since the "dynamometer" will be portable, it will be possible to make studies of lubrication, starting systems, and car performance in one of the cold rooms. This equipment, as well as airplane engine testing equipment, has been designed and is under the direction of Professor Burton J. Robertson.

One of the particular features of these laboratories is a thoroughly equipped concrete and structural test room. It will include three temperature and humidity control units, a freezing and thawing unit in which temperatures of 20 degrees below zero may be maintained, and other special facilities for studying the various problems of concrete construction, especially those which are peculiar to this locality because of the cold weather in which much of the construction work is done. Professor C. A. Hughes, who has charge of the work in this field, has already accumulated a large amount of information concerning the effects of freezing and thawing on strength and other properties of concrete.

Hydraulics Laboratory

This laboratory, known as the St. Anthony Falls Hydraulics Laboratory, is located on Hennepin Island in the Mississippi River. The laboratory was designed by Dr. Lorenz G. Straub and provides facilities for practically every type of hydraulic research work.

The laboratory will be grouped into five units: (1) the main experimental department, (2) the hydraulic machinery laboratory, (3) the turbine testing unit, (4) the large scale volumetric measuring tanks, (5) the administration and lecture rooms.

The main laboratory is approximately 300 ft. long and 45 feet wide. It is a two-story building containing an overhead flume 8 feet wide and 9 feet deep, and two channels at lower levels. The upper channel is supplied with water from the upper level of the falls. One of the lower level channels is a wasteway and the other an experimental flume arranged for a variety of experiments.

The hydraulic machinery unit is 34 feet long and 25 feet wide and two stories high, and is to be provided with an overhead crane and a shaft 20 feet square and 30 feet deep at one end of the room. The shaft will be used to bring water from the overhead channel to the turbine testing laboratory.

The turbine testing laboratory is 60 feet long and 75 feet wide and is 46 feet below the headwater level. Two sides of the laboratory are formed by the limestone ledge of St. Anthony falls. There is a tailrace channel throughout its length which connects the shaft in the hydraulic room to the tailwater pool below the falls.

Volumetric measuring tanks designed to handle a flow of water up to 300 cubic feet per second have been constructed with their floors just above the tailwater pool. Valves, diverters, and recording and indicating gages will be located in a control house; and it will be possible to measure the flow of water from any of the laboratories, excepting the turbine testing unit, in these tanks.

The Purpose of the Laboratory

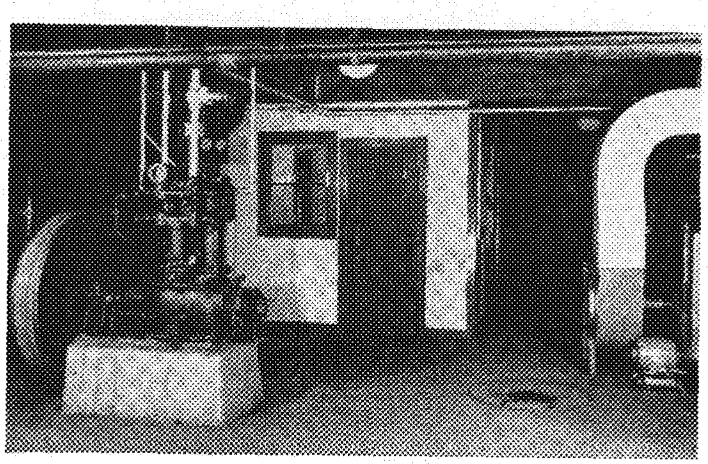
The above description will give a general idea of the splendid opportunity which the Engineering Experiment Station offers for graduate and research work to the student of the Institute of Technology, and also of the opportunities which are available for large scale research and development projects. Many projects are now under way in the laboratories under the direction of different faculty members. Among these projects are the velocity distribution of air in wind tunnels, durability of mortars and concretes as influenced by the cement, durability of fine aggregate and its effect on the durability of mortars, the measurement of gas pressures back of piston rings, a study of the dust problem as related to the air for ventilation, an experimental study of flush valves for water closets, relation between the flows, compressive strengths, moduli of elasticity and the proportions of mortars and gravel concretes, investigation of asphaltic road materials, development of a Piezo-electric indicator for high speed engine work, friction loss in plumbing system pipe lines, sedimentation at the confluence of rivers, investigation of insulated walls, studies of wind generated waves, stability of sand dams, efficiencies of filters at different rates of dust feed, methods of determining dust in the air, an absolute method for measuring the velocity of fluids, and a standing wave method of measuring absorption coefficients of acoustic building material.

Many of the projects for which facilities are available would be too expensive to be undertaken independently by the University, and it is logical for various associations and industries to coöperate in financing them. In the past several coöperative projects of this nature have been conducted in the laboratories, and at present coöperative research projects are under way between the University and such institutions as the United States Bureau of Public Roads, the American Society of Heating and Ventilating Engineers, American Society of Civil Engineers, American Society of Mechanical Engineers, Engineering Foundation, National Rock and Slag Wool Association, Portland Cement Association, and the Northwest Research Foundation. In general, such projects are carried on under the direction of a faculty member, but in some instances full time research men are employed to take care of the project.

Graduate Study

The value of the laboratories for graduate students and research work cannot be overestimated. Technical work has made enormous advances during the past few years, and in order to cover the territory the undergraduate courses are largely filled with routine assigned work. Students who content themselves with a four-year course and a Bachelor of Science degree have an excellent foundation upon which to build an engineering practice. They may, however, have lacked the opportunity to try their hand at some individual creative work.

Engineering is not static. All of the scientific laws governing it have not been formulated and placed in the textbooks. The science of engineering is advancing as rapidly today as at any time in history, and those who would take part in this future advancement must acquire an ability to analyze present day facts and figures, and from these results look out beyond the present horizon of engineering knowledge. Many students acquire this ability at some time prior to graduation, others may acquire it after entering into engineering work, but one of the most effective periods to develop an ability for original thinking is when engaged in graduate study or research work. In general, engineers are behind other professions in this respect. Large masses of students are content to go into a routine professional career after completing four years of undergraduate work on the same basis as engineers did 35 or 40 years ago. All other professions have gone beyond this basic four-year requirement, and some of them are requiring as much as two to four years of graduate study. This apparent inertia of engineers to go beyond undergraduate work may be attributed to several factors, among which may be the lack of facilities for graduate work in engineering colleges, the kind of advice given graduating students by instructors, the fact that the average engineering curriculum is so filled with routine textbook assignments that the average student has never had the opportunity to try his hand at original thinking; or it may be due to the fact that, in the past, industry has been ready to absorb practically all young engineers who have completed a four-year course, very little encouragement being given in the way of better jobs to those students who have taken advanced work.



This equipment will be used to produce very low temperatures in the cold room. Controls are located in the room in the background.

No doubt the time is not far away when many of these conditions will be changed. More undergraduate engineers will look forward to an opportunity for something more than the standard four-year course. Research projects and industrial fellowships may do much to afford this opportunity. The opportunity, however, is not the entire solution. Engineering students must be stimulated with a desire for advanced work, and there must be some competition for the fellowships or advanced positions. It is hoped that with the new organization and facilities at Minnesota more technical students will become interested in research and graduate work, and many large scale developments will be brought into the laboratories, affording graduate students an opportunity for fellowship and contact with industry and also furnishing a valuable service to the industries and the people of the state. If this is accomplished the reorganization and expansion of laboratory and research facilities at the University of Minnesota will have accomplished its real purpose.

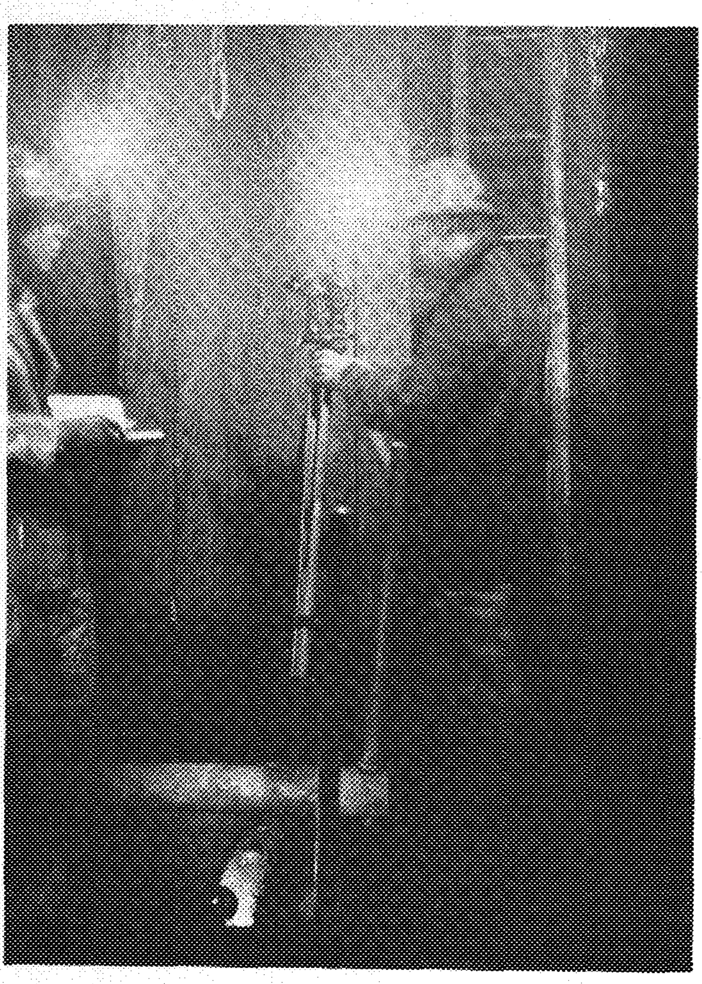
AN UNDERGROUND FIELD TRIP

By M. A. Troxell, Mines '39

The junior Miners annually take a spring field trip to the "Range," in Northern Minnesota. A lot of interesting things naturally happen to them besides the regular scheduled occurrences. Shooting Polaris with the dust cap on the transit—manufacturing root-beer—are some of them. Have we said enough?

THERE! I was all packed—and without doubt the heaviest equipped individual ever to embark upon a School of mines field trip. Professor Lambert had cautioned us about the rigors of the sub-surface cold so there were my three suits of heavy woolen flannels. Besides good suits, shirts and other dress wear (how was I to know that nobody ever dressed up on the Cuyuna iron range?), I had all sorts of jackets, sweaters, boots, breeches, and socks. Of course, I can't afford to slight

Here, by the illumination of carbide lamps and a flashlight, we see Ranta about to "shoot" up a raise, with Zuppann ready to take notes.



the camera, the geologist's pick, the indispensable flashlight, and miscellaneous articles which may have come in handy.

Oh, yes, it was going to be *just like home* up there. Charlie brought along a portable coffee concocting outfit and enough photographic equipment to sink a battleship. Zuppann brought enough photographic equipment to sink two battleships and so much enthusiasm for the science of photography that we predict a brilliant future for him —in the bee-keeping business. By the time we left the cities a casual onlooker would think we were off for a Mediterranean cruise—or perhaps he might just think we were off.

A fellow really appreciates an understanding of geology and nature on a trip like this. I received great pleasure in glimpsing Mille Lac's majestic waters still bearing ice from the spring thaw; Indian birchbark huts set in the emerald splendor of spring; and quaint, rustic hideaways—havens for the tourist and native alike.

As soon as we arrived at Crosby-Ironton, we started to work. That evening equipment was passed out and instructions were given for the next day's work. Bright and early in the morning we went out and ranged in our pickets, then chained distances. Of course we were expected to check, which was inconvenient for us all. And didn't Mr. Lambert say that it was cold up in Northern Minnesota, so be sure to bring your heavy underwear? There I was with the sun beating down on my bare back with the thermometer soaring around 85 and that infernal winter underwear driving me to distraction.

This went on for two weeks. We measured angles by chain and by the Brunton pocket transit. It requires nothing short of genius to bring both bubbles onto their crosshairs, sight your partner holding the picket, and then read the angle. From these simple exercises we progressed to lining in the transit pole and computing the angular error, running out a line with a constant bearing, rod reading, and target setting.

Oh, how those adjustments plagued us! I can see the ghost of the peg adjustments standing before me now, whispering in hollow tones, "You stepped on the ground near the transit just when MacCorquodale had it adjusted. You turned the wrong adjusting screws on the last adjustment and threw all the other adjustments out. You finally had to have Mr. Lambert make the horizontal axis of the transit perpendicular to the vertical axis so you could catch up with the rest of the class." And Mrs. Geldman wondered why her boy was so run down when he came back from the field trip!

By the time we had the transit adjusted we really knew how to run the thing a little. We had the usual problems in traversing, stadia traversing, prolonging a straight line, measuring distances between the crest and toe of a bank and other problems too numerous to mention.

Who could forget that memorable time we stayed up all night to shoot Polaris? In the earlier part of the evening, R. L. Felt searched the heavens for ten minutes, trying to get the stars in focus, before discovering that he hadn't removed the dust cap from the objective of the transit. Phil Gustafson reclined in true luxury upon those pretty green leaves at the base of an old railroad grade, but it turned out to be poison ivy, and for days his face was annointed with $KMnO_4$. I used to wake up nights in a cold sweat thinking how I'd look with a case of poison ivy. Of course, we were all filled with solicitude when Walton's "polaris" refused to culminate. I think he had focused on Mars. The disheartening part about the whole matter was that the professors expected our latitudes and meridian bearings of the polar observations to check with the solar observations. Isn't that cruel?

In my opinion, one of the highlights of the trip was the Helgeson-Troxell Root Beer Manufacturing Enterprises, Inc. Of course, we had to purchase yeast, extract, sugar, bottle capper, crock, and other materials, but the water was all free and, boy, was it *good* root beer! If that had been the popular beverage in Crosby-Ironton, look how much better it would have been for everybody. I'm sure Mr. Griswold liked our root beer, although he muttered something like "Taste makes waste" when he sampled it.

I still can recall the lovely time we had leveling down the Pennington open pit. Perhaps a few of the Junior Miners can remember my clarion voice telling rodman MacCorquodale to set the target. "Up two hundredths. Up one hundredth. Up a hair. Up a split hair. Down a foot!" I have always wished that the energy expended by rodman MacCorquodale in shouting angry phrases to the winds could be harnessed to supply power for the benefit of mankind.

Everyone had to lay out a railroad spur. Much of our engineering experience consisted of hacking down weeds so we could see through them with the transit. Considerable backslapping took place, not because we were in good spirits, but due to the abundance of extremely hungry mosquitoes. I'm sure I kept quite a number of the little duffers well fed and happy—the "Skeeter-skoot" which I applied seemed to entice them over in my direction. Of course, the greatest fun we had was in naming our railroad spurs. The names ran all the way from "Lark-spur" to "Shake-spur"—after the Bard of Avon.

Another of our joyous activities was the stripping estimate of the Pennington pit. Believe me, it's jolly fun to climb over those precipitous slopes with a transit tucked under one's arm. It rained so hard the last day we were in the pit that some of the more practical members of the party proceeded to build an ark, reasoning that the pit would fill up first.

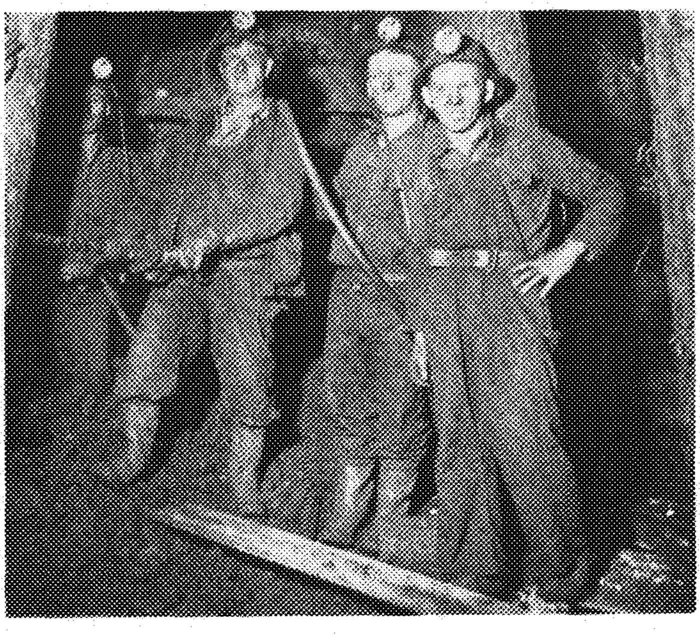
Of course we didn't work all the time while we were on the range. We were always allowed eight hours free every day of twenty-four hours, and every two weeks we had a whole day off—all to ourselves. On this day of days we were able to pursue the favorite avocation of field trippers—hunting for agates. All afternoon we would feverishly roam over old glacial drifts, rushing to the scene of a new "find" in hopes it would prove more profitable than our location. Michalson would proudly exhibit his paragon among agates until someone came along with a better one, and then exclaim, "Oh, well, they aren't worth anything anyway."

Though we didn't know it at the time, we had been dwelling in comparative peace and contentment during the first days of our trip. None of us exhibited any particular anxiety when Prof. Lambert informed us that we were to "plumb the shaft" that evening. We did grumble a little, though, when he told us we were going to work all day Saturday and Sunday in addition—this was to rush all the parties out of the main drift before the miners started to work again Monday morning. We had already "jiggled in" on line with the two wires ahead—copper wires that dangle down the shaft some three hundred feet and end up in pails of oil, which keep them from vibrating unless somebody walks within five feet of them. It takes an hour to get those infernal wires to stay still in the oil and then the weight of all that copper wire below may snap off the wire from its nail on the surface. Now all we had to do was to climb down three hundred feet on rickety ladders while loaded down with a transit, flashlight, tape, hammer, spads and spad tags, lunch pails, raincoat, hard-shell miners' safety helmet, carbide lamp, and other items.

Once in the mine we were instructed to stay away from the main shaft, because once someone dropped a screwdriver which buried itself up to the handle in a timber—that timber might just as well have been somebody's head (no, we're not wooden-headed). Furthermore, "Keep your hard hat on at all times in the mine, even when eating lunch." The miners don't do this but every once in a while a nice big chunk of ore "sloughs off" and conks a miner on the temple of wisdom, thereby summoning him to the pearly gates. "Don't smoke in the mine—if there is a mine fire we don't want it attributed to us. Talk to the miners if you want to, but just remember they know a whole lot more about mining than you do. Don't step in a shadow, it might be a chute. Don't say anything to the mine captain about mine costs—it might be his touchy spot; in other words, don't make caustic remarks!" (This little gem was let fall by Mr. Griswold, who was really a lot of *pun* on the field trip). These are just representative samples of the cautions we received before venturing into the mine.

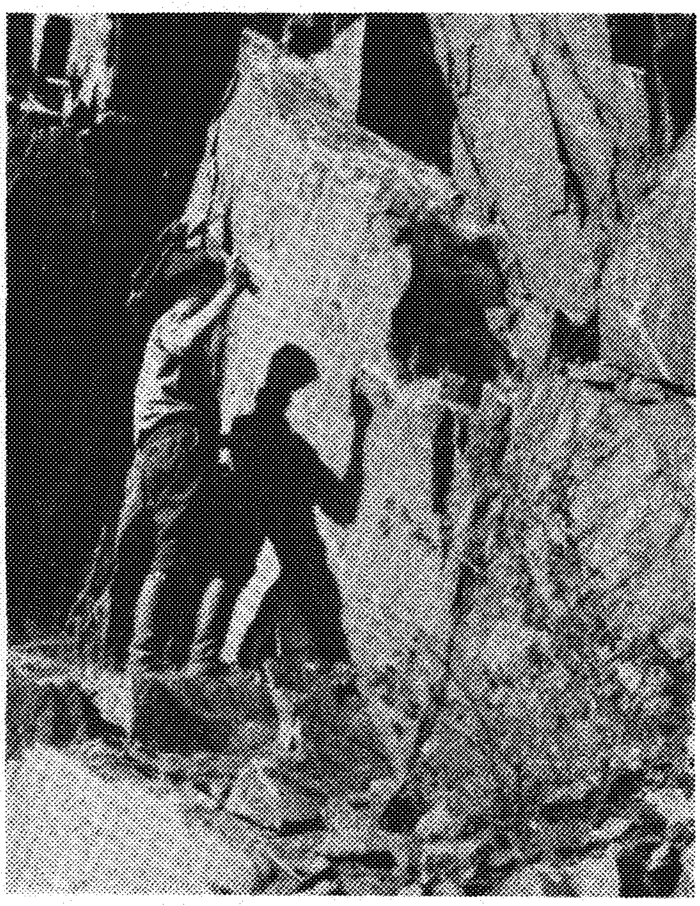
Little did we realize it, but those first two days underground were our easiest for some time to come. The mine

Miners boring holes into props preparatory to putting in sticks of dynamite and shooting out the props to cave in the room.



was deserted except for the student surveyors and our joyous shouts echoed and reëchoed throughout the workings. "Hey, I can't see you. Hold your flash plate still, you sap. Stop that plumb-bob cord from moving."

The most gleeful occasion of those first days underground was the sad tale of the lost transit. We had been cautioned never to leave the instrument unguarded because one can never tell when something will come along and make mincemeat of a $500 piece of equipment. Even now we feel uneasy when we see a transit standing up all



Here is one of the boys sampling an outcrop with his geologist's pick.

by itself over near the Main Engineering building with not a soul within arrowshot.

Our parties were four men each. Three men out of this party had left to push away some ore cars which were obstructing the line of collimation, leaving the fourth man to guard the transit. After five minutes he became worried, and thinking he saw his partners in the distance, he went to meet them. Imagine their chagrin when they returned to find the transit lost, strayed, or stolen. It was really funny to observe the goings-on. Bickford went around with a meaningful look in his eyes accosting people with, "What did you do with our transit?" Helgeson occupied his time by coyly peeping into empty ore cars while Felt darted hither and thither with tears streaming down his face, looking behind posts and in people's pockets and pleading, "Gee, fellows, you haven't seen our transit, have you?" The object of the search was finally discovered standing innocently in the engine room—to the great relief of everyone in general and party No. 9 in particular.

On Monday morning the mine was humming with activity. Now we realized why we had to be out of the main drift. No sooner would a transit be set up and a couple of angles turned than along would come an ore train—the transit would be hurriedly pulled aside for the train to go by, then set up again and the process repeated. After destroying a set-up four times because of ore trains and then again for a dinky little empty timber truck when only one more angle needed to be turned off, one is about ready to spout blue flame and go out and end it all.

Except for "shooting the raise," which is a real feat involving the use of the top and side telescopes and an extraordinary amount of discretion, our mine surveying soon became routine work of angles, distances, and "topog." Our environment was extremely variable: in the "dog drift" we might as well have been continuously sprayed with a fire hose, for the water was jolly well dripping; but on the upper level the atmosphere was warm and dry, with only the "tunnel fleas" for company at lunch time. My lunch began to taste the same every day no matter what I had to eat because it was so thoroughly saturated with "tunnel fleas."

As our time grew short, we began to work more feverishly at night doing our calculations. During the last four days of the trip every one worked all day and almost all of the night, and no one was able to sleep more than three or four hours during the last two days and nights. The clackety-clack of our calculating machines almost led the good townsfolk to believe that a locust plague was coming. But finally all of us had our books checked in and we were rolling on to Virginia, in the "heart of the Minnesota Arrowhead," to observe open pits and geological structure on the Mesabi Iron Range. Most of us were expecting another mining town like Crosby-Ironton when we came upon the cozy little city of Virginia, built around a beautiful little lake.

We worked every day on our geology field trip, but it was really a lot of fun, despite the sketches of open pits, longitudinal sections and cross-sections we were required to draw. While we were at the Soudan Mine in Tower, Minnesota, we roamed over the stock pile for hours collecting excellent specimens of hematite, chalcopyrite, and siderite. Of course, all of those who were in Dr. Gruner's party came home with a well-developed theory on the hydrothermal leaching of the Soudan iron-bearing formation to form the Vermilion Range hematite. We also collected specimens of Dr. Gruner's beloved algal structures.

Although we were supposed to become enthused over the cross-bedding in the lake-shore sandstone and the Keweenawan flows at Duluth, my thoughts kept roaming towards the wild strawberries whose domain we were continually trespassing. I practically subsisted on that delicious Duluth ice cream during my stay in "America's Air-conditioned City."

Going home at last! Just when we were on the home stretch, old lady misfortune hastened to overtake us. She rode with Krefting during the rest of the trip. For a while we thought that Krefting had a diesel engine in his car, but then it used gas too. But after all what can you expect when you buy two tires and two tubes for a dollar?

At four o'clock in the morning with the engine belching smoke and sparks we pulled to a stop in front of my humble abode. The field trip reached a disquieting end when I unceremoniously trod on Brother Bauck's stomach while creeping in a second-story window in the Theta Tau house.

Jobs! Jobs! Jobs!

By A. S. Levens

Director, Placement Service

Do you know what kind of work you will want to do when you leave school? Do you know the best ways of obtaining that work? If you don't, or if you are not sure, you will find this article very helpful. It is intended not only for seniors but for all Technology students.

"HOW is the job situation today?" "Are you receiving many calls for engineers?" "What percentage of last year's class was placed?" "What's Henry Blank doing now?" "Got a job and married too! Well, well, so he's got two jobs."

These questions and others are typical of the many which we listen to over and over again. Interesting? Yes, but also quite vital.

We will discuss some of them a bit later. First, let us briefly review the work of the Placement Service.

The College of Engineering and Architecture and the School of Chemistry started an alumni placement service in 1931. Lack of funds limited the development of the work.

About a year and a half later we learned hat a more potent factor, the 1929 crash, or what is commonly identified as "the depression," made it unnecessary for us to worry much about facilities to carry on effective placement work. Engineering jobs were not available. Many of our graduates, at that time, were glad to work at anything they could find. A survey (Spring 1933) of the class of 1932 revealed the following: Of the 133 (55% of the class) that replied to our questionnaire, 56 were employed, and of this number only 24 were engaged in technical work.

The Placement Service made an effort to locate technical work. A special appeal was sent to our alumni. Letters were mailed to 400, who were either in business or who held positions of responsibility. We received 40 replies and of this number one request for a surveyor.

We are happy to state that the improvement in employment opportunities during the last three years has resulted in the absorption of practically the entire 1932 class.

During the spring of 1931, 22 applications were received from our alumni, of this number 14 yere placed. The following table shows the experience in placing alumni during the period 1931-1936:

Year*	No. of Applications Received	No. of Alumni Placements	Per Cent Placed
1931	22	14	64
1932	44	12	27
1933	186	73	40
1934	83	22	27
1935	122	61	50
1936	137	83	61

*Year in which applications were received and placements made. Does not include the graduates of these years.

UNIVERSITY OF MINNESOTA
INSTITUTE OF TECHNOLOGY
MINNEAPOLIS

PLACEMENT SERVICE

(NAME OF SENIOR)

Degree: Bachelor of Civil Engineering.
Preferred Fields: Highways. Construction.
Personal and Family Data: Born November 23, 1913, Duluth, Minnesota. Height, 5 ft., 8 in. Weight, 135. Single. Health, good. Protestant
Interests or Hobbies: Boats. Motors.
Ancestry: Mother, Scotch Canadian; Father, English.
Father's Occupation: Machinist.
Experience: St. Louis County Highway Department, Court House, Duluth, Minnesota, September to December, 1934, rodman and chainman.
St. Louis County Highway Department, Court House, Duluth, July to September, 1935, inspecting placing of bituminous pavement.
Fuller Brush Co., Carl Johnson, Mgr., Duluth, 1936, salesman
High School Information: Denfeld High School, Duluth, Minnesota.
Activities: Thespian Club (2, 3, 4)*, Pyramid Club (1, 2)*, Welfare Work (2, 3, 4)*.
*Refers to school year.
Honors: Small gold "D" for scholarship.
College Information: Duluth Junior College, Duluth, Minn., 1932, 1933.
Activities: Techno-Log Board (4)*.
Engineering and Scientific Societies: Theta Tau Fraternity (2, 3, 4) American Society of Civil Engineers (2, 4)*.
College Work Enjoyed Most: Highways, Surveying, Drafting.
Portion of College Expense Earned. Thirty per cent.
References:
Prof. F. C. Lang, College of Engineering, Univ. of Minn., Minneapolis.
Prof. O. S. Zelner, College of Engineering, University of Minnesota.
Mr. James F. Taylor, Principal, Denfeld High School, Duluth, Minnesota.
Mr. George Deibler, Asst. County Highway Engineer, Court House, Dulut
Employment Information:
College Address: 1668 Berkeley Avenue, St. Paul, Minnesota.
Home Address: 108 South 61st Avenue West, West Duluth, Minnesota
Available for Employment: June, 1937.

The Dean's Office will furnish scholastic information upon request.

The Institute of Technology Personnel Leaflet

In 1934 a federal aid student was assigned to do some of the clerical work. Since the establishment of the Institute of Technology, additional part-time assistance has made it possible to give attention to the placement of the graduating seniors. The November issue of the TECHNO-LOG presents an employment summary of the June classes 1934-1937. The "recovery" made in 1936 and 1937 is clearly evident in this tabulation.

Personnel Leaflets

The members of the class of 1935 were the first ones to be given an opportunity to participate in the plan to use personnel sheets as an aid in making contacts with prospective employers. The industries, which have received our booklets, have expressed an enthusiasm which warrants the continued use of this type of information.

In reply to a questionnaire, pertaining to the use of personnel sheets, which was sent to several hundred companies, Mr. Truelson, of the Norton Company, Worcester, Mass., stated:

"We are interested to receive the record sheets outlining the education and experience of several of your graduate engineers. The form which you have adopted for presenting the data for each man can hardly be improved upon for clearness of arrangement and reasonable amount of information."

Mr. R. H. Prewitt, Executive Engineer, Kellett Autogiro Corporation, Philadelphia, Pa.:

"This will acknowledge with thanks your letter of February 25, enclosing personnel leaflets of your aeronautical graduates of the class of '37. We very much appreciate receiving this record as it is just possible that we will be needing a stress man in the near future.

You will recall that Raymond Kochevar was employed by this Company through your service. Unfortunately, we were compelled to cut down our force and Raymond went to California where, I understand, he is doing very well."

Recently we received the following letter from the Giddings and Lewis Machine Tool Company:

"In view of the fact that we will need another man or two to start with us on or about January 1, 1938, I am woundering if you would kindly contact for us any of your recent mechanical engineering graduates who are contemplating a change, or any of the men who graduate at the end of the quarter nearest to January 1st. I would appreciate their sending me promptly *your regular printed leaflets*" (italics ours).

These are only a few of the many such letters that we have in our files available for inspection.

In 1935, 55 seniors ordered leaflets; in 1936, 164; in 1937, 146; and this year over 200 seniors have requested leaflets. At a meeting held October 21, 1937, it was pointed out that the use of personnel sheets aids in the following manner:

(1) Contacts are made by the Institute with several hundred companies which do not find it convenient to send representatives.

(2) The student has a convenient personal data sheet which can be used in making his own contacts.

(3) The members of the faculty have access to information which greatly facilitates the writing of recommendations.

(4) The company representatives who interview our seniors have a picture of the student as well as an experience and training record which enables them to devote more time to a discussion of the work of the company.

The cost of printing 200 copies of the leaflets is $4.00. Of this number, the student keeps 100 copies. Twenty-five sheets are retained for use by the Institute while the remaining 75 sheets are used in making up booklets, which are mailed to prospective employers.

This involves the preparation of groups of sheets in accordance with the request of the company. For example, one request will be for those who are especially interested in power plant work; another, for those who have high grades in mathematics and stress analysis, and who are capable draftmen; still another, for men who have carried on graduate work in Civil Engineering and Aeronautical Engineering; another, of those who are especially trained in metallurgy. One request was made for those who were in the upper one-third of the class scholastically. Some companies requested men who were at least average scholastically and possessed other qualifications, such as, initiative, honesty, coöperativeness, and good appearance.

Many problems present themselves in the proper preparation of the booklets. Several members of the faculty have rendered invaluable service in this respect.

Present major functions of the Placement Service are:

(1) To fill positions which are available. Last year we received 117 calls for experienced technical graduates. Thus far this year, we have received 152 requests.

(2) To assist our alumni and graduating seniors in locating positions.

(3) To arrange for interviews. In 1936 20 companies sent representatives to interview our seniors. Last year

Self-analysis Is the First Step in Seeking Employment

60 companies sent secouts. We believe this is a new record.

(4) To supervise the work entailed in preparing and mailing of personnel sheets.

(5) To make available information pertaining to fellowships, scholarships, and assistantships.

(6) To conduct meetings pertaining to employment.

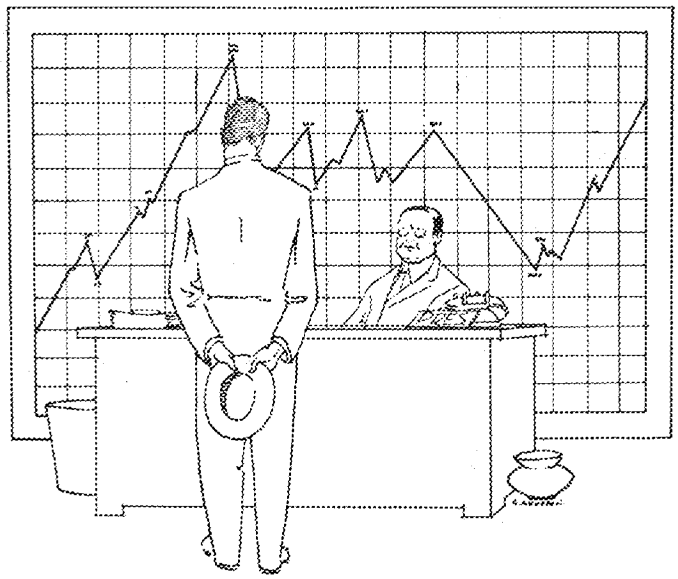
Seeking Employment

Before discussing this subject, let us listen in to the following conversation:

Alumnus (after entering placement office): "Do you know of any openings?" or, "How is the job situation?" or, "What field of work is the best one to get into?" *Mr. L.:* "Please be seated. What is your name?" *Alumnus:* "I am John Doe, class of '33." *Mr. L.:* "What are you selling?" *Alumnus:* "I'm not selling anything." *Mr. L.:* "Then how do you expect to find a buyer?" *Alumnus:* "But I'm not a salesman." *Mr. L.:* "So I perceive." *Alumnus:* "What's that got to do with a technical job?" *Mr. L.:* "Aren't you trying to sell your services? What can you do? What have you done? Before we can offer any assistance we must know these facts, because it is likely that your training will not fit you for all jobs." *Alumnus:* "But I'm willing to do anything." *Mr. L.:* "Can you do anything?" *Alumnus:* "Well, almost anything." *Mr. L.:* "If we had jobs available in all the technical fields, what would you choose?" *Alumnus:* "Well-erah-well, I don't know." *Mr. L:* "What do you enjoy? What would you like to do? Have you ever taken inventory of your ability? Of your experience? Have you attempted to learn the names of companies that do the type of work that you believe you could perform successfully? Have you investigated the technical fields which are in need of well trained engineers? Do you know that many non-technical business concerns employ engineers? In what way does your training and experience fit you for the type of work you would like to do?" *Alumnus:* "Gee whiz! Maybe I had better think this over a bit. I'll be back in a few days."

These questions lead to a discussion of the problem: "What can the student do to prepare himself for seeking employment?"

An excellent treatment of this question is found in a



Much Weight Continues to be Placed on the Interview

pamphlet written by Mr. Howard Lee Davis, Director of Technical Employment and Training, New York Telephone Company. (Preparation for Seeking Employment, published by John Wiley and Sons, Inc., 1937.)

Mr. Davis states: "This problem seems exceedingly complex to applicants. As a matter of fact, it is not complex. The idea of complexity usually results from attempting to achieve the perfect result with little or no mental effort."

Mr. Davis establishes some very important fundamentals such as:

(a) Every job-seeker is a salesman.

(b) Successful salesmen understand the products they offer for sale.

(c) A man is happiest when doing things he wants to do. Interest is the spice of the job.

(d) He should have the best chance to succeed if he is engaged in an activity which has a major interest for him.

(e) The job-seeker's problem of securing employment which is the nearest practicable to that which is most suitable for him is one of the most vital problems that he has at that time.

(f) The most effective way for a job-seeker to impress a prospective employer with his ability to do satisfactory work is for him to demonstrate thorough consideration and execution of his own personally important job-hunting problem.

(g) The employer has no sure means of classifying the job-seeker and placing him in work most suitable to him. The job-seeker should share fully in that determination.

(h) During his lifetime every person must make decisions that are based upon incomplete data. He must do the best he can with such information as is available at the time each decision must be made.

(i) When a man has little knowledge, his judgment tends to become chance.

All of our students will do well to read this article. If you are in earnest and are really interested in reading a copy, and tell us so, arrangements will be made to order a sufficient number.

As an aid in preparing yourself for employment will you give due consideration to the following suggestions?

I. Take an Inventory of Yourself.

(a) Try to determine your technical and personal qualifications. (b) Analyze your experience record. (c) What good has each job done for you? (d) What type of technical work do you really enjoy? (e) What subjects are least interesting? (f) Are you aggressive or retiring? (g) Do you like to work with a group, or do you prefer to work independently? (h) Do you plan your work or do you operate on a hit-or-miss scheme? (i) Do you give attention to your personal appearance, or are you indifferent? (j) Do you coöperate with others, or do you cause friction? (k) Are you lazy, or industrious? (l) Are you satisfied to merely "get-by?" (m) Do you always depend upon others? (n) Do you ever take the initiative? (o) Are you honest? Are you easily tempted? (p) Can you be trusted under the most trying circumstances? (q) In what type of work do you believe you would be successful?

II. Make an Employment Survey.

(a) Search for the names of companies engaged in the lines of work in which you are interested. For example, if you are interested in railroads, consult the *Railway Officials Guide;* if in public utilities, consult the McGraw-Hill *Central Station Directory;* if in manufacturing, the *Thomas Register.* Names of other books which contain valuable tips may be obtained from the placement office; most of them are in the Main and Engineering libraries. Some of your instructors can help. The Placement Service can offer suggestions.

(b) Select 40 or 50 companies in your field. Secure further information by writing for data concerning the work of the company. Many of the larger firms print booklets which describe the work of their company. For example: *The Graduating Engineer and Ingersoll-Rand, Some Employee Policies of the Bell Telephone Companies, The Loop Course,* Bethlehem Steel Company. These and many others are available in the Placement Service office.

(c) Again, consult with your instructors, alumni, and local representatives of companies. If you follow the plan suggested you will be better prepared to ask intelligent questions of the scouts who interview you.

III. Apply For a Position.

(a) The most effective method is to apply in person.

(b) Interview those who are responsible for employing college men. By all means make a definite appointment for the interview. Don't drop in anytime and say, "You don't need an engineer, do you?" If you have made a careful analysis of the type of work the company does, you will be better prepared to answer the first question: "Well son, what can I do for you?" and a subsequent question: "Just what would you like to do in our company?"

(c) Where it is not possible to apply in person, write a letter.

(d) Be prepared for personal interviews. Good taste in dress, poise, and appearance are quite important. However, it is not necessary to be overdressed to the point where you demonstrate what the well dressed man will wear in 1942.

Last year a company representative in discussing a group of seniors he had interviewed said, "In general, you have fine boys, but I observed at least three distinct types. There is the average young man who asks a few questions about the possibility of advancement with the company, salary, and permanency of employment. He listens well. Then there is the type—most reticent and shy—from whom it is necessary to pump information. The third type like to talk and talk some more, and babbles on and on. He makes it almost necessary to shut him off with the remark: 'Send in an application and we will see what we can do.'"

Many companies ask for ratings of the candidate. The following is typical of the forms used for that purpose.

accomplished, especially, if it has some bearing on the work of the company.

IV. Try to Attain Desirable Traits Which the Prospective Employer Seeks.

(a) Scholastic Rating (In research—very high; In design—very high; In the general fields—at least average), (b) Honesty, (c) Judgment, (d) Initiative, (e) Industriousness, (f) Coöperativeness, (g) Appearance.

V. Read a Few Books Pertaining to Employment:

(a) Board, S. S.: *Finding Work*, Mechanical Engineering, 1934; (b) Davis, Howard L.: *The Young Man in Business*, John Wiley & Sons; (c) Dooley, C. F.: *How to Get and Keep a Job*, New York, Appointment Office, Columbia University.

The Placement office has a sizeable list of books of this nature.

It is recognized that it is not a simple matter for the graduating senior to answer the question "Just what type of work do you want to pursue?"

A limited choice at time of graduation is not essential. We believe that our students will be more capable of arriving at an answer to the question, if a real effort is made to get the facts.

True, economic conditions do make inroads upon one's plan. It may be necessary to accept temporary work while preparing for the opportunity to enter the field for which

RATING CHART For ....

Characteristics	Please give the percentage grade which, in your opinion, comes nearest to covering these characteristics.				
	90-100 Per cent	80-90 Per Cent	70-80 Per Cent	60-70 Per Cent	Below 60 Per Cent
Health as far as you know (Explain any defects)	Very vigorous	Vigorous	Healthy	Often sick	Sickly
Creative ability: Initiative, imagination, originality Resourcefulness: Ability to see and solve problems	Very sanely original	Can solve problem after it is suggested	Can solve problem if occasionally helped	Has to be helped considerably	Has to be helped all the way
Training: Of technical nature	Exceptional	Very good	Good	Fair	Poor
Intellectual honesty: Dependability, reliability of work	Absolutely dependable	Above average	Average	Below average	Almost hopelessly unreliable
Perseverance: Application and persistency	Very industrious	Good worker	Steady	Dilatory	Lazy
Faculty of observation: Power to observe and record results accurately	Exceptionally accurate	Accurate	Average	Inaccurate	Unobserving
Enthusiasm: Energy, interest put into work, enterprise	Exceptional	Enthusiastic	Average	Below average interest	Disinterested
Conduct: Coöperative attitude toward others; consideration for others	Exceptional	Very gentlemanly	Well behaved	Annoying	Unsatisfactory
Character and morals	Very high ideals	High ideals	Moral	Careless	Immoral
Ability to coöperate	Very tactful	Tactful	Average	Individualistic	Very untactful

An Example of the Type of Rating Chart Widely Used in Industry

Mr. C. A. Phillips, personnel officer of the Northwestern Bell Telephone Company, in discussing the topic, "Selling Yourself to the Employer," pointed out that it was desirable that (1) the student should conduct himself in a gentlemanly manner; (2) should analyze his strong points and weak ones; (3) should recognize his limitations; and (4) should plan an objective early in his college career.

(e) Bring your Personnel Sheet along. The company representative finds it a convenient form for much of the data he wants. It affords more time for the actual interview. It is not amiss to bring samples of some of your work: drawings, laboratory reports, or a paper you have written. Capitalize on any outstanding work that you have

the student is best prepared. In most cases preparation must continue long after graduation. It is a pity that many of the students look upon "Commencement" as the finish. Unfortunately, in too many instances it is just that.

It is hoped that this brief discussion of the employment problem will stimulate some thinking on the part of students. The graduating senior should realize that the major responsibility in locating a position is his. The assistance given by faculty, alumni, and the Placement Service will undoubtedly continue, but the methods used are not cure-alls, nor are they "spoon-feeding" in character—rather, they are instruction in the use of the spoon, that is, simply an effort to help the student help himself.

The Minnesota Techno-Log

DECEMBER, 1937

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A General Engineering Course

Do you ever wonder whether you are in the right course? Did it ever occur to you that after graduation you might find yourself in a job where the particular brand of training you received in college would be of little help to you? Many a graduate engineer has found himself in this predicament. Surveys show that in many cases engineers trained in one field are found holding positions in another. The problem presented by this situation, that of properly training the engineer for his future job, is a very real one.

Engineering education as such began in the United States about one hundred and fifteen years ago when West Point and Rensselaer instituted engineering courses. From this beginning it grew steadily, more schools offering courses in engineering, and the science itself dividing into the various branches as we know them today. As the science of engineering grew, the process of educating engineers underwent various changes. The emphasis shifted from specialization to liberalization and back again. According to Dr. C. C. Williams, president of the Society for the Promotion of Engineering Education, we are just emerging from an epoch of research with its attendant specialization, and are entering into an epoch of economic adjustment. Other educators concur in this analysis of the trend. Since the general problems of an epoch of economic adjustment include the problem first proposed, the question to be answered is, "How can engineering education be adapted to meet the demands of this new era?"

We feel that the most adequate answer to this question lies in the institution of a course in General Engineering. Such a course would consist of four years of study of a general nature plus one year of specialized work. In his first four years the student would be given a strong foundation in the basic sciences—chemistry, physics, and mathematics—and a working knowledge of the basic principles of applied science. In addition to these he would be given courses in economics, business administration, speech, psychology, and sociology.

A student completing this course would then be able to go into industry and handle minor technical jobs. When, after looking around, he found out for certain which field he liked best, he could return to school for his final year, and take specialized work in that field. When he completed this he would be equipped to build his career, free from doubts as to his choice, and with the firm knowledge that his foundation was sufficiently broad and firm to sustain any career, no matter how ambitious.

LETTERS

This month our letter column begins in earnest after two months' campaigning. We're really beginning to get letters, two of which we are publishing this month. (If you think we wrote them, read them.) They're not too complimentary but at least they're honest criticism.

To the Editor:

. . . If my memory serves me correctly, the construction of the Telephone Building took place in 1933-34. It seems to me that an up-and-coming magazine could find a picture of later date than the one used which was suitable for the purpose. To continue, about ten minutes a day during the editorial makeup time would produce a picture of as good esthetic value and showing engineering endeavors.

The nerve of some people—asking for a "column" from every student in the college—when there are already four in the magazine. I shudder from fright when I mentally peruse the results of the magazine if the plea of the editor was carried to its optimum value.

C. B.

Of course we're no esthete, but just the same we think that cover picture does have esthetic value. We agree that there were too many columns last month. If our plea is "carried to its optimum value," we shall be more than gratified.

To the Editor:

". . . may I suggest that you get rid of some of your numerous "humor" or "inside dope" columns, and substitute an additional feature article, which are not only more interesting than columns but also the real purpose and backbone of the magazine.

I don't quite see the purpose of printing the table of contents twice on the first page. Once should be plenty. In place of the conversational version of the contents, you might return to the previous custom of listing the societies in the Institute. Or, inasmuch as engineers are represented as a husky, virile lot, why not devote this space to a real humor column, which wouldn't print *damn* as *d - - n*, like you usually do

ROBERT J. SCHOONMAKER
Aero. E., '38

We agree that an ample number of good feature articles is to be desired, but it must be recognized that even four columns take less space than one regular article. As for "damn" vs. "d - - n": thus far no editorial blue pencil has been used to convert the first into the second.

NOW HERE'S A BOOK

By C. I. Haga, Instructor in English

IN urging you to read George Gray's *The Advancing Front of Science*, I have two purposes in mind. The first is very simply that of introducing you to a well-organized, well-written, swiftly-moving review of the progress made in the physical sciences during the last ten or a dozen years. The second purpose is by far more serious and will attract those whose minds turn to reading of a different order of magnitude than mere amusement or information—it is to challenge you, as impressively as I can, to assume even so early as in your undergraduate years a feeling of responsibility for the professions you hope to enter and for the world which needs their services.

As news or information, *The Advancing Front of Science* has all the virtues of timeliness and good writing. Gray's ambition is a serious one: ". . . an attempt to present the current news of scientific research promptly, in convenient form, and in terms that will convey the meaning and spirit of the endeavor without indulgence in false emphasis or sensationalism." In sixteen chapters, introduced and summarized by a prologue and an epilogue, he swings us briskly through the universe, all the way from the remote outer spaces (where everything is 10^{10} something-or-other) back to the atom and its parts (where everything is 10^{-10} something-else) and even into the as yet unmeasured scrutiny of life and thought. If a scientist can reach a million million miles out into the universe to spy on the lonesome elements dwelling there and name them as confidently and accurately as I can name the householders in my block, that is news and very exciting news. Likewise, if his brother in the laboratory can pry into that invisible little brother of the universe, the atom, and weigh, picture, and name the doubly and trebly invisible, that also is news. And when a third scientist comes along and proposes to discover the hidden, picture the protean, define the indefinite—to imprison on the laboratory table life and thought and train them to the shameless (some think sacrilegious) public life of the test tube and the ultramicroscope, then we have to guard against saying *miracle* instead of *news*.

As current news, unspoiled by false emphasis or sensationalism, *The Advancing Front of Science* is exciting reading. Its plan is such that we lay down the book with a new and reassuring belief in the unified advance of science on every front wherein success in one sector contributes to success in other sectors. Because the book so vividly pictures the unity of science we are confident that it also gives us a clear idea of the meaning and spirit of science. We all know that chaos has neither meaning nor spirit.

It is this unity, by whose light we glimpse the meaning of science, that suggests my second reason for urging you to read the book. Through *The Advancing Front of Science* I want to challenge you to realize that a serious ambition—that of becoming a scientist or an engineer—demands of you a feeling of responsibility for the basis of your future. Science has made our civilization what it is—and some of the extraneous influences now affecting that civilization may destroy science. Scientific and mechanical invention multiplying our gross physical powers has been speedily, even recklessly, adopted; but social invention (a term by which we can describe similarly effective improvements in our economic and political machinery) has been less generally applied and even, some say, decellerates almost as rapidly as the first accellerates. The reason for this disparity seems to be a stubborn inconsistency. We are as daring as we are timid: we like to boast that for the practical advantage of a possible extra two per cent of profit we will junk overnight a billion dollars worth of obsolescent plant and equipment; we hesitate to admit that for the sake of a withered tradition we will cling fiercely to a demonstrably inequitable system of taxation.

Observing such a tug of war between daring and timidity, we would be wise if we learned more about the great power of science and of the scientific method—and knew why they can offer even more than we are very soon likely to want. In *The Mind in the Making*, James Harvey Robinson tells us that although tested and useful scientific information is now incalculably greater than it was fifty years ago, ". . . that knowledge is still so novel, so imperfectly assimilated, so inadequately coördinated, and so feebly and ineffectively presented to the great mass of men, that its *direct* effects upon human impulses and reasoning and outlook are as yet inconsiderable and disappointing." The problem, therefore, is one of education, you will say. That is exactly what Gray also concludes. The "Epilogue" is a plea for education, for some sane animating of the human intelligence to prevent what John Dewey calls "our halfway and accidental use of science." That is the task whose beginning must be largely the responsibility of the technologists and the scientists. The people do not ask of them ring-side seats in every laboratory, nor do they ask a fresh miracle every day of the week. What they do ask and what the scientists must give is merely a sharing of purposes and methods. The scientist is not so highly specialized that he has become a parasite, nor is the public so ignoble that it may not be respected.

Consequently I make of Gray's *The Advancing Front of Science* a challenge to the serious student that he read it and other books of its class to prepare himself for the task of guiding the people in their choice between progress and degradation. This choice is one which only the people can make and one that they can make intelligently only if the scientist's purposes are theirs and their purposes his. His role is that of first among equals. He can be first only if he knows more, thinks more, feels more, cares more.

ALUMNOTES

'23

A. C. Zimmerman, C.E., spent a two weeks' vacation in the cities in order to see the Notre Dame game. His home address is 438 Sunset Road, Coral Gables, Florida, and his business address is G. O. Reed, Inc., Marine Engineers and Contractors, Miami Beach, Florida.

The Vice President of the Mason City Brick and Tile Company is **M. D. Judd**, C.E., who resides at 1112 Second Ave. S. W., Mason City, Iowa. Of the three little Judds, the eldest is an eight-year-old boy, and the others are four-year-old twins.

'25

Harold W. Jones, C.E., reports in from Ely, Minn., where he is resident engineer inspector for the PWA, to tell of his latest hobby. He says his piano accordion insures isolation and keeps the crowds away.

'27

Working for the U. S. Engineers Office on Lake Michigan harbor improvements is **John Borrowman**, C.E., of Milwaukee, Wisconsin. John is married, has two children, and boasts that his hair is still black.

'31

James J. Dovolis, Arch. E., of 3403 Chicago Ave., Minneapolis, is with the Minnesota highway department.

Jim McHugh, Arch. E., is with General Mills, Inc.

'32

Signing his Armistice ahead of time when he was married on Nov. 11, 1937, was **Henry J. Langer**, C.E., of 2015 Bryant Ave. North, Minneapolis. Hank is doing concrete and soils laboratory work for the U. S. Engineers on the Mississippi river project.

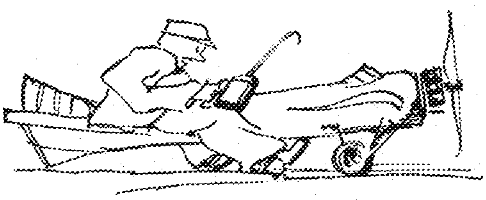
Martin Swanson, E.E., dropped in during Homecoming to renew old acquaintances. Martin has been in the heating and air conditioning business for the past three years.

F. X. Kerr sends a note from the Panama Canal Zone, where he is assistant estimator for the Panama Canal. Mr. Kerr, another of those famous Civils, was with the Signal Corps of the U. S. Army in Corozal, Canal Zone, until resigning two years ago to accept his present position.

From Conchas Dam, New Mexico, came a plea to Prof. Zelner for tickets to the Notre Dame game from **Milton E. Schmids**, C.E., who is in the Hydrography Department of the U. S. Engineers.

'34

Reynold Caleen is flight engineer for United Air Lines but his home address is not known.



Wolf Sagalovitch, of 30 West Chicago Ave., Chicago, Ill., is with the Cowham Engineering Co. Wolf worked on the design of the Buffalo sewage disposal plant for Greeley and Hansen, consulting engineers.

'35

Carlyle Burton, E.E., after two years with General Electric Company, is now located in Hibbing, Minn., with the Oliver Iron Mining Company. Carlyle is married, but when last heard from he did not have a permanent home address.

Otto Dahl, C.E., Box 512, St. Cloud, is a draftsman on construction working out of the St. Cloud office of the state highway department. Otto says he is not married.

Another civil with the state highway department in St. Paul is **Amos Sutton** of 1489 Van Buren. Amos says he has been "Very happily married since July 9, 1937."

Walter C. Holmstrom, C.E., is working as an estimator for the American Bridge Company, Wolvin Building, Duluth. His home address is 1226 East First Street, Duluth.

Robert R. Gilruth, Aero., and **E. Jean Barnhill**, Aero., were married in Washington, D. C., on April 10, 1937. They are making their home in Hampton, Virginia. Bob is with the National Advisory Committee for Aeronautics at Langley Field, Virginia.

Out in sunny California is **Raymond J. Kochevar** who married Ann Margaret Murphy on October 20, 1937, in Santa Monica. They are at home now at 32 West Crest Ave., Venice, California.

'36

Wilbert F. Arksey, C.E., is a rodman for the Great Northern Railway engineering department in Superior, Wisconsin, and has been doing quite a bit of mine construction work. His address is 4431 Jay St., Duluth, Minn.

James Weston Moore, Aero., and Gail Goodhue, were married June, 1937, and live in Paterson, New Jersey, where Jim is with the Wright Aeronautical Corporation.

Donald A. Martin, Aero., stood before the preacher with Betty Horton in May, 1937. They are now at home in Troy, Ohio, where Don is with the Waco Aircraft Corp.

Marvin Walseth, Aero., is with the U. S. Air Corps at Randolph Field, Texas.

James Bradford Baker, Aero., graduated from the Air Corps training school at Randolph Field in October, 1937

'37

Thurman Erickson, Aero, is now assistant operations manager for the trans-pacific division of Pan-American Airlines.

Richard Black, Rolph Oversvee, Robert G. Bush, Thomas A. Feeney, Vincent Spoor, and **Wesley Wilkes**, all Aeros., are with the Boeing Aircraft Corporation in Seattle, Washington.

TECH NEWS

By Charles Strom, E.E. '40

Mechanicals Return from Eastern Trip

Harley Hughes, Arnold Matthies, Bill Andres, Alf Anderson and Jack Davies were the five delegates from the Minnesota chapter to attend the national convention of Pi Tau Sigma at Lehigh University in Bethlehem, Pa., and Drexel University in Philadelphia, November 18, 19, and 20. Following the convention, the delegates stayed over for a day in Philadelphia and then proceeded to New York, where they visited and went sightseeing. On the return trip to Minneapolis, the delegates visited the aluminum plants in New Kensington where they found Bob Teeter (last year's TECHNO-LOG editor), Pete Lohman, Gerry Mitchell, and Marvin Lee. After a day (and night) of sightseeing in New Kensington, the group returned to Minneapolis. They reported that if the girls out east were like those at home they might have had a better trip.

A.I.E.E. Hears Talk on European Plants

Morris Newman, instructor in electrical engineering, addressed the A.I.E.E., Nov. 23, on European power plants and their distribution systems, illustrating his talk with photographs he took when he visited those plants last summer. Plans for an inspection trip to the Ford Motor Co. plant were discussed at the close of the meeting.

Mixer, Meetings Held by I.Ae.S.

Official pictures of the National air races at Cleveland, Ohio, were shown December 2, to members of the Institute of Aeronautical Sciences and their guests: members of the Flying Club, A.I.E.E. and A.S.M.E.

The I.Ae.S. launched its season when it held its annual mixer in the Engineering auditorium, October 7. Several faculty members, E. E. Brush, and Gordon Strom were on hand to officially welcome the new students and invite them to join the organization. The organization of the I.Ae.S., its history and plans for this year were discussed.

Prof. H. W. Barlow addressed the Institute, Oct. 20 on the "National Air Races." He was a member of the official timing staff.

On Nov. 10, Mr. Henry Salisbury, former aeronautical engineering instructor at Minnesota, now an engineer with Northwest Airlines, addressed the organization on the new "Lockheed 14" transport planes recently purchased by his company.

The membership of the Institute at this time is 98 members—two less than its quota.


To Gladden Hearts and
Lighten Labor

Civils, Mechanicals Hold Joint Meeting

Members of the A.S.M.E. held a joint meeting with the A.S.C.E., Friday, November 26, in the Minnesota Union where they saw pictures of the 1937 Minnesota football games and listened to a lecture on the history of locks by a representative of the Yale Lock Co.

Business, Editorial Jobs on Techno-Log Are Still Open

As in every year in the past, this year again finds the staff of the Techno-Log in need of new members. There is work for you here in a great number of different capacities.

On the business staff you may work at soliciting advertising, at circulation, or at general office work. Here you can enjoy practical business experience at the same time that you widen your circle of friends.

There is room for many more workers on the editorial staff. News reporters are needed, as are stenographers, copy- and proof-readers, feature and editorial writers, and office workers.

Won't you drop in at the office soon and let us know what you can do and what you would like to do? We'd be glad to meet you.

AERONOTES

By Roger Parkhill, Aero. E., '40

Dreams Come True

Travel in the stratosphere! Yesterday only a dream, today a reality! The high-altitude version of the new four-motored Boeing 307, now rapidly nearing completion, will operate at altitudes above 20,000 feet and will have a cabin designed to resist a difference in pressure of six pounds per square inch. Air at normal pressure will be circulated through the sealed cabins by mechanical superchargers in the wings. The Boeing 307, powered by four 1100 horsepower Wright cyclone engines, will carry 32 passengers and a ton of mail at a speed of 250 miles per hour.

New Army Fighter

A radical innovation in military aircraft, the Bell XMF-1, has passed its preliminary tests at the Air Corps Experimental Station, Wright Field, with flying colors. This plane is equipped with two 1000 horsepower liquid-cooled Allison engines arranged in pusher fashion. In front of each motor is a glass-enclosed gun turret mounting a fifty caliber machine gun. The center fuselage is occupied by the pilot, the radio operator, and the rear gunner. Accessibility to all parts of the plane occupied by the crew is possible while in flight. This fighter, whose maximum speed is close to 300 miles per hour, is the designer's answer to the hitherto invulnerable "flying fortress" bombers.

U. S. Airlines Lead

There are 92 domestic air routes in the United States, operated on exact schedule by 22 airlines. Their planes fly over 31,194 miles of organized airways, the daily average of miles flown reaching the incredible total of 202,804 miles. In addition, American airlines operate 22,100 miles of foreign airways. These include airways in China, South America, and Alaska, and routes to Bermuda, New Zealand, and the Orient. While Europe spends her time, energy, and capital on vast military airfleets, the United States extends her airways to the four corners of the earth.

Inexpensive Sextant Manufactured

Engineering students who wish to learn elementary principles of navigation will be interested to know that a practical sextant, complete with case and instruction book, is now on the market. Cost of the sextant is only $4.50. With this instrument the solution of the spherical triangle will be greatly simplified.

Flying Boats Over Atlantic

With the completion of their first huge, four-motored Boeing flying boats, expected by the spring of 1938, Pan-American Airways, coöperating with Britain's Imperial Airways, will be ready to start scheduled transatlantic flights. With the establishment of transatlantic service there will be no place on the face of the earth that a person cannot reach by airplane. At last the legend of the magic carpet will become a reality!

Patents, Good Will, etc., $1.00

Discovery of this item in a financial statement of General Electric Company prompts special reference to this most regular national advertiser in our magazine.

To us the *etc.* needs no interpretation for admittedly Men produced the patentable Products and Processes. Friendly Men have created Good Will and many friends for General Electric over a period of years.

Men have so developed and improved the products and processes of research that hardly anything is made today without some direct or indirect assistance of General Electric Men.

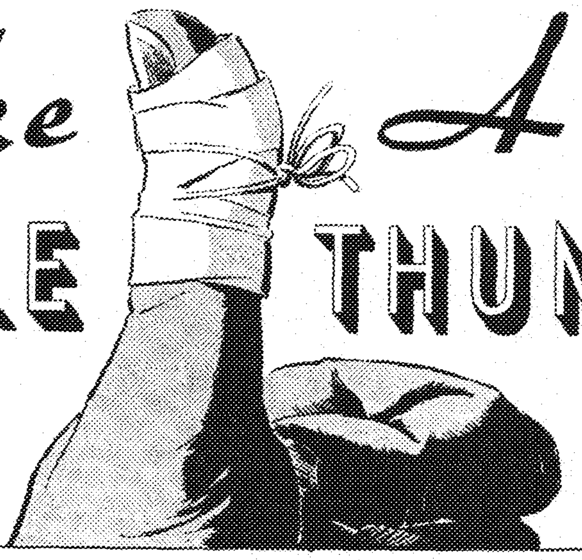
Advertising in this and other engineering college magazines represents a large investment for General Electric in good will—in making friends.

Tradition, background, products to meet the exacting needs of tomorrow's industry and the public—all these form an ideal foundation upon which General Electric may advertise today in this magazine to the important men of tomorrow.

Making friends of students in this community today by advertising is possible through the pages of this magazine. They are open to other farsighted manufacturers of character who expect to stay in business and want to establish friendly relations with us now before we scatter in various jobs of many industries.

The Minnesota Techno-Log

STANDS OUT *Like A* SORE THUMB



Yes, you hear it said:
"His advertising stands out like a sore thumb!"

Well, there's much more to it than that.

Advertising, a form of merchandising or selling, must sell merchandise . . . at a profit!

Our long experience in many different fields of selling may be helpful to you. Consult us!

MAin 6951 NEstor 2641

BRUCE PUBLISHING COMPANY

Minneapolis Saint Paul

MAGAZINE REVIEWS

By C. Vernon Olson, E.E. '39

UNIONS FOR ENGINEERS

The question of whether or not we should join an engineers' union will face many of us in a few years. Our decision will have a very real effect on the course of our engineering career.

Engineers can be divided into two classes. First, there are engineers who are directed and supervised in everything, having no ultimate technical responsibility. Then there are professional engineers serving as chief engineers, consulting engineers, and heads of departments. These men do have ultimate technical responsibility.

If you expect to remain a member of the former group, a union membership will undoubtedly be helpful. On the other hand, if you believe that there is something to this thing we call a profession, something that you really value along with the pecuniary compensation you may get now and later on, the chances are that the labor union will not give you what you desire. It depends upon the situation and upon you yourself.

"The Profession's Current Problems," by Willard Chevalier, from *Engineering News-Record*, November 18, 1937, p. 834.

LUBRICATION ECONOMY

When very young, I set out to get rich quick, purifying used oil by straining it through an old felt hat. Though I never got rich, experiment shows that decided economies can result from the use of an oil purification system in any plant of over 100 horsepower.

Efficient filters which remove carbon, metal parts, and dirt from lubricating oil are invaluable in preventing excessive wear of parts. With continued use, however, the quantity of small foreign particles not removable by filters builds up to such an extent that the oil is no longer suitable for use in the engine. This does not mean that the oil has been worn out, but that a more complete treatment than filtering is needed to restore the oil to its former state of purity and color.

Three prominent systems of oil purification are centrifuges, chemical treatment, and systems using activated clay. The centrifuge, in effect, is a means for securing rapid settling of impurities in the oil. The chemical system depends upon the use of a chemical coagulant to precipitate the foreign matter.

"Don't Throw Away Used Oil; It Can Be Reclaimed," from *Diesel Power*, November, 1937, p. 850.

PICK AND PAN

By M. A. Troxell, M. '39, and H. A. Larson, M. '39

We made a mistake in asking for comments on the column in last month's issue. Students would come up to tell us about it and promptly forget about the column as they laughed over the misplaced eyebrow one of the columnists attempted to grow (it was a splendid try and would have been the first one in the Mines School, but repeated ridicule and threats of physical violence abolished it after two weeks of unrestrained growth).

* * *

Have you heard about the butcher who accidentally backed into a meat grinder and got a little behind in his orders?

It seems that every college has some sort of a eulogy on the merits of the feminine part of the engineer's life in college. Here's the Mines School's contribution—author unknown at present—a poem called "An Engineer." It is just a mite of advice to the girls.

POME

Verily I say unto you, "Marry not an engineer,

For the engineer is a strange being and possessed of many devils.

Yea, he speaketh eternally in parables which he calleth 'formulæ,'

And he wieldeth a big stick which he calleth a slide rule, and hath but one Bible—a handbook.

He talketh always of stresses and strains, and without end of thermodynamics.

He showeth always a serious aspect and seemeth not to know how to smile,

And he picketh his seat in the car by the springs therein, and not by the damsel beside him.

Neither does he know a waterfall except for its power,

Nor the sunset except that he must turn on the light,

Nor a damsel except for her specific heat.

Always he carrieth his books with him, and he entertaineth his maiden with steam tables.

Verily though his damsel expecteth chocolates when he calleth, she openeth the package to disclose samples of iron ore.

Yea, he holdeth his damsel's hand but only to measure the friction, and kisses but to test the vicosity.

For in his eyes shineth a far away look which is neither love nor longing, but a vain attempt to recall a formula.

There is but one key dear to his heart, and that is the Tau Beta Pi key;

And one letter for which he yearneth, and that a 'C.'

And when to his damsel he writeth love and signeth with crosses, mistake not these symbols for kisses, but rather for unknown quantities.

Even as a young boy he pulleth a girl's hair to test its elasticity, but as a man he discovers different devices;

For he would count the vibrations of her heart strings and reckon her strength of materials.

For he seeketh ever to pursue the scientific investigation, even his heart flutterings he counteth as a vision of beauty and inscribeth his passion in a formula.

And his marriage is simultaneous equations involving two unknowns and yielding diverse answers."

* * *

One of the girls in a western engineering college was called upon to define a bolt and a nut. She thought a moment, then replied, "A bolt is a thing like a stick of hard metal such as iron with a square bunch of windings on one end and a lot of scratchings on the other end. A nut is similar to a bolt, only just the opposite, being a hole in a chunk of iron sawed off short, with wrinkles around the inside."

* * *

There I was in the chemistry laboratory, at the mercy of the elements.

* * *

It seems as though the lads in the ore dressing lab have a pronounced love of good old "aqua pura"—when distributed on someone else. Consequently, it was with considerable delight that we agreed to join in a diabolical plot. Victor Krause, with a smile of satanic glee, beckoned us to turn on the faucet—the other end of an attached hose presumably being inserted into the pocket of one Henry Sarja. Imagine our moist embarrassment when the hose that was really connected to the faucet turned out to be pointed at us—the hose in Sarja's pocket was just a fooler.

* * *

"Curses, foiled again," said the candy bar.

* * *

While Bob Felt was viewing a specimen through a microscope in metallography lab., someone casually removed the specimen. Immediately a puzzled frown crept over Bob's face. For five minutes he focused and refocused, finally lamenting, "Aw come on, guys, what did you do to this thing?" And then he saw the vacant space where the specimen should have been.

* * *

Parting thought:

"Lives of great men still remind us
That to dishonor we must not stoop,
Nor in departing leave behind us
Footprints 'round the chicken coop."

* * *

"Hmm—"

THE IONIZER

By Beta, Ch.E. '39, and Sigma Ch.E. '39

This is the story told by one of the more prominent seniors, who came home one day and found his father in a state of unusual excitement.

"Well, son," the father bubbled, "I have great news for you. I'm going to get married. I've met a wonderful woman. She can sew like Ed Wynn and cook like the husband of a bridge club president. She's as strong as a civil engineer and as smart as a chemical engineer. She's a wonderful woman. She'll make me a fine wife, a fine wife."

"Well dad," replied our hero, somewhat perplexed and taken aback by this sudden outburst, "that's fine, that's very fine. What's her name?"

A puzzled, vague look came across his father's face. "By God, son, I forgot to ask her!"

Oh, yes, Bob Longfellow, don't think we missed the story about you finishing your stadia survey down at the "Bowery." But don't worry, we'll not tell Mr. Zelner.

Some Definitions

Involute—a person who has to go around in a wheel chair—by G. Libby.

Cycloid—a one-eyed monster.

Libido—something society says you have, but cannot exercise.

Free love—something an estimated 90 per cent of the students on a particular campus have had.

Mr. Jerabek was trying to transfer Thursday metallography lab. students to the Saturday section. When he came to E. Plant he asked, "Can you transfer to the Saturday section?"

"Nope," replied Ted.

Asked Jerabek, "What is the conflict?"

Replied Ted, "Touchball lab."

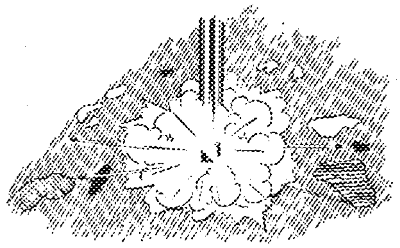
Leo Holahan stoutly asserts, "I gyp no man," adding under his breath, "no man is gypped unless he knows he is."

It's finally reached the point that whenever "Wild Bill" Trutna enters the Engineers' Bookstore, whoever waits on him automatically hands him a glass for his slide rule. . . . And then there was Earl Wookey who experienced considerable difficulty in finding the sources of area in his planimeter experiment for Heat Engines Laboratory. . . . Dr. Jerabek, of the Mines School, states that there are only two known substances that their grinding wheels won't cut—tungsten carbide and Al Colby's head. . . . Harold Cromer: "Gosh, I certainly am lucky to know a fellow as fine as you." Any Other Chemical Engineer: "You always were luckier than I." . . . Observation: It's really remarkable how the Chemical Engineers manage to preserve their fine sense of eqilibrium.

G-E *Campus* News

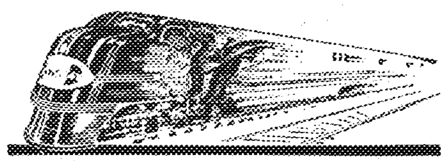
SHARPSHOOTING TWO MILES UNDERGROUND

SHOOTING HOLES through an oil-well casing at a depth of two miles underground is another problem successfully solved by electricity. The Lane-Wells Company Gun Perforator is an ingenious device used to pierce casings with steel bullets. When an oil pocket has been exhausted, the operators pierce the well casing at a different stratum, thus opening another pocket.



In order to know where to pierce the casing and how deep the gun is, G-E electric locating, weight, and depth instruments are mounted on a panel in a truck from which the shots are fired and the results recorded. Over two and one half miles of steel-sheathed cable is used to lower and fire the gun, the current for the charge being carried in the core of the cable. Accurate measurement of the depth at which the gun strikes or leaves the fluid level in the well is indicated to the operator by a weight indicator which utilizes two General Electric Selsyn motors.

In General Electric Company, numerous groups of engineers devote their entire time to the most efficient use of electricity in all types of industries. These men, former members of the Test Course, have solved many problems such as Sharpshooting Two Miles Underground.

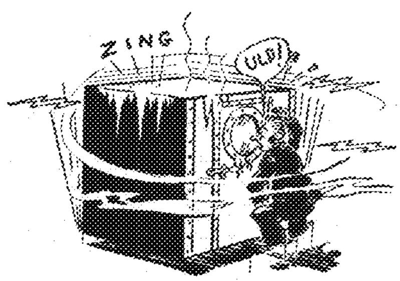


TRAIN-PERFORMANCE DETECTIVE

IN AN EFFORT to determine more accurately the performance of an electric locomotive and to calculate the most efficient motor for the train, T. F. Perkinson, R.P.I., '24, a former Test man now in the Erie Works of General Electric Company, invented a machine which performs these operations mechanically.

Computation by the step-by-step method of these calculations necessitates many hours of tedious slide-rule work; repeated adding and subtracting of time, speed, and distance increments; and reading of charts. The Transportation Calculator eliminates this work and solves the mathematics at least five times as quickly, depending upon the skill of the operator.

The Transportation Department of General Electric Company offers many opportunities to mechanical and electrical engineers in the design, construction, and production of electric locomotives, trolley cars, and trolley buses. The solutions of many interesting problems are found in this department, the Transportation Calculator being but one of them.



BOXING THE ELEMENTS

WIND, RAIN, SLEET, SNOW, arctic and tropical temperatures, six-mile altitudes, and power dives—all are found within the confines of two steel rooms in the radio-transmitter test department in the Schenectady Works of General Electric Company.

To assure perfect performance of aircraft transmitters, the equipment is placed in these two rooms where extremely severe weather conditions are simulated. Portholes of one-inch glass in the rooms permit the test men to observe the effects on the instruments without being subjected to the same strains placed upon the transmitters.

These complicated tests are made by college-trained men now on Test. The field of radio transmission from airplanes is, of course, new and progressive. The "flight rooms" provide radio engineers with a new and clearer conception of designs for radio equipment.

GENERAL ELECTRIC

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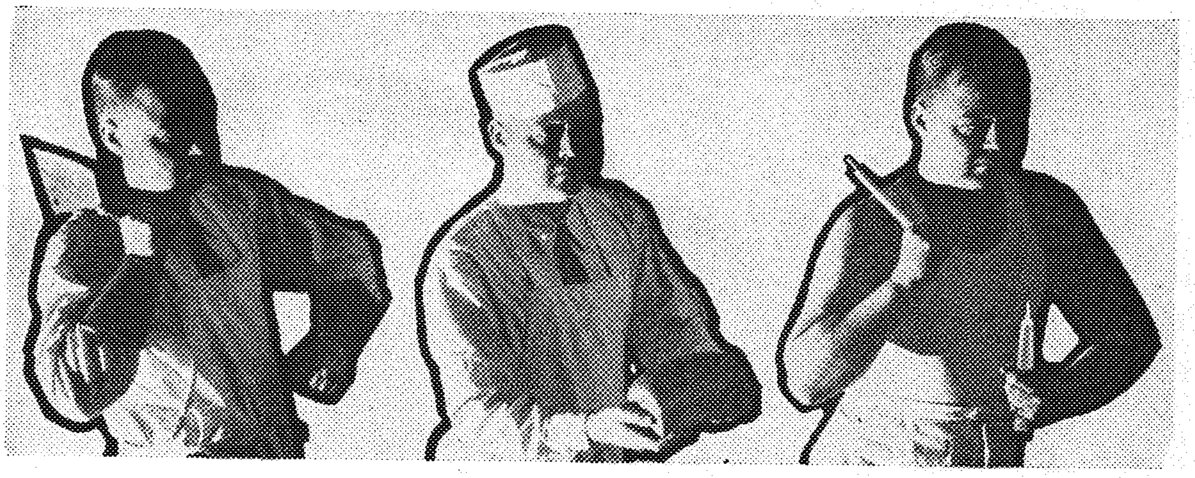
JANUARY 1938

MINNESOTA TECHNO-LOG



Minnesota Techno-Log

Volume XVIII 37 Electrical Engineering Building, University of Minnesota, Minneapolis Number 4

ERLING HELLAND, Managing Editor WARREN WALEEN, Business Manager

Published Monthly
from October to May

This Month . . .

Here are thumb-nail sketches introducing to you the personalities who have contributed this month's feature articles.

Professor Harlow C. Richardson brings this month's faculty contribution. In the summer of 1934 Prof. Richardson and Dr. John Turner, of the University zoological department, set out for an extended trip through the Orient. They visited Hawaii, Japan, Manchukuo, and China. In Japan they remained for two weeks, during which time they climbed Fujiyama.

Prof. Richardson is one of the best loved professors on the campus, respected for his good humor and for his interest in student activities. A few of the organizations with which he is connected are Alpha Rho Chi, Plumb Bob, and Alpha Tau Sigma.

Gordon Griffith speaks from his experience as an undergraduate in Chemical Engineering on the Chemical Engineer's relation to industry. Gordy comes to the U. from Winnipeg. He formerly attended Manitoba and Toronto Universities. His primary interest is metabolism under stratospheric conditions. Gordy is a member of Alpha Chi Sigma.

Bert Lindquist, more widely known as B-H-T-L, steps out of his column to write a feature article this month. He is a rabid photographer and dotes on pictures—the right kind. Bert spent several months at Pensacola flying for the navy. He is a member of I.Ae.S., president of both the Technical Commission and the TECHNO-LOG Board.

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MEMBERS OF ENGINEERING COLLEGE MAGAZINES ASSOCIATED

Chairman: PROF. RICHARD W. BECKMAN, Iowa State College, Ames, Iowa

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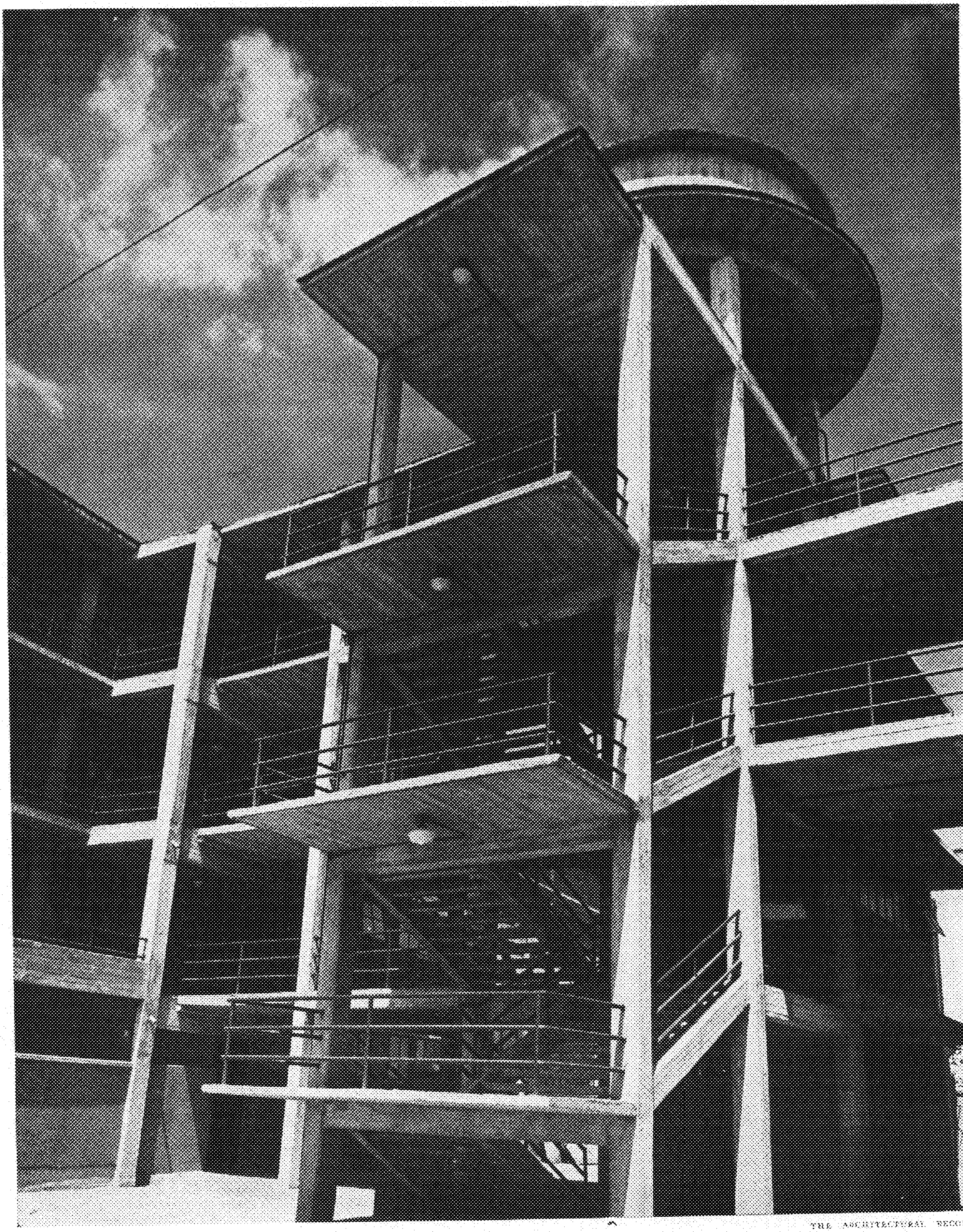


THE ARCHITECTURAL RECO

Concrete Unadorned

The Chemical Engineer —What is His Work?

Who is he? What does he do? Why is his profession gaining in prominence so rapidly? Is he really a chemist, or an engineer, or both? Does he, together with other engineers, take a sufficiently active part in human affairs?

By Gordon Griffith, Chem. E. '39

Illustrations by Albert Arneson

IT IS possible that these questions have all been answered several times, both verbally and in writing, but I have not seen a complete set of answers. Let us not compile a book of questions and answers, as that would turn a very interesting topic into a dry technical discourse; rather, let us make it an interesting and rational discussion of the whole subject. Then we will see whether we have answered all the questions which might arise. We will work this thing out together, then the topic will have been well covered, and there will be no one-sided opinions. When we have finished we will have a much better idea of the status of a chemical engineer, and we will have formed some definite opinion of the profession.

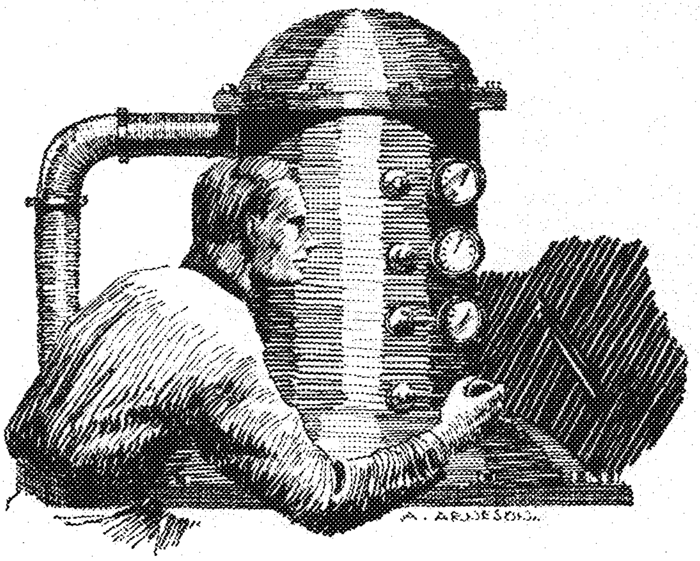
Course Important in Institute

According to statistics, chemical engineering has the largest registration in the Institute. I think therefore that the profession should be regarded with corresponding deference, and its importance should be considered in proportion. Now, if I were to state that at least 75 per cent of the students in the Institute do not know what a chemical engineer is, or what he does, then I would be looking for an argument. But consider it well before you jump on me. Can you tell me exactly what a chemical engineer is supposed to know, or what kind of work he is supposed to prepare himself for? Don't feel too badly about it if you are unable to answer, as you are probably not in that profession. But if I were so bold as even to hint that a great number of chemical engineering students do not know themselves all that their profession stands for, then it would be the same as if I walked into a den of lions—I would be pounced upon from all sides. And justly so, as I have absolutely no right to make such a statement, especially in front of the whole Institute, as it might embarrass some of the chemical engineers. So, instead of putting it so bluntly, I will merely ask you to read the following short article first, and then I will ask your permission to make that statement, using the past tense of the verb.

This branch of engineering is a very new profession. It deals with the very latest engineering practices which are common to the unit operations in chemical processes. The chemical industry itself is a development of the last hundred years, and chemical engineering, only of the last few years. Probably the fact that it is such a recent development is very good reason for its lack of publicity. It is a field in which a great deal of work is being done, but very little is being said. Why? Well, I think that the reason for this is the fact that the field is growing so rapidly that its literature, as yet, has not become very widely read. Thus the public is practically ignorant of its existence. I am sure that in the very near future the public will be made familiar with this new type of work. The field is expanding and very rapidly becoming important. The number of jobs open to the new students in the profession is indicative of its rapid expansion, and the high salaries paid are indicative of its importance.

Definition of Chemical Engineer

A great number of questions arise due to the confusions arising in the study of this profession. Is chemical engineering a composite of chemistry and mechanical engineering, or is it a separate branch of engineering? Probably this would be a very good place for me to define, as best I can, the scope of this branch. Chemical engineering is the study of the unit operations common to the industrial chemical processes, paying particular attention to the unit operations in themselves, their proper sequence and coördination in production on a commercial scale, with efficiency and economy the chief aim. This



"... the Chemical Engineer concerns himself with the unit operations and their sequence..."

definition proves beyond a doubt that chemical engineering is a very special technical branch of engineering, an entirely new field.

The chemical engineer must not be confused with the industrial chemist. They are members of two distinctly different professions, having very little in common, although in their work they are interdependent. However, there is a definite line of difference between the two. The industrial chemist is interested in each chemical process purely from a chemical standpoint, while the chemical engineer concerns himself with the unit operations and their sequence, which are necessary to carry out the chemical process from the raw materials right down to the finished product. The chemist is interested in all the factors which will influence the chemical reactions in such a way as to change the yield of the product, with some regard for the cost of raw materials and chemicals involved. On the other hand, the engineer is interested in the nature of the raw materials and the chemicals to be used, the size of the operations, temperatures and pressures required, and other specific factors, and is concerned with operation and production costs, and the efficiency of each operation. Thus you see that if you analyze the case carefully, there is considerable difference. The majority of us have never drawn this line before, so we have often used the terms interchangeably. Now that we know better, let us resolve not to belittle our profession by confusing it with another one.

Lack of Recognition for the Field

If the profession is so important, then why is it not more widely known and advertised? Why don't we let the public know more about what is going on? Well, there are probably several reasons for this, depending upon the approach. Let me suggest a few.

I have already put forth two good reasons for this lack of common knowledge, namely, the rather recent development of the field and the great rapidity with which this development has taken place and spread. It is rather difficult for even a student in the profession to keep abreast of the advances. Now I have a third, rather different, reason for this public ignorance, that is, the type of work that is being done. Going more deeply into this, we find it subdivided into two separate reasons: there is the fact that it is a very highly specialized technical profession and that it would take a well-educated person to comprehend it all. This is very true of all the newer professions or branches, because of their specialized terminology.

Now there is also the relationship of the work to similar fields as it is recognized by the general public. Let me give you a rather good example of the same thing in another branch of engineering. Let us consider the aeronautical engineer; he is not very well known either. Why? Because of the relation his work holds to some other profession in the public eye. In flying, the aviator, or the manufacturers, or the commercial concern gets all the publicity and credit; but where would these men be without the aeronautical engineer? He interests himself in all the separate operations which go together to build, operate, and maintain these magnificent flying machines. He studies the strength and the nature of the materials of construction, and does the research work in creating new materials of construction. He also studies, carefully, atmospheric conditions, wind resistance, and other factors which are to influence the design of these machines. He works continually in creating and perfecting measuring and operating instruments and mechanisms. In other words, he is the backbone and the framework of aviation.

Do you not see how closely this parallel runs with the chemical engineer and the industrial chemist? We might even find the same parallel in the case of the mechanical engineer, the electrical engineer, and the civil engineer. In all these cases, the commercial man gets all the credit, while the engineer does all the real work, deserves all the credit, but is practically unrecognized by the public. I think that it is about time for us, as engineers, to make our professions much more widely known. We should stand up for our rights, and demand the credit and recognition due us. This has been done already in most of the other branches of engineering, but the latest branch, chemical engineering, has not had the time to get into the public eye. I think that if we get behind it and help promote the cause, it will not be very long before we receive proper recognition. I believe that the time is not far off when chemical engineering will rank as the most important branch of engineering, and this will be due to the ever increasing importance of chemistry, both industrially and for satisfying this modern world of the engineer. As the importance of chemistry grows, chemical engineering becomes doubly important. The industrial chemist becomes more and more dependent upon the chemical engineer for the designing and operation of chemical equipment.

Varied Demands Are Made on the Chemical Engineer

Let us now consider the chemical engineer more carefully and study what demands are made of him. First of all, he must have both a theoretical understanding and a practical knowledge of a very wide field of chemical and engineering subjects. His knowledge and understanding must extend into the field of chemistry, into the fields of mechanical, electrical, and civil engineering, and into physics and mathematics. This is a rather wide range of subjects and calls for a general knowledge. He must know especially well the chemical and physical properties of all materials of construction, as well as their costs. This knowledge forms one of the most important factors to be considered in the construction of the various types of equipment used in the unit operations. He must also have a good theoretical understanding and practical experience in the application of the laws of heat flow, heat transfer, and fluid flow, and the properties of fluid and vapor films. He must know all the unit operations and their proper sequence and coördination. He must know all the types of equipment used in each operation well enough to be able to choose efficiently and economically the proper equipment to suit the special set of conditions. He must know all the advantages and disadvantages of each piece of equipment, in order to consider the type of material and the required capacity and the condition of the material. These requirements call for a very intensive study of the unit operations and the types of equipment available for each operation. For each process he must avail himself of a knowledge of the chemical materials, size of the operation, the temperature and pressure factors in each operation, and other specific factors involved in the process under consideration. As this is no small task, a student must really earn his position in the profession.

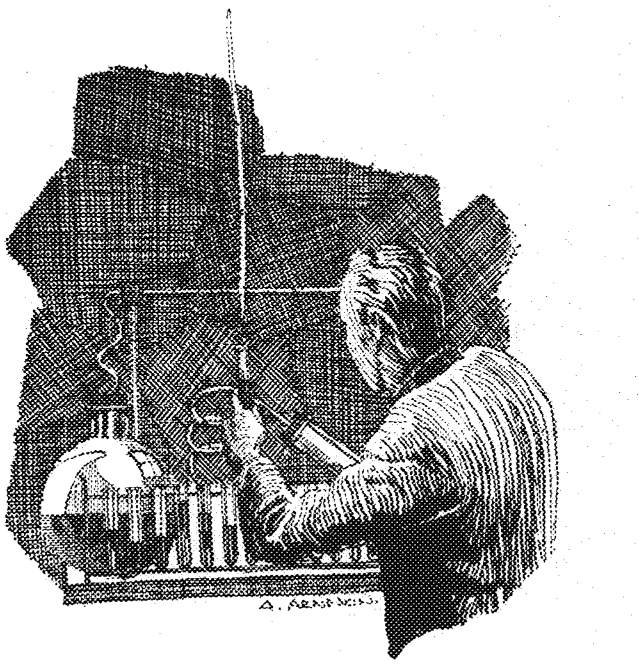
Probably the most important characteristic a successful chemical engineer must have is a certain alertness for all developments in materials of construction, new types of equipment, and new measuring instruments. The equipment and the practices for the unit operations are ever changing, and for that reason the chemical engineer must be a student at all times, keeping his practical knowledge as nearly up to date as possible. He must be able to fit all this incoming new material into the proper relation with the old.

With these modern improvements also come the instruments and devices for better control of the chemical reactions, temperature, and pressure. A chemical engineer must keep in close enough touch with the chemical field to know all of these newer methods for increasing the yields in the processes. He must know enough of these chemical advances to be able to find their effect upon the chemical equipment. Thus he must keep abreast of the times from a chemical standpoint as well.

Advances in physics and mathematics are usually important to the chemical engineer in the designing and improving of equipment and measuring devices. Therefore, a practical knowledge of both of these is usually necessary and important.

Ample Opportunity for Research Is Provided

Of increasing importance is the research aspect of this field. Chemical engineering involves no end of research for which the newness of the field provides ample opportunity. Modern laboratories make it possible to carry out the operations on a small scale. When these small scale operations prove successful, the carrying out of the same operation on a larger scale can be considered. The scale is increased slightly and the factors of large scale operation are studied. If indications are such as to warrant this



"The Industrial Chemist is interested in each chemical process purely from a chemical standpoint. . . ."

new type of equipment, or the new operation in place of an old one, or if it will suit a specific set of conditions better than any other, then it is adopted. Quoting from Doctor Baekland, "Make your blunders on the small scale, and make your profits on the large scale." Following this plan, the advances of the chemical engineering profession are rapid, sure, and successful.

Engineers Are Responsible for World of Today

This world of ours today is the world created by the hand of the engineer, whereas the world of yesterday was based upon subsistence from agriculture. The "happiness" sought by our forefathers is replaced by the "satisfaction" sought after today. This "satisfaction" is brought to the public by the engineer. This is another fact that the engineer must not forget. In fact, it gives all the more reason for us to advertise our engineering profession more. Let us show the public that we are the real builders of our present day civilization. We can best do this by writing and speaking, but each one of us can do infinitely more by merely telling or educating our neighbors along engineering lines. Tell them exactly what our task and aim is—our own modest endeavors.

I have come to the close of my article, which was written with the sole purpose of stimulating new paths of thought in the minds of all engineers, although more so with the chemical engineers. Read it through, think it all over, but don't swallow it. I haven't directly answered all your questions, but I sincerely hope that I have caused you to think a little more deeply about your own profession, whether it be chemical engineering or not. And in conclusion, may I ask you of the Institute, in particular the Chemical Engineers, "Do you know any more about this profession called chemical engineering, which represents the latest field of endeavor of the engineers?"

We Climb Fujiyama

Let's forget international tensions, calculus, and that long report—forget them long enough to settle down and climb by the armchair route the tortuous trails of Japan's sacred mountain.

By Harlow C. Richardson
Assistant Professor of English

Illustrations by Albert Arneson

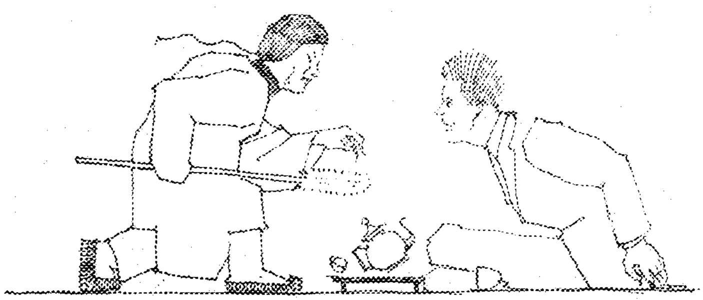
ON our trip to the Orient Dr. John Turner, my fellow traveler, and I decided that we would not come home until we had climbed Fuji. Like every one else we were familiar with the appearance of the mountain, Dr. Turner from actual observation of it previously and I from seeing countless representations of it since the days of my grade school geography. During the first part of our stay in Japan we had seen it from afar, looking exactly as it should—a huge frustrum of a cone against a blue sky with occasional white clouds clinging to its summit. It is obvious at first glance why this mountain is venerated and why it draws to the shrines on its top thousands of pilgrims annually. It is not rugged or chaotic like the Rockies or the Alps. It rises with the beauty of line and proportion of a simple geometrical figure, its sloping sides inviting the climber to ascend with only a pack sack and stick, unencumbered, in July and August at least, with ropes and ice axes.

After one or two postponements, we chose August 27 as the date for beginning our adventure. We were in Tokyo visiting friends. The general opinion seemed to be that a night ascent would be desirable so that we might view Japan from the summit of its highest mountain just as the first rays of the rising sun fell upon it. Accordingly, after having supplied ourselves with a pack-sack full of probable necessities, including a lunch prepared by Amasan, the housekeeper, we set out for the Shimbashi Station to catch the 6:05 p. m. train for Gotemba, the station nearest the mountain.

At 9:05 p. m. we reached Gotemba. A six mile taxi ride on a very dark and narrow road brought us to the Yoneyama Hotel at Subashiri. At the comfortable inn we prepared for the ascent. Before leaving Tokyo we had been advised to take horses for part of the journey. There are ten or a dozen stations or huts where pilgrims may rest along the trail. We asked for horses and a guide to take us to Station Five. They were sent for, and in due time two horses and two boys appeared. Before we started, the innkeeper and the two men insisted that each one of us take along a wooden staff. I looked for one about the size of a cane but could find none in the collection. They were all of unfinished light wood, over five feet long. This seemed too long; but we bought them, mounted our chargers, and rode away.

We soon discovered that our horseboys had no horses. They simply followed on foot, some distance in the rear. It was 10:15 when we left the inn, and a blacker night I have never seen. Our horses, old timers at the business, knew the way and proceeded to take it in most leisurely fashion. A heavy mist was in the air. The world seemed to have two qualities, darkness and dampness, both of which enveloped us completely. The strangeness of the situation came over us. Here we were, thousands of miles from home, in a strange land, proceeding into the night on an unfamiliar and invisible trail, followed by two men we had never seen before, whose language was as foreign to us as ours was to them. We could hear the murmur of their voices behind us. Suddenly we were aware of little shafts of light coming from the direction of the voices. They moved about searchingly, like the erratic beams from tiny airplane beacons. Was this a natural phenomenon peculiar to Fuji? Or were these signals? Was our night on the mountain to include an unexpected adventure? The lights disappeared. Nothing happened. Evidently the spookiness of the night was getting on our nerves. We would snap out of it! Of course modern Japanese guides would provide themselves with flashlights for use on dark nights. What they were looking for, we never learned.

". . . she moved toward me, a black disheveled figure, with a red hot iron in her hand."

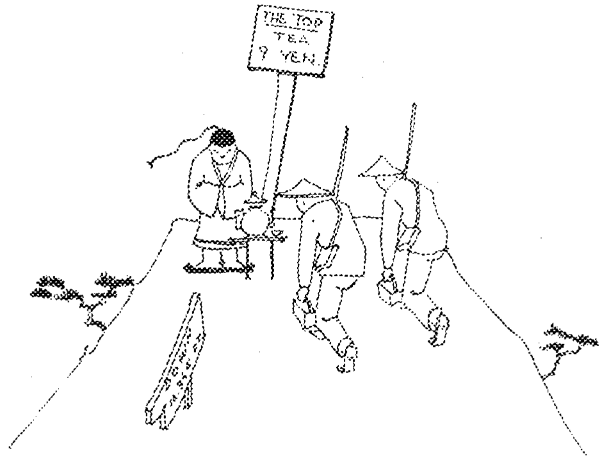


Weird is the word for the rest of our night's journey. Slowly we rode upward through dripping boughs with the trail so narrow that the luxuriant growth of underbrush and low hanging branches of trees constantly deposited their wetness upon us as we brushed past. We could do nothing with our horses. They were equipped with halters instead of bridles. They knew from experience what they could do and nibbled at the juicy vegetation almost continuously in spite of our efforts to concentrate their attention upon the work in hand. My horse found the overhanging branch of one tree so much to his liking that I feared he planned to spend the night on the spot. I protested with jerks and kicks; whereupon he became more determined than ever and pulled at the tree so vigorously that a private rainstorm descended upon us. We met no one and the feeling of isolation was very strong. We might have been in a South American or African jungle as far as we knew. Occasionally the mist lifted and we got the impression of pale silver light through the leafy brush and enveloping forest of tall trees. The light seemed to be diffused as though filtered through a silver drop on a stage. Suddenly we paused to rest the horses. A *torii* and shrine were vaguely discernible nearby. My horseboy exclaimed and pointed to the sky. There was a patch of blue and in it a brilliant star! Then we looked behind us and through the trees came the light of the moon, three-fourths full!

We stopped at various stations as the night wore on and the mists again hid the sky. At these places, which were no more than huts, sleepy women appeared, stirred up the ash-covered coals in the middle of the dirt floor, heated some water, and served us hot, unsweetened tea. During these stops the horses were watered and sometimes fed. The horseboys then threw themselves down in the driest place obtainable and were instantly fast asleep. In a short time they were wide awake again, and the horses were made ready for the trail. At the first stop, as we were sitting cross-legged on the floor drinking our tea, I noticed that the old woman was busily engaged in blowing the coals with a small bellows. For some reason she wanted a hotter fire than was required for tea making. Suddenly she moved toward me, a black disheveled figure, with a red hot iron in her hand. Her action was so unexpected that I didn't have time to get to my feet. She reached forward, grasped my long walking stick which lay on the dirt before me, and placed the hot iron upon it. There was a slight smoke, and then the odor of burning wood. My stick was officially branded. For ten *sen*, the desired contribution, I could show the world that I had been a guest of the station. This incident was repeated many times in the hours that followed; but, needless to say, none had quite the dramatic effect of the first.

About 4 a.m. we reached the timber line. Here was Station Five. Thus far our vision had been so obscured by darkness, fog, and trees that we had not really seen the mountain. Once at a turn in the trail some distance back, my boy suddenly called out "Fuji!" Sure enough, the forest above us was gone and the fog had cleared enough for us to see the famous mountain, looking very near and incredibly smaller than I had anticipated. It seemed that we could run up its gently sloping sides in no time. In the half light our task seemed simple enough. At Station Five we dismissed our horse boys with instructions to meet us later in the day at Station Two and One-half. As we left the station a faint color appeared in the East. The trail now became well-defined. It zigzagged upward through the volcanic ash and cinders of which the mountain seemed to be made. We soon realized that we were above the clouds. The faint light brightened. About 5 a.m. we heard shouts that seemed to come from above. There must be other human beings on the mountain. *"Banzai! Banzai!"* came the shouts. Almost immediately we saw the sun, a gorgeous red, slowly appear above the clouds. The watchers nearer the summit, of course, had seen it first and were shouting their greeting to the new day. We added our *"Banzais"* that must have sounded like feeble echoes if they were heard at all. Now we saw a perfectly blue, cloudless sky above and a world of billowy white below. We couldn't see Japan at all. What we did see, in effect, were the mountains and valleys of an Arctic world without an object of any kind to dispel the illusion. Not until later in the day did the clouds thin enough to allow distant mountain tops here and there to appear like small dark mounds through the billowy white floor below us.

At Station Six we had more tea and ate Amasan's lunch. The trail became increasingly difficult as we proceeded, not because it was a poor trail but because of the altitude. Trudging through the volcanic ash and cinders was like hiking up the slag dump of a huge manufacturing or mining plant. The feet of many pilgrims had crushed the larger cinders but the small ones gave insecure footing, and we often found ourselves slipping backward instead of going forward. We depended more and more upon our walking sticks. We formed the habit of sitting down frequently at the end of a "zig" or a "zag" and getting our breaths. It was incredible how fresh we felt after each breathing spell and how quickly our supply of oxygen was exhausted.



"We kept our eyes on the torii . . . and made bets on when we would get there."

At about this point a group of three Japanese and one American caught up with us. They had spent the night at a station well up on the trail and were now fresh and vigorous. When they heard that we had been traveling all night, they strongly advised us to stop at the next station, Station Eight, where there were accommodations for sleeping. We took their advice.

The man in charge spread *futons* (padded comforters) on the floor, rolled up others for pillows, and gave us extra ones for covering. This was the first sleep we had had except for occasional cat naps during resting moments. Dr. Turner had a bad headache from eyestrain caused by the brilliant reflection of the sun on the clouds below us. I was weary enough and was greatly refreshed by the sleep. We paid 50 *sen* each for the hospitality extended.

The rest of the way was hard work. We kept our eyes on the *torii*, or gateway, indicating a shrine at the summit, and made bets on when we would get there. At approximately 12:30 we arrived, greeted by loud hand clapping from the group that had caught up with us and passed us on the trail.

Here we were at last on the summit of Fujiyama, 12,395 feet above the Pacific. Below us in all directions stretched the clouds. Near us on the mountain was the circular crater said to have a depth of 548 feet and a mean diameter of 1,500 feet. It is shaped like an inverted cone. The volcano is inactive. Trails lead around the crater and down into it. We went to various points and peered into its depths. We should have taken the trail around it if views of the country had been possible, but the clouds interfered. Although we usually see pictures of Fujiyama with a snow-covered summit, at this time of year there was almost no snow. What little we saw was in a ravine on the side of the mountain. The prevailing color above the line of vegetation is a dusky black, about like coke in appearance and consistency, with considerable brick red near the top. There is much gray lava flow but what we walked in was like ashes, cinders, and clinkers.

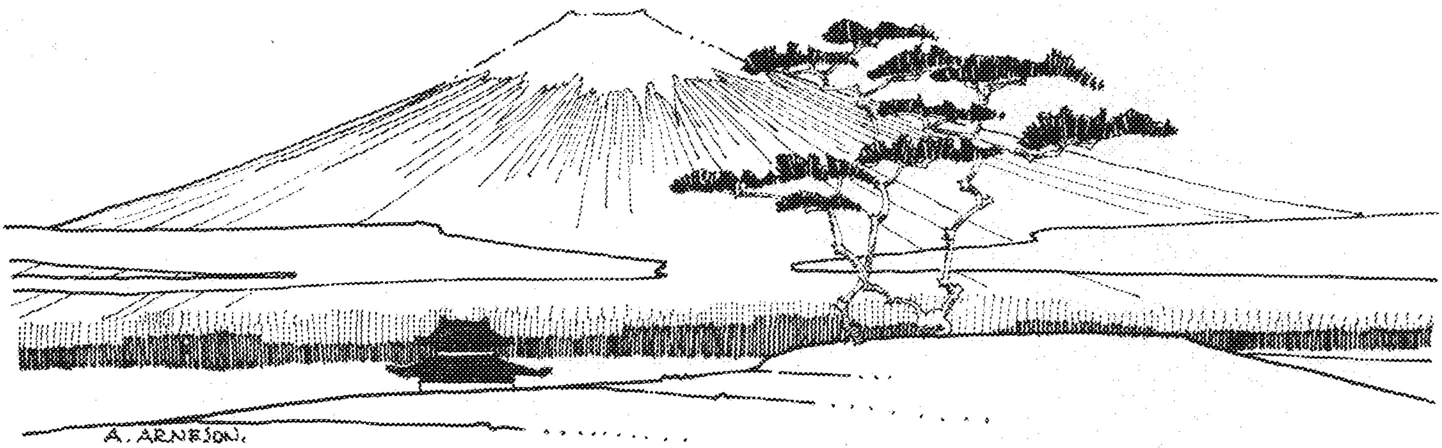
Several shrines and rest huts find space on the summit. We had the usual tea and rested awhile before thinking of the descent. I had my walking stick branded twice—once with the official summit stamp and once at the Shinto shrine. The stick is well decorated even if we didn't wake the sleepers in every station and ask them to bring out their branding irons.

We began the descent about 1:15 p.m. Instead of retracing our steps, we chose the slide toward Gotemba. There was little zigzag about this. It was mostly what its name implies—a rather steep slide of cinders down to the timber line. There was no trail. We simply started down the side of the mountain and trusted to luck to keep our feet. Now we knew why walking sticks were so long. The cinders were loose and deep, and gravity quickly carried us into a run. We had to control this speed, or we would have been sprawling, perhaps rolling, down the slide. We did the natural thing. We grasped our sticks with both hands and let one end drag behind us. When we leaned heavily on them, we had sufficient brakes to moderate our speed and keep us upright. The cinders gave way at every plunging footstep. Occasional rock-like pieces, large enough to sit on, gave us a few moments rest, but often they were too insecure and started sliding down the mountain as soon as we touched them. There was nothing hazardous about this way of coming down. It was almost as much fun as skiing—but it was literally the dirtiest sport I have ever taken part in!

The main slide reaches the timber line at Station Five. We had told the horseboys to meet us at Station Two and One-half, so we proceeded on a continuation of the slide to that point. As we left the main slide we said goodbye to the sunshine and the billowy white floor we had seen since sunrise and came down through the clouds themselves. The mist became very thick and we could see nothing but the cinders at our feet. Finally we reached the level of small flowering plants, then larger and more numerous ones, and at last small dripping bushes and trees. Down a coal-black sunken path, like the bed of a stream, we went; and suddenly out of the fog appeared Station Two and One-half. Here were our horses and guides. It was now 2:30 p.m. and our hike was over.

We reached Tokyo at 9:45 p.m. We had climbed Fujiyama, but now there was nothing so important in the world as a hot bath.

"... we had seen it from afar ... a huge frustrum of a cone against the blue sky..."



You Can Do It With Your Camera

By Bertil H. T. Lindquist, Aero. E. '38

Are you one of the modern legion of camera fans? If you are, you will find much value in this article, regardless of whether you use a costly miniature or an inexpensive box camera.

PHOTOGRAPHY is an art, a profession, a hobby, or a headache—depending entirely on how much money you have to spend and your ability to develop a well-heeled sense of sang-froid.

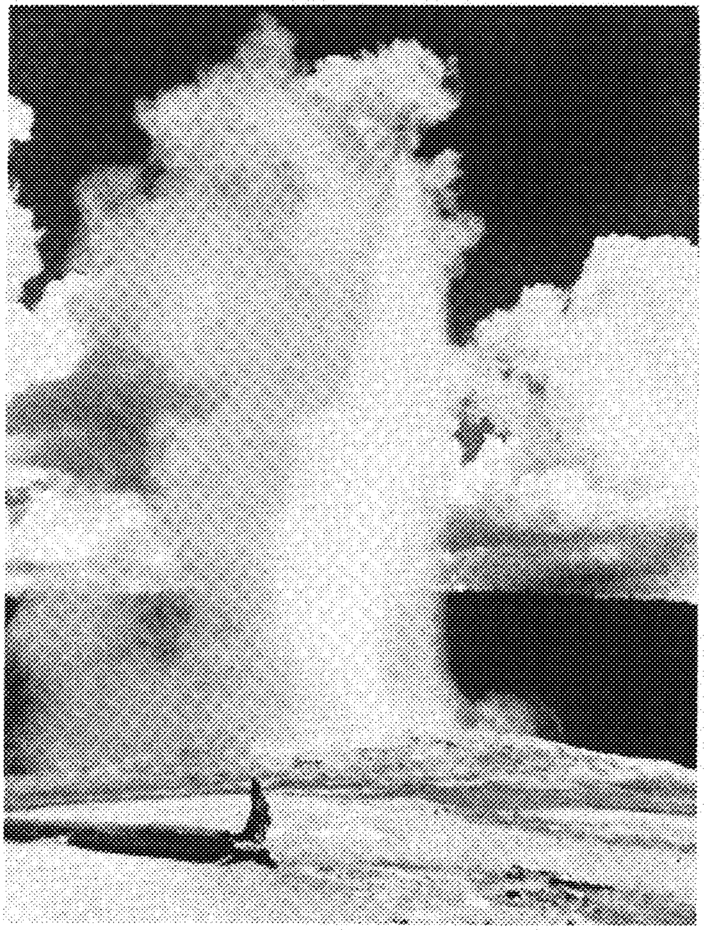
There is such a wealth of technical information available now that the ordinary snapshooter is left out in the fog, without a glimmer to guide him. In this work we will try to explain a few of the simpler aspects of the technique of photography.

The Lens

The lens of the camera is, of course, the most important part of it. Lenses are now all rated by the "f." system. The smaller the "f." number the more light the lens will admit and the greater will be your range of obtainable pictures. A small "f." number does not necessarily mean that the camera has a fine lens, but it is some indication of the lens' worth. To find the "f." number, adjust the camera so that it is focused at infinity and then divide the maximum lens opening into the distance from the center of the lens system to the film. This quotient is the "f." number. The focal length of the lens is the approximate distance from the lens to the film. There is a definite relation between the focal length and size of the image in that a lens with a 12 inch focal length gives an image twice the size of that of a lens with a 6 inch focal length. Another conception of the "f." number is that an f.8 lens has a diameter ⅛ of the focal length. A 1 inch aperture on an 8 inch lens admits the same amount of light as a 2 inch aperture on a 16 inch lens and therefore the "f." rating on the two lenses would be the same. The actual physical diameter of the lens opening and its true effective aperture vary slightly, depending on light transmission factors and the number of components in the lens system.

The standard series of apertures are based on the ratios of ¼, ½, 1, 2, 4, 8, 16, etc. On the camera, these apertures, or "stops," as they are called, are designated as f.4, f.5.6, f.8, f.11, f.16, f.22, f.32, etc., corresponding to the above ratios. There are intermediate stops in this main series such as f.3.5, f.4.5, and f.6.3, but these bear no definite relation to the other stops.

The differences in apertures in the main series of stops are so arranged that they increase or decrease the relative time of exposure by two. That is, f.16 requires twice the exposure of f.11, but only half the exposure of f.22. Then, you ask, "Why stop down at all, then? Why not shoot everything at f.4.5 and 1/100 of a second?"



EDWARD E. BRUSH

Steam and Clouds. *K2 filter, panatomic film.* **The filter brings out the contrast between the white and blue.**

Depth of Focus

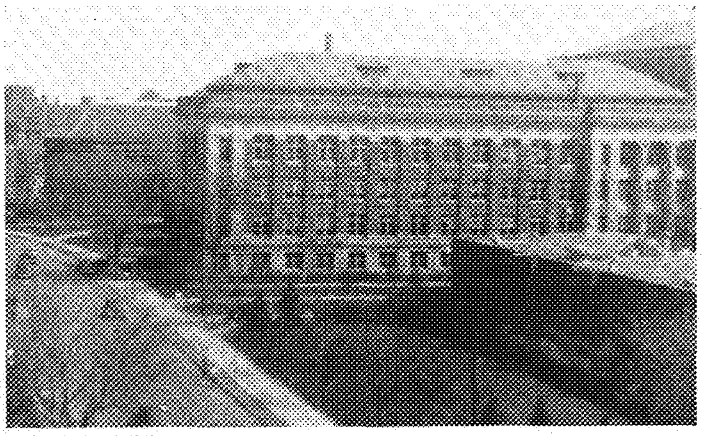
The answer lies in that old bugaboo known as depth of field, which is generally referred to as "depth of focus." Depth of field means the distance between the acceptable planes of focus before and beyond the plane of critical focus. Simply, it means that when you focus your camera on a certain object, some objects closer to you than that object are in focus and some behind it are also in focus. The distance between the point nearest you where the definition is acceptable and the point farthest from you where the image does not get too "fuzzy" is the depth of field. Depth of focus is the depth of "sharpness" you find when you move the ground glass of your camera back and forth.

The controlling elements of depth of field are: (1) the focal length of the lens. (The shorter the focal length, the greater the depth of focus. That is why the miniature camera has such a great depth of field); (2) the size of the stop used. (The smaller the stop used, the greater the depth of field); and (3) the distance from the lens to the plane of the subject in sharp focus. Therefore, if you want to make a portrait without including objectionable background, open the lens wide and focus directly on your subject. If you want to make a picture of a landscape or a long corridor, stop the lens down and increase the exposure. Stopping the lens down is very useful when you wish to make a picture of a street where there is traffic interfering with your subject. Here again you should stop it way down and, as long as nothing in the field of view stops moving, it will not show on your finished picture.

You often hear "circle of confusion" mentioned by professionals and advanced amateurs. Theoretically, there is only one plane that can be in sharp focus; and the only reason there seems to be a depth of field is that the human eye does not have the ability to resolve, at a distance of 12 inches, any object less than 1/100 of an inch in diameter as anything but a point. A small circle, the diameter of which is this visual vanishing point, is called the circle of confusion. A circle of confusion of 1/100 of an inch gives very sharp contact prints but must be reduced as the size of enlargement is increased. That is why many pictures which make perfectly acceptable contact prints will not give sharp enlargements.

Exposure

The matter of judging exposure is a very difficult one. The human eye is not dependable because it is adaptable to a much larger range of light values than any camera ever could be. A photo-electric exposure meter is of course the best solution, but any kind of a meter is better than none. Exposure tables may be purchased for about 75 cents which will indicate very closely the correct exposure. There are also several ocular type meters that are infinitely better than just wild guessing and which cost about $2.00.



BERTIL LINDQUIST

Church Street. *f.32 1/10 second, 8 x 10 camera, 12 inch lens.* **Can you orient yourself in this picture?**

When using an exposure meter, don't point the thing blindly in the direction in which you point your camera; instead, go up to the object that you are photographing and get a reading from it. Otherwise the amount of reflected light will affect the reading that you get and it will not be reliable.

A sunshade for your lens is a very valuable addition to your equipment. It will enable you to take pictures facing more closely in the direction from which the light is coming, when that is necessary, and will prevent fog and light streaks on the negative. A sunshade can easily be made by cutting a piece of inner tube to a conical shape and fastening together with patching cement.

A tripod is almost a necessity for the amateur photographer. It assists greatly in composing the picture and making short time exposures when the light is poor—at times when a picture would otherwise be impossible. It also proves useful in fending off irate folk who feel irked after you have just caught a candid shot of them in a particularly compromising situation.

The Box Camera

That old reliable photographic institution, the box camera, is fitted with an f.16 lens in the cheaper models, while the better grades have lenses designated as f.11 or f.12, approximately. The shutter speed is 1/25 of a second and there is usually a device for making time exposures. A metal slide projecting from the box may be pulled out to change the size of the aperture to f.22 and also f.32. For time exposures, an approximate method of judging time is to count "one thousand" for every second, such as, "One-thousand one, one-thousand two, one-thousand three, etc."

A reasonably accurate portrait lens may be made for the box camera from a cheap magnifying glass. They can be purchased for 20 or 25 cents in the five-and-ten. Fasten the glass in front of the lens on the camera with rubber binders and open the shutter on "time." With the back of the box removed, place a piece of ground glass in the position the film normally occupies. (A sheet of thin bond paper will do if you can't get the ground glass.) Set up a clear incandescent light bulb and move the camera back and forth until you obtain a clear image of the filament on your screen. Measure the distance from bulb to lens carefully and write it on the bottom of the box where you will always have it when you want it. It is the proper distance from subject to camera. No increase in time is necessary to use this device. If you have an old camera that you don't use any more, you can use a little trick to take the "soft-focus" pictures that are usually obtained with a diffusing screen: cut the diaphram out so that all of the lens is exposed; this will increase the speed of the lens slightly and will make your pictures look soft and fuzzy—an effect desirable in some types of photographs.

When you want to take pictures of moving objects, don't take them moving directly across your field of view. They will be sure to blur. Get in such a position that you can have the moving object coming toward you or going away from you so that the amount of angular change is small. This will result in a clear picture.

Photographs may be made at night with the use of photoflood bulbs but they can never be snapshots with the box camera. Set the camera on "time" and then open and close the shutter as rapidly as you can without moving the camera, this will give an exposure of approximately a second and the latitude of the film should take care of any mistakes you might make in timing.

"Moonlight" Pictures

There are two kinds of "moonlight" pictures, one of which, strange to say, is taken in the daytime. This kind is much easier to take than those actually shot at night. The third photo was taken just at sunset with a fast shutter speed and a relatively small lens opening. In this manner the film is underexposed just as though the picture were made at night.

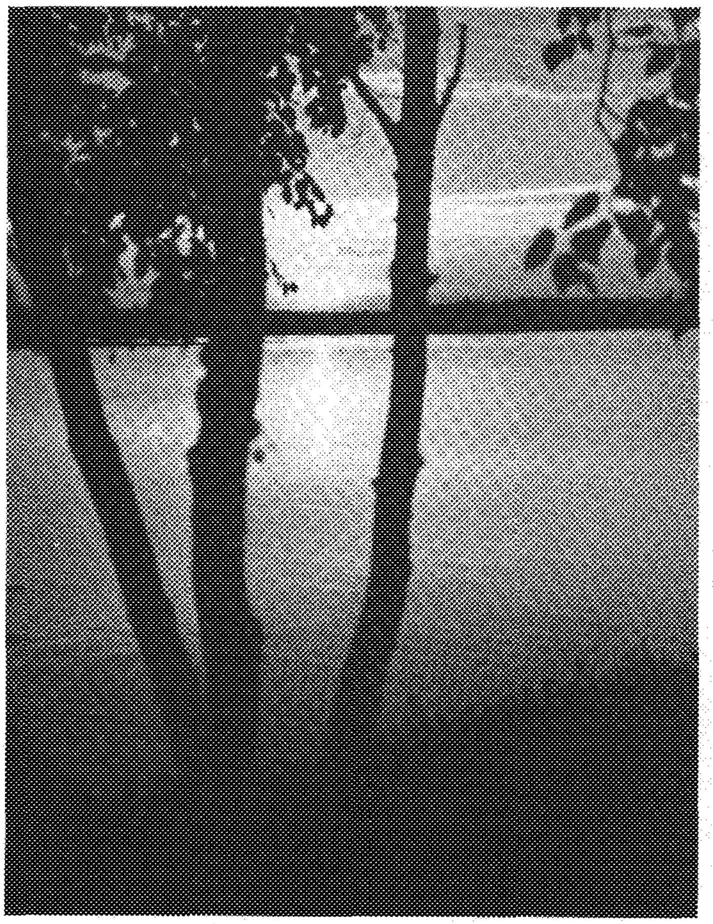
There is still another method open to the advanced amateur in the use of infra-red film. This film uses the red end of the spectrum and a good picture can be made by using the "light" from a pair of electric flat-irons. The heat rays furnish enough infra-red rays to make the picture, even though to the eye the room is in total darkness.

In making moonlight pictures where the picture of the moon is to be included, if the exposure is made long enough to allow the landscape to be photographed properly the moon will not show up as a disk but as an elongated "banana." For this reason it is best to compose the picture in such a manner that the moon will pass behind a tree or some other shade for the lens. Expose the picture for 2 to 5 seconds to get the picture of the moon, close the shutter until the moon has become obscured, and then expose for the rest of the picture the usual 20 to 50 minutes.

Films and Filters

The two general types of film in common use today are the orthochromatic and the panchromatic. Orthochromatic film has limited sensitively to some of the colors in the spectrum but is not affected to same degree as is the eye. The sensitivity of ordinary film lies in the violet, blue, and blue-green sections of the spectrum, with almost no sensitivity to the yellow, orange, and red. The orthochromatic film has a sensitivity range that runs from the ultra-violet to the orange but has almost none to the red. Panchromatic films are sensitive to the entire visible spectrum but not in the same degree as the sensitivity of the eye. To the eye, the yellow-green part of the spectrum seems the brightest while the light that affects the photographic emulsion to the greatest extent is the violet. To obtain a color rendition similar to that of the eye it is necessary to use a filter. These are usually screens of thin gelatin dyed the proper color and placed between glass disks.

There are correction filters and selection filters. The correction filters balance the color-sensitivity of the negative to that of the eye while selection or contrast filters specifically separate or select certain colors which the photographer wishes to emphasize. An effective use of the selection filter is in the photographing of distant views and landscapes. The haze that is almost always present in landscape scenes makes a fuzzy, blurred picture with poor definition. This is because the haze scatters the blue light and in so doing tends to blur the picture. The haze does not scatter the light of longer wave lengths nearly so badly and, consequently, the green and the red light are not diffused. Therefore, if a yellow filter is placed over the lens, the picture is made by green and red light and distant detail shows up clearly. Of course, some knowledge of the range of color-sensitivity of the film is necessary before a filter can be used, since it is readily seen that a red filter would be useless on orthochromatic film since that film is insensitive to the red transmitted by the filter.



BERTIL LINDQUIST

Trees in Moonlight. *f.32 1/50 second, taken at sunset, orthochromatic film.* **This shows that the moon is really not essential for "moonlight" pictures.**

Because ultra-violet, which is invisible to the eye, affects photographic emulsions to a marked degree, the use of a yellow correction filter to reduce the intensity of the blue light gives a picture of balanced color-values approaching the sensitivity of the eye.

As most filters absorb the active rays of light it is necessary to increase the time of exposure when they are used. This amount of increase is termed the factor of the filter. Since artificial light has less ultra-violet in it than does daylight, a different filter factor must be used for artificial light.

The effects of contrast filters are as follows:

A yellow filter absorbs blue light.

A red filter absorbs blue and green light.

A green filter absorbs blue and red light.

A dark blue filter absorbs green and red light.

A working knowledge of the practical aspects of photography would be an asset to any engineer. Technical photography is still in its infancy, but more applications of it are discovered every day. It is difficult to conceive of a business or profession in which some phase of photography could not be used advantageously.

The Minnesota Techno-Log

JANUARY, 1938

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Technological Unemployment

WHO is responsible for the economic ills of the day? Economists, politicians, and others in search of a suitable "goat" have convinced many people that the machine is guilty. This has been easy to do because there is a lack of conclusive data on the subject. Furthermore, we engineers, the sponsors of the machine, are not as a group active in public debate, being, as we are, more given to producing results than to bandying words.

History shows that economic maladjustment is not peculiar to the Machine Age. Technology affects the social economy through the invention of labor saving devices and through the creation of new industries. It is interesting to note here that the installation of labor saving machinery does not necessarily throw men out of work. The net result of Technology over the 100-year period preceding 1930, according to the U. S. Census, has been a 13 per cent increase in the gainful employment of the population. There is, however, some unemployment that can be distinctly laid to scientific progress.

The solution to this ill does not lie in such short-sighted plans as moratoriums on invention and research or schemes involving further government meddling in business. While it might be feasible, even desirable, to have a five or ten year moratorium on the fruitless bickering and wild-eyed experimenting of the social "scientists," natural science cannot be thus curbed. Nor would it be desirable to do so, for it is the workers in the most progressive industries who are least affected by technological unemployment. Unemployment has most seriously affected workers in technologically stagnant industries. Furthermore, there are large numbers of workers who have been thrown out of work by the shifting of industries from one country to another or by the death of unprogressive companies and industries. These men can only be re-employed by the growth of new industries; these new industries can only come from the development of new methods resulting from research. The futility of attempting to regulate scientific progress or industrial efficiency, in a democracy, by government edict should be obvious to anyone giving the matter practical consideration.

So, you see, the engineer is not entirely responsible for our economic troubles, nor would curbing his activities allay them. It is up to you to do your part in correcting these prevalent fallacies.

WHY & HOW

We begin the new year with a series of brief discussions on the "TECHNO-LOG behind the scenes"—the whys and hows of publication. This column we devote to the whys.

What is the objective of a student-operated publication such as the TECHNO-LOG? What service does it perform? Is its presence in extra-curricular activities justified by the service it renders?

The primary objective of the TECHNO-LOG is to present news of educational, professional, and occupational value to all students in the Institute. For that reason strictly technical discussions are avoided. We feel that professional publications in the various fields are better fitted to take care of that side of engineering development. These pages also provide the best medium for reporting news of student engineering activities and for giving recognition to deserving engineering organizations and individuals.

The publication of a technical magazine offers opportunities for experience in technical writing, technical journalism, business practice, and management. Much of the experience gained from working on the staff is a valuable asset when seeking a job—sometimes as valuable as the scholastic accomplishment. It is unquestionably agreed that extra-curricular activities broaden a man's outlook and better prepare him for living and working in a complex society. There is no better extra-curricular activity than the TECHNO-LOG.

In addition to these two main services the TECHNO-LOG provides a means of contacting alumni. Many alumni are still interested in student activities. Lastly, the advertisements in the magazine give students an idea of the work of various engineering and industrial organizations. The advertisers, themselves, have an opportunity to acquaint students and alumni with their business and to foster good will among these potential future buyers of their products.

The value of any magazine is measured by the service it performs for its readers. We feel that the services discussed here establish the value of the TECHNO-LOG and justify its presence among the engineering activities on the campus.

NOW HERE'S A BOOK

By C. I. Haga, Instructor in English

LAST month when I so enthusiastically recommended Gray's *The Advancing Front of Science,* I said that there were many other books useful to the technology student interested in organizing his knowledge of the relations between his work and society, and, ultimately, the culture of his times. One of them is the book I want to tell you about this month, *Technological Trends and National Policy.* It is a report presented by a sub-committee on technology to the National Resources Committee. The National Resources Committee is composed of cabinet members and of scientists. The subcommittee responsible for this report is headed by Professor Ogburn of the University of Chicago; he organized the project and farmed out the various divisions of the task to a score of competent authorities in the federal service, in universities, and in industry. These details of responsibility for the report are worth noting; they make it possible for us to expect a well-rounded, many-sided analysis of the problem.

A further indication of the completeness of the analysis is given by an outline showing the manner in which the task was organized. The report is in three parts. Part One, "Social Aspects of Technology," is treated from five points of view: National Policy and Technology, The Prediction of Inventions, Social Effects of Inventions, Resistances to the Adoption of Inventions, and Unemployment and Increasing Productivity. Part Two, "Science and Technology," is very brief and has two perfunctorily-developed sections: The Relation of Science to Technological Trends, and The Interdependence of Science and Technology. Part Three fills out over three-fourths of the report in nine sections: Agriculture, The Mineral Industries, Transportation, Communication, Power, The Chemical Industries, The Electrical Goods Industries, Metallurgy, and The Construction Industries. The assumption is that representative inventions in these industries indicate the technological trends for the next 20 years and, consequently, can be made the basis of social prediction and planning. As Dr. Ogburn says in his introductory article, "A study of invention offers a very good clue to future social conditions and problems of a nation. . . . The usefulness of scientific discovery as a guide for national policy is also strengthened because of (a) the great variety of inventions and (b) the number of points of contact between a modern government and the affairs of its citizens." *Facts for a Plan* may be called the purpose of this report.

In a report presenting the joint effort of a score of authorities, it is natural that some sections will be more interesting or more profitable than others because of the novelty or authority with which they are developed. The sections I found most interesting were these six: The Prediction of Inventions, Social Effects of Inventions, Resistances to the Adoption of Inventions, Transportation, The Chemical Industries, and Metallurgy. Only the first two of these are likely to seem novel in their development; the others impress us chiefly because of the inherent interest of their subjects. I might add, with a schoolmarmish snigger, that all of them, even the good ones, could be improved merely by meeting the elementary requirements of good writing demanded of a passing freshman theme.

The two which I found particularly interesting are both by S. C. Gilfillan, and I am sure that they will also attract those readers who are acquainted with his little book in the Engineering Library, *The Sociology of Invention.* The first section, The Prediction of Invention, summarizes Gilfillan's earlier analysis of the What, When, Why, and Who of invention, and seeks to predict where the lightning of innovation will next strike. The second, The Social Effects of Invention, gives a brief review of the obvious and direct forces, as well as the more amazing ultimate effects, profoundly influencing social institutions.

B. J. Stern's Resistances to the Adoption of Inventions makes interesting reading because of the astonishing ridiculous anecdotes he relates from the history of invention. When railroads were proposed in Germany a century ago, "experts" demonstrated that a speed of 15 miles per hour was impossible: ". . . blood would spurt from the travelers' noses, mouths, and ears, and also passengers would suffocate going through tunnels." But the mistakes of the experts, Stern finds, are smaller obstacles in the way of invention than the stubborn resistance of the industrial leaders and bankers, many of whom echo the words of one financier, "I don't know how to define invention. All I know is that it ruins my investments." When dividends and future profits are at stake, there is no point in encouraging these inventions which "enter the world like newborn babies. Their power to change the modes of life and the thoughts of men does not appear until they are grown up."

Of the sections in Part Three, I consider Transportation, the Chemical Industries, and Metallurgy the most informative and satisfactory. The section on Agriculture has much good material, but is in parts so badly-written that I cannot do more than publicly regret the ruin of useful information by slovenly writing. Transportation, and Metallurgy have the most animated style of any sections in the whole report and are full of useful material presented with a cheerful and disarming bias. The section on Chemical Industries is, in my opinion, the best in the report. That impression is especially gratifying since one of Dr. Ogburn's conclusions is the prediction that chemistry will be one of the chief sources of future social change.

About all I can do in telling you of this report is to name the titles of the separate articles and, with a murmured apology, hope that this crude enumeration will in itself invite you to read the book, just as a menu will encourage a hungry man. As a continuation of the earlier report edited by Dr. Ogburn, *Recent Social Trends, Technological Trends and National Policy* is worth reading. As an example of popular technical writing, the report is in some sections atrocious; in fact, there is scarcely a page which could not have been improved by the use of an editor's blue pencil. Read it, therefore, with your fingers crossed.

ARCHITECTURALLY SPEAKING

Best Works in Design Honored by Faculty

A FIRM transition between the more traditional and the newer methods of teaching architectural design is shown vividly by the traveling exhibit now on display in the third floor corridor of the main Engineering building.

This traveling exhibition, showing first year's work in design, is sponsored by the Association of Collegiate Schools of Architecture. From the University of Minnesota it will be sent to various other schools belonging to the Association.

As a graphic representation showing the various types of work from Association schools it is of special interest, for it illustrates the many and diverse ways of teaching architecture. Many of the schools cling to the classic tradition with time and effort spent on the orders, the design, the details, and the preparation of the composition. Other schools have a much different conception of the best approach to architectural design. They often study with models in a three dimensional treatment. Integrated planning, considering the building in relation to its site and the city plan as a whole, are studied.

By merely reading the written programs of the schools one becomes aware of the vast difference in study methods. One school attempts to "develop a technical expression, using the classic idiom"; while another strives, at first, only to assist in the "ability to organize the whole, to progress from the general to the particular." Great stress is placed upon self-expression and the importance of the relation of each part to a greater whole. Another school uses "progressive exercises intended to familiarize students with units, composition, drafting facilities, proportions, the orders, and rendering."

It is interesting to note, too, the ways of acquainting a student with actual architectural practices. The Massachusetts Institute, for example, instead of doing a mere paper architecture, has its students direct the construction of a house. This house is later sold, and the next year a similar problem is handled. Other schools send their students out on field trips to study building in actual construction.

The general trend in all the schools seems directed toward a more rational study of architecture. There appears a striving for an honest structural expression in the problems considered, and a thorough integration of design with its surrounding elements.

Society Makes Extensive Plans for Winter Quarter

The Architectural society under the leadership of John Wenzel, president, is already planning an extensive program for the winter quarter. Last quarter, in addition to organizing a membership drive, it sponsored the Beaux Arts Ball, usually held during spring quarter.

A luncheon was held for Lewis Mumford, noted author and lecturer, who spoke at convention on January 13 on "Architecture Today."

During winter quarter also, all first-mention problems will be assembled and photographed. These photographs will be compiled in book form and will be on file in the Architectural library for student use.

Exhibit Displays Methods of Teaching Architecture

Among the best works done in architectural design during the fall quarter were the three undergraduate theses submitted by John Magney, John Voosen, and Robert P. Pierce. These theses, done entirely by the students with their own selections of the subjects to be studied, represent the culmination of a five-year course in Architecture. In each case at least one quarter was spent on the project.

The student first decided on the problem he wished to develop, then submitted his written program for the consideration and approval of the faculty jury board. During the development of the problem, an extensive study was made of the various elements of plans, sections, elevations, and construction. Later a model of the project was constructed.

John Magney's "Water Sports Center" was planned for a site in Duluth, Minnesota, supposedly owned and controlled by the Department of Parks and Playgrounds. With a growing interest in all sports, and a need for more extensive water sports facilities, this project is very timely. It was designed with pools and locker space for those who wish instruction in and relaxation through swimming. Space for boat dockage was also provided. There was also an adequate yacht harbor for small lake craft. Dining and lounge areas were provided for the general public and exclusive rooms for private parties.

"A General Hospital," submitted by John Voosen, was planned for a middle-western city of about 300,000 population. Under the direction of a Catholic order, it was not restricted in any manner. The hospital was to have space provided for 100 beds, with consideration given to medicinal, obstetrical, and surgical units. A dining room, a small, modern chapel, and ample administrative offices were included. John made an intensive study of the plot plan.

Robert Pierce chose as his subject, "A Beach Club." This beach club was designed to provide comfortable ocean bathing facilities for an athletic club in Southern California. The club membership was to be composed of about five hundred wealthy, retired Easterners and well-to-do business and professional men. Space was provided for ocean bathing, fresh water bathing, casual sports, dining, dancing, and lounging.

These theses, in the opinion of the jury, were among the finest ever submitted by undergraduate students. They showed fine understanding of the subject matter and a thorough development throughout.

PICK AND PAN

By M. A. Troxell, M. '39, and H. A. Larson, M. '39

We think it very fitting that the representation of the Miners at the Slide Rule Frolic far exceeded the percentage of Miners in the Institute. We Miners like to feel that we are more active than our numbers indicate.

News Note: Swig-time music was very popular on New Year's Eve.

Undeniably, the rip-snortin' top-notcher in the social calendar is the Miners' Shindig. All the jolly Miners will be there with their best picks, pans, and girl friends. The Engineers are cordially invited, if they promise not to appropriate the gold nuggets profusely adorning the ball room. The decorations will uniquely portray the twentieth anniversary of the Shindig in a good old mining way, while the admission certificates will consist of gold or aluminum foil.

Heard in St. Paul: "Wouldn't it be grand if Summit were over a block?"

Memories of the Slide Rule Frolic: "I don't mind your dancing on my feet; it's the continual jumping on and off that bothers me."

Here's one for the records: A Prof remarked the other day, "I shall now illustrate what I have on my mind, . . ." and then he erased the blackboard. The best part was the missing of implications by the class.

Wonder how many of you know just what The Technical Commission, The Bookstore Board, and The Techno-Log Board are for and what they do?

The paint-like iron ore of the Mesabi Range seems to have a definite affinity for the people's clothes. In Ore Dressing, Professor Searles was lamenting the general uncleanliness of the range concentrating plants, but had only praise for the one at Nashwauk. Quoth he, "It's a nice clean place—it's the only plant on the range where you can go in with your clothes on and come out the same way." And then we laughed.

"What's the scar on your forehead?"
"Oh, that's a birthmark."
"It looks like a wound."
"Well, I got into the wrong berth."

Have you ever run a gun in the winter over a traverse seeking to cross section undetermined country? It's an experience that we warn you not to try. The transit man barehanded stands at the gun in 40 below weather, cursing and reviling all who are able to move. Your feet freeze, your nose freezes, you build a fire to try to keep warm, which doesn't do a damn bit of good. And those lines need to be re-run in the summer for more accurate work since there is at least six feet of snow on the ground. Then the mosquitos eat the hide off of you, the four or five foot stumps from the previous year need to be rechopped for a line, and the rodman wades hip deep in the mud and slime of the Northern Minnesota swamps for location of old test pits, diamond drill holes, and anything else that looks good enough to put on an exploration map. Such is the life of a mining engineer or a civil who dares to take up the noble profession for the sake of advancement. Just the same, we will endeavor to fill the shoes of those who have gone before, and swear, bull, and enjoy our life to the utmost.

Library sign: "Only low talk permitted here."

George Piercy was laboriously trying to grind a flat surface on his metal specimen in metallography lab preparatory to polishing and etching for microscopic examination. A faculty member chanced by and, observing George's plight, took his specimen to show him the correct technique. During his demonstration he told the story of the fellow who was there for a year and a half and never could obtain a flat surface. "He's now a broker in St. Louis," he concluded. "Yup," someone murmured, "crooked to the end."

The penalty fee system around here works about the same as getting a traffic tag in our courts. They make life so complicated and miserable for you that—even though you may be pure as the driven snow, and just as innocent—you'd rather pay the fine and shut up than go through all the grief connected with getting it waived or removed.

The month's jewel:

"Mary had a little swing,
It wasn't hard to find;
And everywhere that Mary went,
The swing was just behind."

MAGAZINE REVIEWS

By C. Vernon Olson, E.E. '39

WHICH WILL YOU BELIEVE?

Shall we, as optimistic young engineers, be disillusioned with respect to future opportunities and remuneration?

In the booklet, **"Engineering—A Career—A Culture,"** prepared by the Educational Research Committee, we read, with a gleam in our eyes, that thirty years after graduation 75 per cent of the engineers earn more than $4,500, 50 per cent, more than $7,000, and 25 per cent, more than $14,000.

A comparison with the recent survey of the U. S. Bureau of Labor Statistics entitled **"Annual Income in the Engineering Profession, 1929 to 1934"** reveals some startling differences. The government report shows the earnings after thirty years to be $3,600 for 75 per cent, $5,200 for 50 per cent, and $7,600 for 25 per cent.

Election of an engineering career should be made on the basis of an inherent liking for engineering work rather than an anticipation of high monetary returns.

"Earnings of Engineers," by D. B. Steinman, from **American Engineer**, December, 1937, p. 7.

UNFAIR TAXES?

The December issues of the technical magazines published by McGraw-Hill contain two pages of suggestions for United States tax reform on three counts.

"First—Repeal the undistributed earnings tax." It is believed to obstruct recovery by holding back normal industrial improvements.

"Second—Repeal or amend capital gains tax." Sound investment practice is held to be discouraged by this levy which taxes an investor when he profits from the sale of securities at rising prices, while he must stand all losses when prices go down.

"Third—Reduce the excessive personal surtaxes." This tax, designed to "soak the rich" by taking 75 per cent of the rich man's income, may defeat its purpose because of the tendency toward investment in tax-exempt government securities, and the removal of capital from private enterprise. No mention was made of the possibility of a solution by making government securities taxable.

Obviously the rich should stand taxes according to their ability to pay. The difficulty, as your reviewer sees it, is in designing a tax structure which, while "soaking the rich," does not do us all more harm than good by hindering business.

"Congress Needs Your Guidance," by James A. McGraw, December, 1937.

WHITHER TELEVISION?

Are you wondering when television will turn the proverbial corner around which it has been lurking for several years? Though many have guessed, no one knows just when the tremendous technical and economic problems will be overcome. The public is exacting; they will not accept with enthusiasm a gadget which is not thoroughly practical. When it finally does come, though, we can expect it to be a very worthy addition to our present entertainment media.

"Television," by Clarence W. Farrier, from the *Armour Engineer and Alumnus*, December, 1937, p. 12.

TECH NEWS

E.C.M.A. Elects Prof. Richardson Vice-Chairman

Word was received early this quarter that Prof. Richardson of the engineering English staff has been elected western vice-chairman of Engineering College Magazines Associated. Prof. Richardson was nominated at the E.C.M.A. convention in Minneapolis last fall, but because not all E.C.M.A. colleges were present at the convention, the balloting was carried out by mail. Tom Rogers, eastern vice-chairman, is also a graduate of the University of Minnesota.

Aero Ball Date Set

The annual Aeronautical Ball, sponsored jointly by the I.Ae.S. and the Flying Club, will be held February 21 in the Minnesota Union.

Major Lester D. Gardner, National Secretary of the Institute of the Aeronautical Sciences, has ordered from the Minnesota branch 300 meeting cards used to notify students of meeting dates. These cards are to be distributed to all other branches of the Institute throughout the United States. Credit will be given the Minnesota branch for the original design.

A small lapel emblem is now available to members of the I. Ae. S. The design of this emblem features a perfectly streamlined form with the air-flow pattern around it and is executed in white and chromium.

Heads of Chem Ball Announced

Committees have been appointed for the annual School of Chemistry Ball, which will be held in the Plaza Hotel on Friday, January 28. General arrangements are in charge of Howard Turner and Charles Berger. J. M. Tuomy is ticket chairman and C. W. Moll is publicity chairman. Bob Owen's orchestra will play.

Football pictures of the Golden Gophers' 1937 season will be featured at the A. I. Ch. E. meeting January 18. Subjects to be discussed are the key awards made later in the year and prospective trips to industrial plants.

A.I.E.E. Announces Prize Competition

This year student members of the A.I.E.E. will have three chances to present papers and to compete for prizes offered for the best papers. The Minnesota section, the Great Lakes District, and the National Organization of the A.I.E.E. are each offering prizes for undergraduate and graduate student papers on subjects pertaining to electrical engineering.

According to Professor Kuhlman, the papers submitted to the Minnesota section must be sent in before the first week in April. A committee will select the four best papers and have the students present these at a meeting of the section. The members of the Institute will vote for the best paper and award prizes of $15, $10, and $5 for the papers.

District and national prizes aggregate $125.

Miners to Dance on February 19

Ray Sundquist and Jack Becker are co-chairmen of the Mines Society dance which is scheduled for February 19. The dance will be held at the Commodore Hotel in St. Paul, for the first time off the campus since its beginning 20 years ago. The dance is open to everyone, and approximately 125 couples are expected.

Burton's Book of Etchings Released

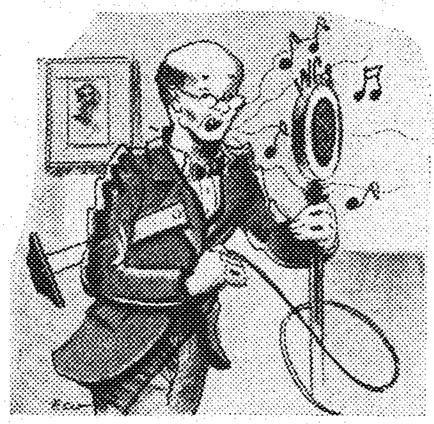
The University of Minnesota Press has announced the release of *Spain Poised: An Etcher's Record* by S. Chatwood Burton, professor of fine arts. Professor Burton visited Spain during his sabbatical leave, 1922-1923, and made a number of etchings of cities, towns, and castles. Many of these scenes, now shattered by the revolution, are reproduced in his book. The original etchings are in the New York Metropolitan Museum, the Chicago Art Institute, and the Minneapolis Art Institute.

Dr. Rogers Added to Chem. E. Staff

Dr. Marvin C. Rogers came to Minnesota January 1 to become an assistant professor of chemical engineering. He was graduated from the University of Minnesota in 1926 and three years later received his Ph.D. from the University of Michigan. He has acted as teaching assistant at Michigan and has taught a course in petroleum refining at Armour Institute. Before coming to Minnesota, Dr. Rogers was a research engineer with the Standard Oil Co.

Glee Club Looks for Jobs, Singers

The Tech Glee Club, under the direction of Bob Heath, senior in the School of Music, is looking for a chance to try out its collective voice. According to Richard Wagner, chairman of the Glee Club, the organization is open to all technology students (except girls—they do have a girl accompanist) and can ac-



commodate any number of singers. Prof. Zelner is the faculty adviser for the Glee Club. Some of the appearances in the past have been with radio stations KSTP and WLB, the Engineers Club, the Y.M.C.A., and other campus organizations.

The department of chemistry is installing hoods along the wall in 310, qualitative analysis lab., and in 317, graduate research lab.

ALUMNOTES

By John Murray, E.E. '38

'24

C. M. Stoner, C.E., of Oak Park, Illinois, is in charge of the engineering division of the Association of Manufacturers of Chilled Car Wheels. Mr. Stoner is director of research and of promotion and consultation work for the Association.

'30

"Moon" Mullins, Arch. E., is with the St. Paul district office of the Army Engineers. "Moon" is married and proud of his two little "Moons."

Don R. Bayers, E.E., is living in Minneapolis and is working for the Minneapolis Gas and Light Co. Don, unmarried as yet, is interested in promoting an alumni meeting of the engineering graduates.

In the lighting division of the Northern States Power Company is **Joseph Skovholt,** E.E., who was married to Miss Elvera Meyer last September 11, in Mankato.

'36

From Marshall, Minnesota comes a report from **John P. Goettl,** C.E., who is in the department of soils of the state highway department. John is working under **E. B. Enns,** C.E., '35.

'37

With the Crane Company in Chicago is **Paul Thomas,** C.E., who lives at 5132 Blackstone. Paul, who is doing industrial sales work, finds Chicago a swell town but a little expensive.

A recent visitor was **Bob Teeter,** last year's Techno-Log editor. Bob is with the Aluminum Company of America, in the patent division.

Virgil Frank, Mines, has returned to teach junior mining and mine mapping in the School of Mines. Virgil has been working for the Anaconda Copper Company.

Don Kugler, Petroleum Engineering, has left the Shell Oil Company of Texas to teach petroleum engineering in the Mines School. Don was married in Minneapolis on December 31 to Miss Elizabeth Conklin.

Tom Klingel is working for the Soo Line Railroad.

Dick Appert is with Kimberley Clark Paper Company in Neenah, Wisconsin.

LINDQUISITION

By Bertil H. T. Lindquist, Aero. E. '38

This is about the time of the year the graduating seniors acquire that harassed look and begin circulating the panicky rumors that "There ain't gonna be no jobs this year—things are awful tight."

I had a chance to hop an old Standard a while back. The thing fluttered up off the ground in great shape and behaved beautifully—until I thought I'd sort of like to turn and go back. I kicked the rudder gently, and not a thing happened. I shoved some more—and still nothing happened. Considerably irked, I jammed the rudder against the stop, and then she came around smoothly and easily. After she straightened out, I took a timorous look back and was surprised to see the rudder control cables hanging slackly and flapping in the breeze. They were connected all right, but there was an awful lot of slack in the system.

After a bumpy landing I climbed out and asked the farmer kid who owned the crate why in the devil he didn't tighten up the rudder cable. The fellow answered scornfully, "They're s'posed to be that way—the guy I got teaching me how to fly says I over-control on the rudder and skid all over the sky. He loosed up those wire ropes and now I fly swell!"

The design requirements for aircraft have all been revised in the last few weeks by the tin gods that control that sort of stuff in Washington. They put out a book telling all about it and then followed it the next week with a book of corrections and revisions that was almost as big as the original "bible." . . . And now the braintrusters over in the Aero department are in a dither working their heads to the bone in a desperate effort to untangle this aeronautical mystery sufficiently to make it understandable by the overworked Aero Seniors.

If our Technology secretaries are as efficient as they are good-looking—Boy! what an office force!

Those of you who read the article on photography are probably wondering why that picture of Administration Building and Pillsbury Hall out here on Church street looks so familiar but still doesn't seem to fit in with the general scheme of things. Here's a tip: (if you haven't already found it)—hold the page up to the light and look at it from the opposite side. You'll recognize it immediately now—I printed the thing backwards and screwed it up for you.

Jimmy Dorsey, the swingmeister, was born with a cornet in his mouth but found that it was too cold on his lips so he switched to a clarinet because it had a lower conductivity constant.

My pal Albert J. Hendry, brilliant Electrical, asserts that there is no more poignant feeling of frustration than the discovery that the gal you've been stringing has been stringing you.

We wish that some of the hired help around this place—a couple of assistants and such—would realize that this here University was originally put up for the students—in spite of all the present evidence to the contrary.

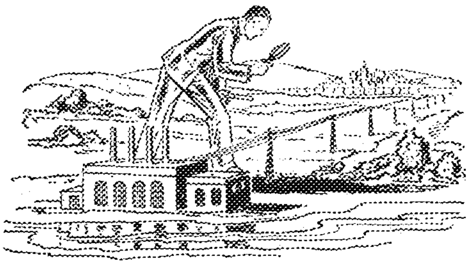
Wonder how Evy (Prof. "Puzzle-Wizard" Brooke's former secretary) likes Savvannahh, Ga.?

Rog Verran, the *Daily* sprinter and writer, often forgets the telephone number of his office at the *Daily* and has to call his pal Waleen here at the TECHNO-LOG to find out what it is. . . . I wonder if Rog became a sprinter as a result of his being a writer, or vice versa? We have found that carrying around a load of beef of approximately 200 lbs. saves a lot of running—in fact, it makes running damn near impossible.

G-E Campus News

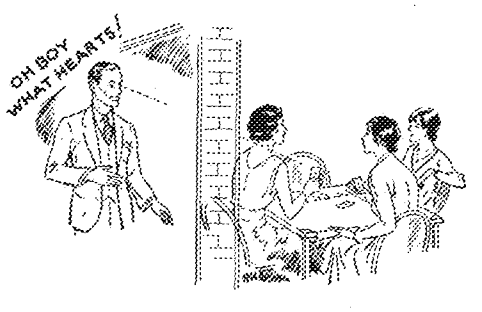
NETWORK ANALYZER

WITH the aim of aiding public utilities in laying out power systems, R. N. Slinger, Oregon State '26, R. G. Lorraine, U. of Colorado '27, and H. P. Kuehni, Eidgen Technische Hochschule '20, Zurich, Switzerland, Union '29, spent more than a year in designing and constructing an alternating-current network analyzer. The apparatus is so arranged that any distribution circuit in the country may be simulated merely by plugging various impedance units and power sources from the plugging cabinets



and reading the results on the master instrument panel.

The a-c analyzer, a miniature power system, provides General Electric engineers with an advanced tool for system analysis and is made available to utility operating companies for their individual problems. Speed and accuracy of calculations are the two main advantages of the analyzer, and any experienced operator can, in two or three days, solve network problems which would take months to work out using other methods.

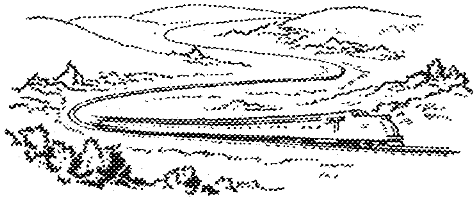


LOOKING THROUGH A BRICK WALL

LOOKING through a brick wall would not be a practical use for the G-E industrial x-ray machine, but it would be less difficult than the tasks to which it is put every day. Developed for use in factories where expensive castings and machined parts must be inspected, the x-ray permits inspection for flaws in castings and welds without damage to the article under observation.

The industrial x-ray machine is, in reality, an enlargement of the familiar machine used by doctors and dentists. Mounted on a dolly, or suspended from a hand crane, the machine is easily transported from one job to another and can be quickly set up for the inspection, saving time and money and assuring the customer of a perfect casting or welded seam.

Developments such as this are being made by college graduates who were at one time "on Test." Many of them have been off the college campus but a few years and are entering a career in one of the many engineering and business fields in the General Electric Company.



RUBBER RAILROAD RAILS

NO, the railroad companies have not started to use rubber rails, but the new welded steel rails that are a mile in length have many of the characteristics which rubber rails probably would have. Developed after research and experimental work by the Delaware and Hudson Railroad, Sperry Products Company, and General Electric Company, the welding which makes possible these mile-long rails introduces flash butt welding of the preheated ends of regular-length rails to form one long continuous rail.

When these rails are loaded on flatcars, they bend easily around the sharpest curves as they are carried to the spot where they are to be laid. In addition to their flexibility, the rails are remarkably quiet. No longer will there be the continual bump and clatter of wheels over worn and gaping rail joints to disturb sleeping passengers. To reduce the noise even more, the rails are laid so that there will be no two parallel joints.

The flexibility and smoothness of the new rails reduce the wear and tear on the rolling stock, so that the initial expenditure for the rails will be compensated by the saving on maintenance.

GENERAL ELECTRIC

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i This Issue:

Cab Signals

Management

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Job Advice

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MINNESOTA TECHNO-LOG

THE 53RD ELEMENT

UNQUESTIONABLY, the most universally present item in the family medicine cabinet is the familiar bottle of Iodine.

Discovered in 1811 by Bernard Courtois, iodine was identified four years later by his compatriot, L. J. Gay-Lussac, as a basic element—the 48th element in point of discovery but now classified as the 53rd in atomic number. Incidentally, iodine ranks 28th in abundance. As a safeguard against infection, tincture of iodine has sterilized the cuts and abrasions of many generations.

Medical science has also taken full advantage of the unique properties of iodine in the form of salts such as iodide of potassium, sodium, ammonium, calcium and strontium. The use of these salts in the treatment of lead poisoning, asthma, syphilis, nephritis, bronchitis, arteriosclerosis and angina pectoris has demonstrated them to be of untold value. The benefits of iodized salt in preventing goitre development are familiar to everyone.

Iodide of potassium is used in photography and iodine finds further use in the manufacture of iodates, dyes, intermediates, and as a chemical reagent.

Some conception of the vast importance of iodine can be gained when one learns that American consumption approaches a million pounds annually.

Until 1928, we depended upon foreign sources for our iodine supply. Then, The Dow Chemical Company began the first production of domestic iodine on a commercial scale.

Intensive study of various processes for the recovery of iodine finally resulted in a totally new method, conceived and perfected by Dow technicians.

Today, Dow is producing a substantial share of all the elemental iodine used in this country—at a price equaling the lowest foreign competition. Thus, Dow has made available to leading pharmaceutical houses and industry a domestic source of elemental iodine, constituting an important step in our national progress.

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ERLING HELLAND, Managing Editor | WARREN WALEEN, Business Manager

Published Monthly from October to May

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This Month

Belated credit for last month's cover illustration, a view of the Minneapolis Gas Light company's plant, is due to Sigmund Jacobs. This month's cover picture was taken in the Midway grain elevator and linseed mill district by Francis Meisch.

Our first feature article this month was written by Albert J. Hendry, a senior in Electrical Engineering. Al has worked for four summers with the Milwaukee Road, so he really knows whereof he speaks. A member of A.I.E.E., he is now taking graduate work and doing research.

Leslie A. Anderson, writer of the fall prize-winning Tau Beta Pi essay, is a member of Chi Epsilon and A.S.C.E. This is his second contribution to the TECHNO-LOG, the first having been published last November.

Olive Foerster, Chem. '40, who describes the testing bureau for us this month, is a member of Pi Delta Nu sorority and plans to teach chemistry and mathematics when she graduates.

"Spain Poised," reviewed by Mr. Haga this month, is written by a member of our own faculty—Prof. S. Chatwood Burton, professor of fine arts and architecture. Prof. Burton went to Spain to look for hidden remnants of medieval civilizations, to find release from routine and schedule, and to find material never before etched.

Assistant professor James J. Ryan —"Jim" to the M.E.'s—who writes this month's employment article, was formerly editor of the Iowa *Transit*, now busies himself with machine design and photo-elasticity; summers he spends working in industrial plants in the Midwest.

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DEPARTMENTS

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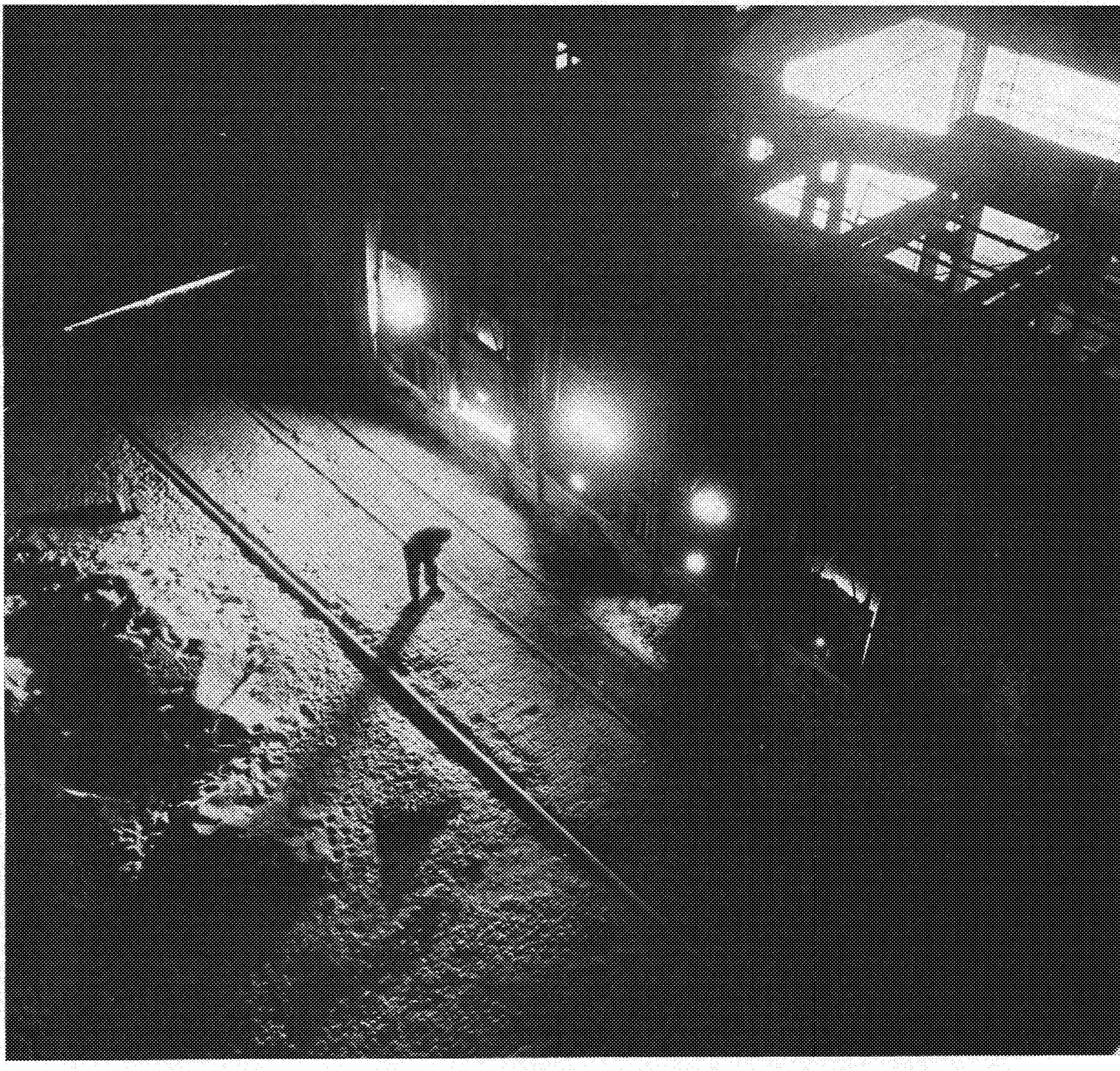


AMERICAN

White Heat

Train Control Through Visual Cab Signals

The introduction of streamlined trains and the innovation of faster service throughout all branches of the railroads has necessitated developments in the field of automatic train control. Visual Cab Signals, for greater safety and regulation of traffic, is one of the important results of these developments.

by Albert J. Hendry, E.E. '38

Photographs by Author

DURING the past 20 years many means of transportation have appeared which offered increasing competition to the railroad with respect to both speed and convenience. The demand for higher speeds received a further impetus from the fact that trains operated at higher speeds resulted in a greater efficiency and a very much lower capital investment in power. Disregarding all difficulties except an increase in speed, many roads were confronted with a situation which involved absolute danger if the average travel rate were increased. The advent of what was known as "Automatic Train Control" eliminated a very large portion of this danger.

The first types of control provided a constant interlocking system between the wayside semaphore signal and the train brakes since electrical equipment on the engine was inductively actuated by currents flowing in the rails. Visual signal lights in the cab of the locomotive were also a part of these systems. While this type of train control did afford excellent protection against such hazards as open switches, broken rails, or cars fouling the main line and while it made possible normal speed operation during low visibility conditions when the block signals were not distinguishable, it had one intolerable disadvantage. If for any reason such as a short circuit due to an excess moisture condition, the track currents were interrupted, any train entering the faulty block would be brought to a complete stop and minutes would be lost before the engineer could disconnect the train control equipment and again bring his train up to speed.

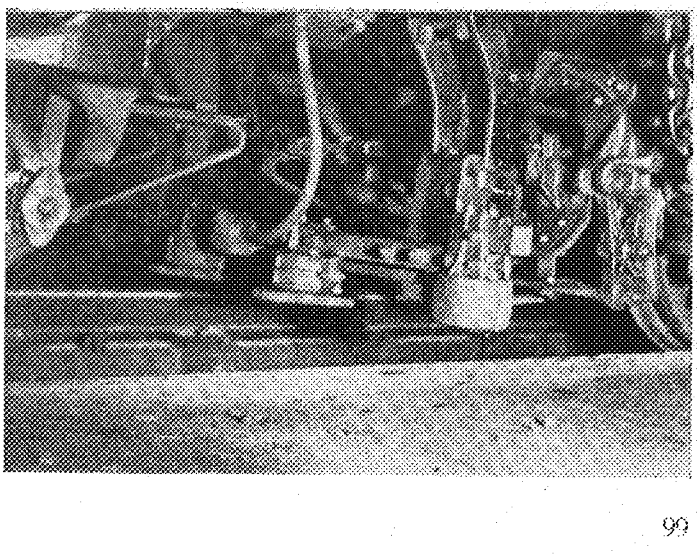
To insure the public safety, however, the Interstate Commerce Commission in 1922 ruled that all class A roads, i.e. roads capitalized at three million dollars or over, would equip at least one division with an acceptable form of automatic train control. This order was supplemented in 1924 with one which excluded some roads, included in the first order, that could show cause for exemption. Many of the roads voluntarily equipped more than one division after recognizing the economic merits of such operation.

In the processes of maintenance and development, automatic train control gradually resolved itself into the visual cab signal system of today. Here the engineer has complete control of the train on the main line and in addition has the advantage of uninterrupted knowledge of the track conditions in the block ahead. After all, the engineers possessing the most experience and ability are entrusted on the main line with thousands of dollars worth of equipment and paid fares; why should not their experienced judgment be utilized in the process of train control?

Over the heavily ballasted double track roadbed of the Chicago, Milwaukee, St. Paul, and Pacific railroad, from Minneapolis to Chicago, travel 12 first class and 10 second class trains daily. Several of these, at times, safely employ speeds in excess of 100 miles per hour. These trains are controlled by visual cab signals from Hastings, Minnesota, to Portage, Wisconsin, with the exception of 3.7 miles where the road crosses the Mississippi River at La Crosse, Wisconsin. This is a total of 212.5 miles of roadway—one of the longest installations in use.

The system is a continuous inductive, three indication type. This implies that the signal in the cab indicates the instantaneous condition of the track ahead of the train in both the occupied block and the next block by either a clear, caution, or stop signal. It was developed and installed by the Union Switch and Signal Company, manufacturers of railway signal equipment, and was first placed in operation in 1923. A great many changes have been

The loop receiver which is located near the rails in rear of the first trucks on the tender.



made since, and today total installation expenditures stand in excess of a half million dollars.

In general the apparatus involved in this visual cab signal system can be analyzed in three parts: The wayside circuits, the receivers, and the engine equipment. In addition there is some pneumatic equipment which may be considered as miscellaneous detail. The theory of the system is based on Lenz's law which states that if a coil encounters a changing magnetic field, a current will be induced in it. Thus the currents in the rails provide the changing magnetic field which by induction in the engine equipment through the receivers causes one of three signal lights in the cab to be illuminated.

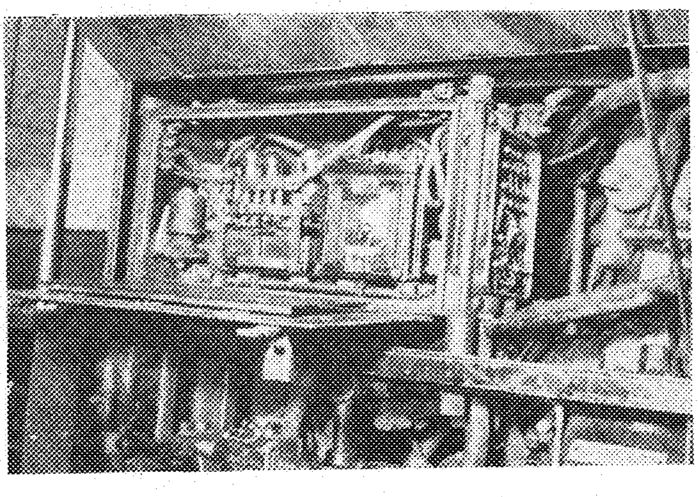
The Wayside Circuits

The current in the rails is supplied and controlled by the wayside circuits. Power is obtained from the railroad's 440 volt, 60 cycle pole line along the right-of-way and is transformed to about five volts. As will be seen later, two phase current is necessary to operate the main relay on the engine. This phase difference is produced by an iron-core coil whose inductive reactance is much greater than the resistance in its circuit. The phase angle is generally about 80 degrees.

The direct phase component of this current, termed the "track current," is fed into the rails in series, its circuit being completed through the axle of the first trucks on the locomotive. In addition to its function in the cab signal system, the direct phase current also operates the wayside block semaphore. The quadrature component, known as the "loop current," is fed into the rails in parallel and returns by a pole line along the right-of-way. It derives its name from the long loop circuit formed by the rails and transmission line along which it travels. Since the track current is at all times in the rails, it is quite natural to refer to it as such. The track current is adjusted to 2.5 amperes and the loop current to about 0.4 amperes, both being introduced at the distant end of each block.

Each block, or section of track, from one to five miles long, is electrically insulated from the neighboring blocks but is mechanically interlocked with them. Interlocking is accomplished by a double layer rotary switch attached to the mechanism of the semaphore and so connected that it can alter the phase relation of the currents in the preceding block by 180 degrees. This is simply done by reversing the connections of the loop current supply to the rails. Thus, when the semaphore is in the vertical or clear position, the currents in the block just in rear are changed by 180 degrees from their relation when the semaphore is in either the caution or stop position. Ultimately such changes cause the cab signal lights to conform to the block signal indications.

The engine equipment in its cabinet located under the right cab window.



The Receivers

The receivers are induction coils which provide the means of communication between the track circuits and the engine equipment. These coils are contained in weatherproof aluminum housings mounted on a five-foot laminated iron bar so that there are coils near each rail. The bar provides a low reluctance path for the flux to pass through the coils. There is both a "track" and a "loop" receiver.

The track receiver is mounted under the pilot and in front of the first wheels, about eight inches above the rails, the core being parallel to the axle. Its two coils are so connected that the track current induces currents in them that are additive while the loop current induction is entirely canceled.

The loop receiver is composed of four induction coils arranged in much the same way as the track receiver except that two coils are just outside of the rails and two are just inside. Its coils are connected so that the track current induction will exactly cancel; as a result the induction due to the loop current becomes cumulative. To further insure a minimum of interference from the track current this receiver is mounted under the tender as shown in the first illustration. On the streamlined Hiawatha the loop receiver is mounted just behind the front truck on the tender while on all other locomotives it is placed at the rear of the tender.

The Engine Equipment

The engine equipment is composed of two vacuum tube amplifiers, a magnetic vane relay, a slow-action relay, and the cab signal lights. These four pieces of apparatus complete the cab signal process from the receivers to the cab.

The voltage induced in the receivers is very low due to the large air gap and would be of no practical value unless it were greatly amplified. Consequently, a two-stage vacuum tube amplifier is associated with each receiver, the output power from which is sufficient to operate the two-phase engine relay. Plate voltage for the tubes is derived from the 32 volt headlight supply through a 350 volt dynamotor while the filaments are fed directly. The track receiver feeds a resistance coupled amplifier while the loop receiver is connected to an impedance coupled amplifier. Both amplifiers use a commercial type, triode vacuum tube very similar in appearance to an ordinary Type 45, commonly used in broadcast radio receivers. The track amplifier has a gain of 240 while the loop amplifier has a gain of over 700. Ultimately, the output voltage from each amplifier is the same since the initial loop induction is somewhat less than the track induction.

These amplifiers in turn energize the two-phase magnetic vane relay which is the selection mechanism for the entire system. Both amplifier units are assembled in one chassis, the theme of rigidity and compactness being strongly emphasized. Each amplifier has as its load one induction coil of the two-phase engine relay. These coils are tuned by parallel condensers in order that the greatest amount of energy may be absorbed by the relay.

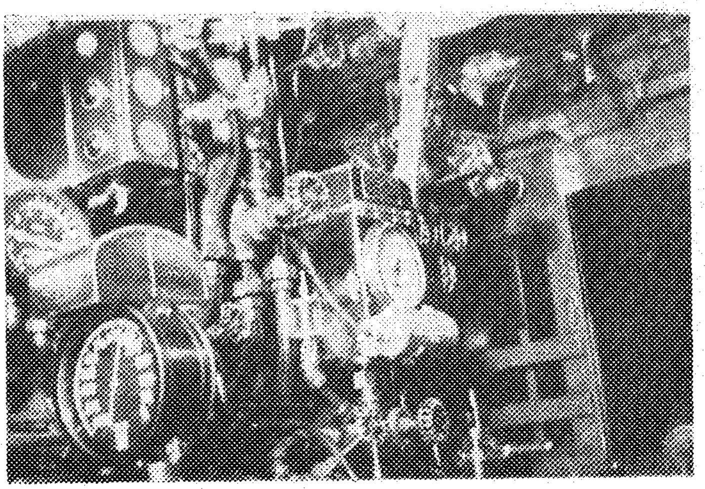
The main relay is a two-phase induction type having characteristics somewhat similar to an induction motor. The vane is an aluminum disc pivoted in a verticle position and counter-balanced so that when it is not energized it will automatically assume an intermediate position.

Since the phase relation of the currents in its coils determines the direction to which the relay deflects, this property is made use of in the signal system. More explicitly, from the previous discussion it was stated that when the clear track signal is in effect, the loop current lagged the track current by nearly 80 degrees; under this condition the relay is designed to deflect clockwise and in so doing close contacts which produce a clear signal in the cab. If restrictive track conditions exist, the loop current is in the reverse relation and the relay deflects in the opposite direction to produce the suitable caution signal. If the immediate block is occupied by a train in advance, the track current is shorted out through its axles and does not reach the following train. With this current absent the relay cannot deflect and in its intermediate position produces the stop signal.

Although the main relay does select the cab signal light, connections are not made directly to them but are made through a delayed time relay. This relay is the result of recent development and is a part of the equipment on the new freight engines placed in service in November. It is energized through auxiliary contacts on the main relay described above and in effect prolongs the time of action whenever the signals change. Fundamentally, it is operated by direct current and has associated with its electro-magnet a short-circuited coil of high inductance and low resistance which produces a time lag of five seconds. A function of this relay is the control of the pneumatic warning whistle which sounds in the cab whenever the signal changes to a more restrictive indication. This whistle is pitched to about high C and is definitely audible in the cab of a freight engine under the worst noise conditions. The whistle cock is controlled by a pneumatic relay, which in turn is governed by the slow action relay. The pneumatic relay is in effect electrically controlled but pneumatically operated since an electro-magnet opens its air valve. The air drives a small piston which sounds the previously mentioned pneumatic whistle at the end of its stroke.

All of this time delay is designed to permit the engineer to acknowledge the change in the cab signal. He does this by temporarily opening the "acknowledging valve," located very near the air-brake lever. In so doing, the air is discharged from the piston of the pneumatic relay and the sounding of the warning whistle is forestalled. After the acknowledgment the equipment is ready for the next change of signal.

Of the above described equipment, the slow action relay, the amplifier unit, and the vane relay are contained in a weatherproof steel cabinet and in the order mentioned, as may be seen in the second illustration. This view is from one of the Hiawathas and shows the equipment box under the engineer's cab window. It is similarly located on the new S2 freight engines, but on all other locomotives it is found on the top of the boiler near the sand dome. There are two main cut-out switches on all locomotives, one of which may be seen under the equipment box in the illustration, the other being in the cab. These switches are used to disconnect the entire engine equipment from the dynamotors when running in territory where the cab signal system is not used.



Interior view of an engine cab showing the three signal lights.

The cab signal lights are compactly contained in a cast aluminum case mounted on the eye level of the engineman and at the center of the boiler head. The colored bull's eyes, arranged vertically from top to bottom, are green, yellow, and red signifying clear track, caution, and stop, respectively. Lights are provided on three sides of the case, as may be seen in the interior cab view, making it possible for them to be seen from any point in the cab.

Now with the stop signal in effect the train is not brought to an immediate halt but merely proceeds at a speed such that it could be stopped at will. Under the caution signal the engineer begins to reduce his speed until it is moderate for his class of train. With the green signal the engineer is permitted to use any speed his judgement dictates.

Tests

The cab signal equipment on the engine is tested each time the engine enters or leaves the roundhouse. For this purpose test track sections about 100 yds. long are equipped near the roundhouse on both incoming and outgoing tracks. The currents in these sections are so arranged that as the engine passes over them, all three signals are indicated. No engine is ever permitted to couple onto a train that will travel through cab signal territory unless its signal equipment is in operating condition. The routine inspections made by the roundhouse electricians during the engine's stay in the roundhouse are such that a rejection of an engine is very seldom necessary. Information concerning the operation of the wayside circuits is continually received in reports which the engineer must submit at the end of his run.

Considering the preceding discussion one may conclude that the engineer is equipped to "fly blind," and, if you could ride an engine over the River Division on a severe winter night, you very likely would agree that at many times he does just that. Yet one can confidently relax in the comfort of a soft coach seat knowing that, although the train may be going over 70 miles an hour, his engineer at all times knows what lies ahead.

The Engineer as a Municipal Administrator

Tau Beta Pi Prize Winning Essay

By Leslie A. Anderson, C.E., '39

Illustrations by Albert Arneson

WITHIN the last two decades in the United States, the economic and physical structure of the average municipality has assumed a complexity not unlike that of a huge business corporation. Population increase, speedier means of transportation, and the recent economic depression each played its part in creating new municipal problems and in increasing the importance and critical nature of old, apparently solved problems. Transportation and traffic difficulties multiplied rapidly; population congestion and its related problems of housing and slum clearance loomed on the horizon as vital and pertinent factors in continued municipal development.

Simultaneously with the growth in complexity of urban structure, new types of municipal government were evolving in the United States. The outmoded mayor-council type was modified in some sections by the commission type, and more recently by the city manager plan of government. This latest modification consists of a small elective commission replacing the council, and a city manager replacing the mayor or administrator. The city manager is appointed and discharged at will by the commission. He is endowed with all administrative powers, and is held wholly responsible for the management of the city's business.

Realizing that perhaps the city manager plan embodies features of efficiency and economy lacking in other forms of municipal government, city after city has adopted it as a probable solution of its problems. With the adoption of the plan arises the question of the choice of managers and minor administrative officials. In most cases in the past, the man appointed was one with some sort of engineering experience coupled with additional training or experience in municipal economics and finance.

The place of the engineer in municipal government is beginning to assume more definite proportions as a result of his achievements not only as a city manager but also as a technician and city departmental head. It is becoming increasingly apparent that municipal administration is definitely a coming field for the engineer. Accordingly, the profession is being divided for the first time into two distinct branches: (1) that of the technician and (2) that of the engineer trained in history, economics, and finance, and possessing knowledge of the city's political as well as economic structure.

Institute Offers Public Service Course

Recognizing the existence of this trend, numerous universities and colleges throughout the United States have given undergraduates in engineering opportunities for obtaining the additional training needed in the form of combined courses in engineering and business administration or in engineering and political science. Our own Institute of Technology has recently added a second course in Civil Engineering, the public service option course, which permits the student to take more advanced work in political science, public health, or business administration than under the regular curriculum.

Perhaps one wonders why there is such a growing demand for engineers as administrators. An analysis of the needs and problems of the typical municipality will serve to show more clearly the proximity of the engineer to municipal government and administration.

Municipal Planning Unites Public Services

Practically all of the tangible problems connected with municipal administration may be included under the general head of municipal planning if the latter is defined as the science and art of unifying public services and improvements in accordance with the peculiar economic needs and conditions of the municipality. An analysis of municipal planning may properly be divided into (1) the preparation of the plan, (2) its operation, (3) its cost, and (4) its value.

In preparing the plan, after receiving legal permission to begin, the first step is the making of a preliminary survey. Here the engineer's training in municipal history and economics aids him in studying the community's past development, including the suitability of different parts of the community for different uses as well as the actual present uses of the same areas. His training in his own profession enables him to draw up a series of maps, charts, and sketches of this past development as well as a coordinate set of charts showing the probable direction of future expansion.

After the preliminary survey, the actual drafting of the plan takes place. The planner must prepare a rough sketch of future improvements in such a manner as will best control, stabilize, and stimulate future private development. Two lines of action await him: (1) the control of public investment and (2) the control of private improvements. Once again the twofold training and versatility of the engineer is needed.

According to S. L. McMichael and R. F. Bingham in *City Growth and Values*, the typical and comprehensive plan usually provides for street systems with building lines, waterfront improvements, public building sites, transportation systems, traffic control, public utilities, the subdivision of land, location of private enterprises, zoning, etc. A good financing plan is usually but not necessarily included.

Engineer Best Fitted for This Work

Who besides the engineer is capable of planning and developing such a variety of projects? His extensive training in the various phases of engineering and his additional training in municipal affairs have proved adequate in the past and will become increasingly necessary in the future as cities continue to grow in size and complexity. The civil engineer, with his knowledge of highway, structural, sanitary, and municipal engineering and of surveying, is especially qualified for the position of city planner.

After the plan has been approved by the legislative body, the task of systematically carrying out its provisions rests with the city manager and his appointed assistants. Its important provisions may be classified under three heads on the basis of the degree of directness with which they attempt to serve the community. These are (1) the zoning system, (2) the transportation and traffic control provisions, and (3) the public welfare provisions. All are basically concerned with furthering human welfare. The first two achieve this end indirectly, while the public welfare provisions for housing, slum clearance, population density, recreation facilities, and civic beauty attack the problem more directly. All three are distinctly related; they are not only related but also dependent on each other for success. Practically all planning projects may be included under one of these divisions. Even the layman can appreciate the usefulness of the engineer as city manager in the efficient and economical execution of these provisions.

Zoning Part of City Planning

The zoning system is an arbitrary means of determining the character and use of sections of the municipality, and of regulating the height of buildings in these sections. Zoning is a recent development in the United States, although it has been practiced for some time in German cities, from which it was adopted.

According to *City Growth and Values,* by determining the character and use of sections of the municipality, and by regulating the height of buildings in these sections, the orderly growth of the city and the stabilization of property values may be achieved. In addition, zoning specifies the percentage of a lot which may be built upon, and the distance from the street to the building. These provisions are directly linked with traffic control, since they remove obstructions to view and thus reduce traffic accidents. The building line is also helpful when street widening is undertaken. Thus it is seen that correct zoning permits an advance estimate of both transportation and traffic requirements.

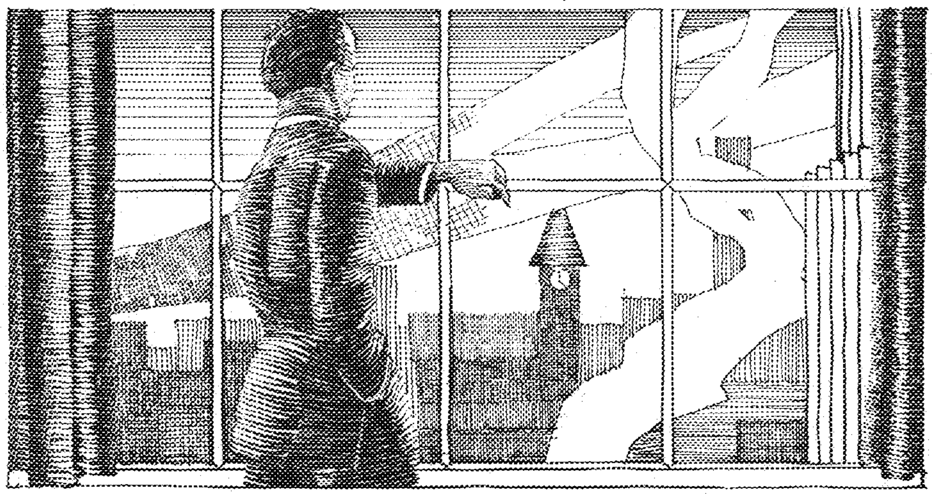
Although the arguments against zoning are almost as numerous as those for it, in general, in a city where it has been at all effective, zoning has not exercised a negative value either upon growth or upon land values. Furthermore, R. M. Haig, in *Major Economic Factors in Metropolitan Growth and Arrangement,* states that "zoning finds its economic justification in that it is a useful device for ensuring an approximately just distribution of costs."

Transportation Aided by Planning

Needless and excessive transportation within the city may be curtailed by the correct location of the various economic activities through zoning. The economic distribution of factories and their dependent residential areas saves money, time, and energy for all concerned.

Traffic congestion may be reduced by such projects as widening streets, separating traffic at intersections of importance, building new streets, and passing through traffic on highways on the city's outskirts. These projects, although almost prohibitive in cost, may be the only means of solving the problem because of lack of vision in planning in the past. With an efficient administrator at the head of the municipality, these difficulties would have been foreseen and partially corrected at least.

Traffic accidents may be reduced by the planner by such methods as separating pedestrian and vehicular traffic through the use of overhead and underpass walks, removing obstructions to view by zoning, providing more playground space, etc.



"The place of the engineer in municipal government is beginning to assume more definite proportions . . ."

It is in the carrying out of the public welfare provisions for housing, slum clearance, and recreation facilities that the engineer manager has an advantage over the ordinary city manager or mayor. He is able to design a sound housing program which will save the city money and yet effectively alleviate overcrowding and the objectionable slum district problem.

The recreation problem involves the furnishing of sufficient park, playground, and open space to meet the need of every part of the city. The method of attack usually employed is the comprehensive park plan. Besides specifying an economic distribution of park facilities, such a plan further saves the city money by making possible the advance purchase of recreation sites to meet future development.

Knowledge of City Finance Important

Perhaps the most important part of municipal planning is the city's financing program. In addition to paying for the projects planned, the city's credit standing must be improved if a manager's administration is to be judged successful. The engineer's knowledge of municipal finance at least enables him to recognize an adequate program for the city and to determine whether or not the financial condition of the city is improving. Aided by financial and economic experts, he may accomplish much towards restoring a city's credit to its earlier soundness.

A new era has already begun for the engineer. Always primarily interested in public works and in rendering public service, he may now play an active part in the actual administration of the governments and the public he has served in the past. The efficiency of the engineer in his own particular field has never been doubted. Why should not this efficiency be utilized in the broader field of municipal administration?

1948—Will You Be Satisfied Then?

by Olive M. Foerster, Chem. '40

Illustrations by Albert Arneson

Do you know the answer to this question? If you don't, the University Testing Bureau undoubtedly can help you. The Bureau's method of discovering your aptitudes and abilities, from which knowledge it draws up its suggestions and advice, has proved quite successful during its short existence.

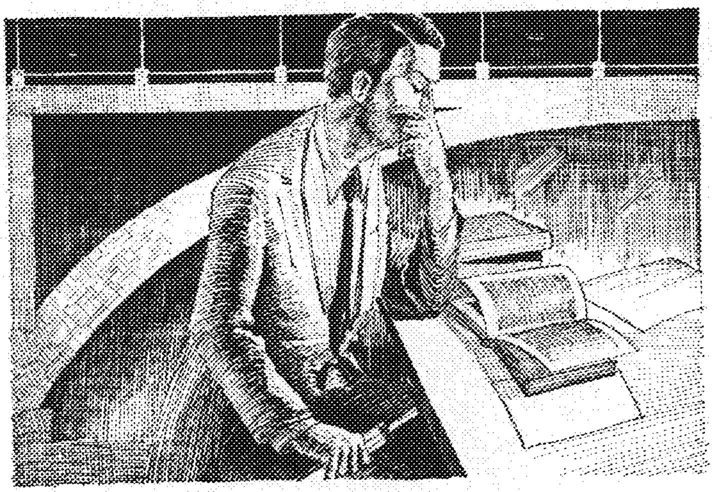
WHEN a new academic quarter begins, students usually experience a tremendous readjustment to their courses, a readjustment which is probably due in large part to a feeling of incompetency by the student. Among engineering freshmen and sophomores such a feeling is more prevalent because of the change from a generalized high school course to a highly specialized technological curriculum. After one quarter in the University's Institute of Technology, the average freshman is prone to reflect on his accomplishments and lose heart, but he usually finds, if he continues, that the first quarter is the hardest.

It sometimes happens, however, that the student's feeling of doubt and self-dissatisfaction persists. Perhaps he feels he could do better in some other course, or perhaps he feels entirely defeated, unfit for training in any specialized field. An attitude such as this is a decided liability to the psychological state of the student, particularly if it occurs in the middle of the quarter. To aid undecided students in choosing a profession, to renew the morale of disillusioned beginners, and to stimulate a growing impetus in tomorrow's generation to cope with the modern trend toward increased economic and occupational competition, the University has established a bureau in which students may be tested, examined, and advised.

By action of the Board of Regents, the University testing Bureau was established in 1932 as an independent service agency, with the Board of Admissions acting as general advisory committee. It serves as a clinic in the field of vocational guidance much as the Students' Health Service functions in the field of student health. It is directed by Dr. E. G. Williamson and is located in Northrop Auditorium. Besides administering educational and vocational guidance to University students, the bureau maintains a department for pre-college counseling, which includes eventual coördination into guidance in higher education. The ultimate end of such a program is apparently a counseling system for all freshmen, but such an establishment could occur only after a sufficient demonstration of the bureau's effectiveness.

Every case handled by the bureau is given careful and individual attention, and with each one there is a meticulous examination of data in an attempt to arrange a satisfactory academic adjustment, as preliminary to a satisfactory life adjustment. Dr. Williamson explains that such a program must include: (1) an intensive study of the individual, coördinating all data from interviews, health reports, psychological tests, and high school achievement; (2) a recommendation from such evidence as to the occupational field probably most satisfactory to the individual; (3) the collection of personal information; (4) an individualized interpretation of academic and occupational opportunities; (5) a continued study of the individual's adjustment after such advisement and orientation.

Students may be referred to the University Testing Bureau from any of several sources, but regardless of the source, all students receive, in general, the same type of service. A clinical tester first interviews the applicant to determine what the nature of his problem might be and to discover what the trend of his vocational ideas has been. Then the student fills out a personnel sheet, listing the activities and kinds of work which he dislikes as well as those in which he is interested. On the basis of this information the tester makes the selection of the set of tests to be given his client. Since there is no standard set of tests, he must choose from the 60 or more combinations which the bureau has on hand. Although the time for examination may vary with the case, the average student requires six to eight hours to complete the tests. They may all be taken at one appointment but are preferably spread out over a period of three or four days. There are almost innumerable kinds of tests, nearly all of them time tests. They include every division of science, mathematics, literature, and other general information: personality tests on likes and dislikes, tests of opinion, tests of manual dexterity, psychological tests, and, in general, tests which will best expose the student's personality in its entirety. There is an artificial language test, designed to investigate the flexibility of the mind;



Will his dream of the future come true, or are all his hopes destined to vanish because of a wrong choice of occupation?

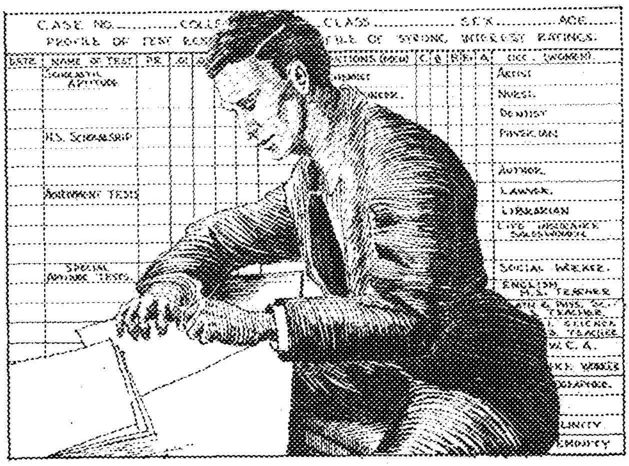
a vocabulary test to determine the extent of the student's observatory reading; a numbers-matching test to show the skill of the student at observing mistakes; and countless other tests of mental alertness. In the grading of these tests, care is taken to note the exact answer given by the student, and these answers are compared with the answers that men of various professions have given for the same questions. Particularly in the personality tests on preferences and opinions these comparisons are taken into consideration. If the replies of a student to certain questions are the same in substance or are stated similarly to those of a man or woman in a given profession, it is assumed to be an indication that that student may be fitted for the same occupation.

After the tests have been corrected and graded, the student is interviewed and advised by a vocational counselor. The bureau has three general principles of guidance as set forth by Dr. Williamson. First, a counselor helps the student by presenting to him the data that have been collected concerning his own aptitudes and interests. In this way, the counselor may be able to predict what may be the result of various occupational decisions the student may make. Second, it has been found that the most effective guidance the bureau can give deals, not with a forecast of success in life's later vocational competition, but rather with judging successes or failures in coping with the different standards occurring in the student's training program. Dr. Williamson explains that this procedure is most plausible because of the impossibility of controlling occupational trends and opportunities sufficiently to make dependable promises or recommendations. When recommendations are made, however, they are made in an attempt to demonstrate to the student, not only his professional specialization possibilities, but also to help him understand his versatility. This is regarded as the best provision for his future economic security and enjoyment as well as providing for the possibility of a change in his work. The third principle observed in the counseling of students is that of guarding against too literal an interpretation of specific test scores. The counselor is careful that such over-emphasis does not occur and puts more stress on the individual student's background.

After the student has had his interview, he is advised about his professional training program. Depending on his needs, he may be referred to the committee on vocational information, the University Testing Bureau's bibliography of titles dealing with various professions, the Speech Clinic, the psychiatrist, the employment bureau, How to Study classes, or a faculty counselor. Regardless of the referral of the case, the bureau attempts a periodic check-up on each case each quarter to investigate the nature of the student's adjustment after the advice. The bureau files a dictaphone record of each interview along with the data for each case history. Broadly speaking, the bureau maintains no inactive cases, for the records are in constant use for purposes of research, follow-up investigations, and reports to parents and advisors.

The extent of the bureau's service has grown yearly since its inauguration in 1932. During the first biennium of its existence the bureau handled a total of 2,209 student cases; in the biennium 1934-1936 it handled 4,325 student cases; and, remembering since then, it is now above the 8,000 mark in student cases. In the second biennium the total number of tests given to students increased 98.95 per cent over the number given during the preceding two years. The increase in the number of volunteer cases at the bureau in the last year has been an indication of the fine build-up the students are giving it.

A study made recently in the effectiveness of the counseling of the University Testing Bureau revealed that of 987 student cases investigated 54.91 per cent made satisfactory adjustment and an additional 28.17 per cent were making progress toward adjustment after taking the tests and receiving counseling. However, these statistics included all cases—those who carried out the recommendations wholly, partly, or not at all. It was found, moreover, that of the 894 who carried out the recommendations of the University Testing Bureau 799, or 89.37 per cent, effected a satisfactory adjustment or progress toward adjustment.



The student is thoroughly tested, then interviewed, and finally counseled on the basis of the tests and the interview.

The staff also renders services to university students in an effort to assist them in the solution of their educational problems. A General college course in vocations, under the sponsorship of the director of the University Testing Bureau, is intended to set forth general principles upon which satisfactory adjustment to life and occupation are dependent. There is also a committee on vocational information, appointed by the president, which acts as a source of reliable information on occupational requirements and opportunities. Its program of counseling new students during Freshman Week has been extremely successful, with about two hundred cases being given what was termed "intensive counseling" during the week. Beginning in April, 1934, the same committee sponsored a series of radio talks given by exponents of various scholastic curricula. The talks were later published as a guide to high school graduates in their orientation to college life.

There have been several contributing factors in the establishment and growth of the comparatively new testing bureau. In the beginning it was probably the continual increase in enrollment and the spread of education that entailed an increase in the University's responsibilities to its students. It was then, through the development of the bureau, that the realization occurred that each student is an individual, with distinguishing abilities and peculiar aptitudes, rather than a mere subject for instruction. Faculty advisers and counselors began to place more and more emphasis on individualized needs in order that a higher education might not only mean advanced instruction in a favored field, but a means of developing the student's several talents. Minnesota students now in attendance at this University are indeed fortunate and grateful for the establishment of the University Testing Bureau, for it is largely through its work that they have been made individuals.

The Minnesota Techno-Log

FEBRUARY, 1938

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The Scientific Method

There is a feeling today that the scientist should forsake his laboratory and come to the rescue of the economist before our economic situation gets too far out of control. It is said that he should apply that wonder-working tool, the scientific method, to economic and social problems. Before any attempt is made to do this on a wholesale basis, let us analyze this tool, considering both its advantages and its limitations.

Fundamentally, there are two elements to the scientific method. A scientist desiring knowledge about a certain process or reaction first sets it up in the laboratory and then observes and records its action under controlled conditions. The second step is the deduction from this data of the exact mechanism of the phenomenon being studied and its probable behavior under a different set of conditions. These deductions are then checked by further experiments. This is the scientific method.

Now, what difficulties are involved in applying this method to social and economic problems? The first difficulty is that of obtaining exact data. These problems usually cannot be studied under laboratory conditions, that is, where the factors involved are all under control. The second, and perhaps even greater difficulty, is to obtain an objective interpretation of such results as are obtained. Whereas scientific data is usually of such a nature as to minimize the possibility of biased interpretation, experimental data on social problems, when it exists, is often completely submerged by the prejudices or preconceived notions of the persons ultilizing it. The tendency is to take an elementary truth, possibly only a half truth, that has been satisfactorily demonstrated, and deduce from it a vast number of other "truths" without bothering to check the results experimentally. Eventually, the original fact becomes but a minute portion of the whole. It is this sort of thing that leads to confusion and disagreements. The third difficulty, one that would be encountered after the first two had been solved, would be that of persuading the people as a whole to follow the design for living that would be developed by scientific analysis.

In the face of these difficulties the attempt to apply the scientific method may look useless. It isn't. These problems will yield in this method of attack, and the sooner it is employed the better. Although the progress will be slower than it has been in the field of natural science, it will come. This is the only logical basis on which to proceed toward the seemingly inevitable planned economy of the future.

WHY & HOW

Last month we began a series of discussions on the whys and hows of publication of the TECHNO-LOG. *This month's column we turn over to the business staff and will let them endeavor to present an aerial view of the business staff and its organization and function.*

The clearest picture of the functions of the business staff may best be obtained by observing the work done by the advertising, circulation, and office departments, into which the business staff is subdivided, from the beginning to the end of the work done on the publication of one issue.

When the magazine is in the embryo stage the advertising department's task begins with its advertising salesmen going out and selling "space" in the forthcoming issue. The salesmen must convince the prospective advertiser that advertising in the TECHNO-LOG is a paying proposition, and in some instances, when successful with the sale, the advertising department must prepare the copy for the advertisement. As the date of publication nears, the advertising department and the editorial staff hold a joint session, determining the relative position of the various ads, articles, and departments.

As the magazines roll off the press, the circulation department stands ready, taking charge of getting the magazines in the post office boxes, and mailing copies to subscribers, advertisers, libraries, and technical publications at other colleges.

The office department is kept busy during the entire period doing clerical work, but the burden comes after the magazine is out. There are statements to be made out, accounting to be done, and bills to be paid.

Association with the business staff provides the technical student with not only an interesting and enjoyable extracurricular activity but with experience that is extremely valuable, especially to those engineers interested in the commerical side of industry. Whether it is intended to follow a less technical line or not, the general knowledge obtained from working on the business staff is an asset upon which there is no depreciation.

NOW HERE'S A BOOK

Our versatile critic departs from precedent to open for us a panorama of pre-revolutionary Spain.

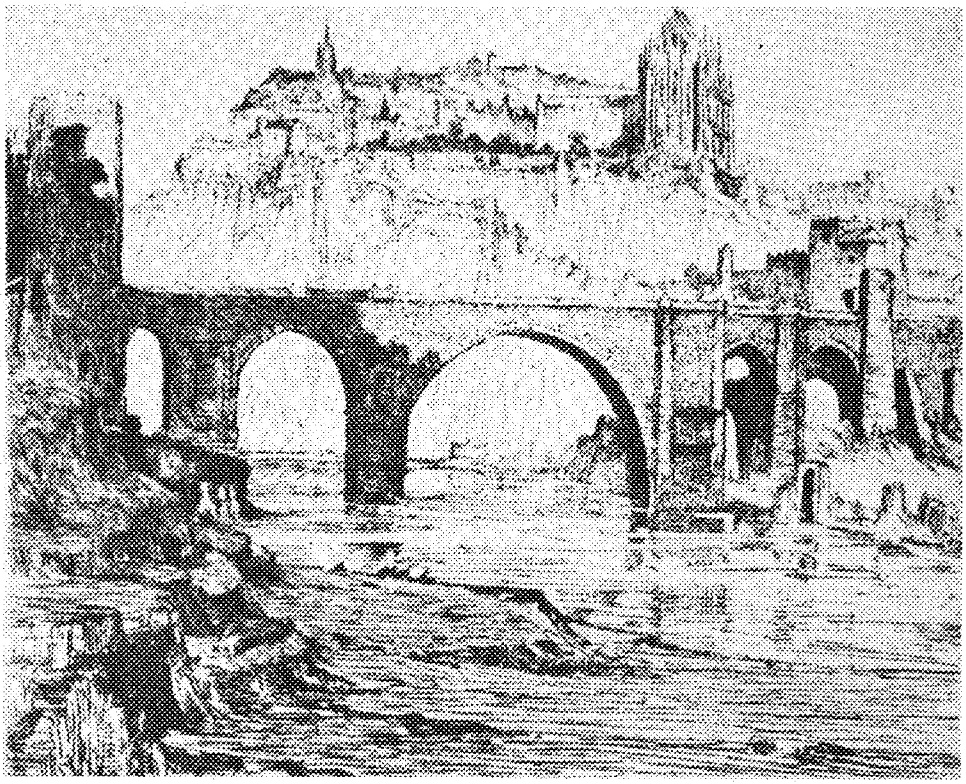
By C. I. Haga, Instructor in English

This month my review calls for an expanded title, "Now Here's a Book to Own." The book is S. Chatwood Burton's *Spain Poised*, a selection from the etchings Professor Burton made during a year in Spain some 15 years ago. It is not like the books for which I generally use this page; most of them need but a single reading to give what they offer of pleasure or profit to a busy undergraduate. Their virtue lies chiefly in the ideas or facts or points of view they present; consequently, they lose none of their value, even when read against time to make sure that the volume shall be returned to the library in due season.

But "reading" *Spain Poised* is a different matter because the book is so completely different from a volume of popular science, government report, or a novel. It is a matter of seeing, not reading; a matter of feeling, not thinking. To be sure, the book can be skimmed through in a few minutes—if you care to spend only a few seconds on each of the twenty-odd prints—but no sensitive person can remain content with such an awkward communion with the artist. The first words of the introduction and the first print give one a quick, clear glimpse of the feeling out of which these etchings grew, a feeling that becomes more intense and eloquent with each succeeding picture. "A boy of twelve leaned over a wall, listening eagerly as an old soldier talked to him of cool Spanish nights, of beautiful dancing girls, of hot afternoons spent at bull-fights or rambling through gardens where pomegranate blossoms flamed against black-green cypress trees." Places and times far away and long ago cut deep into the mind of a boy and became with the passing of years that rich soil of memory and imagination so necessary if sight of the actual mountains and castles and gardens was to strike fertile root and yield the ripe understanding the artist needs if he will make us see and feel in his work what he found there.

Of Spain I know nothing and of etching I can as honestly confess ignorance. My feeling of pleasure in looking through this book I can recognize as genuine and growing, perhaps because of my own sympathy for the joy with which the artist must have worked when time and skill had blest him with the means of realizing so fully the dreams of a boy. I once hearkened to stories of far away and long ago, not leaning over a wall, but bent over books and maps; and I also went to see what there was so wonderful to see on fell and fjord. And now I know how, lacking the artist's gift, my pleasures were the poorer and my memories the duller. There is richness of mind—which words can give; but there is also richness of feeling—and that only the artist can give. Without the one, the other is scarcely worth having.

That is the reason why I say *Spain Poised* is a book to linger over, a book to possess in the strict sense of the word. Guided by the artist's brief comments accompanying each print, we gradually learn to see more in the etchings than the dry, crisp skill of the etcher's engraver cutting in the plate the lines and scratches balancing light against shade, mass against space. Yielding ourselves to the evocative power of these pictures of mountain-rooted houses and craggy castles in which scarcely a single human figure appears, we come to life as we see them animating the page with all the fierce human ebb and flow of wills and wants and cares for whose satisfaction these buildings were erected, hard stone on hard stone, jutting up from sheer cliffs, peering hawklike with deep windows and poised balconies. Look long at these plates and look well—and even their blank spaces and darkest shadows will cease to be sterile contrasts setting off the literal detail of a doorway or balcony or parapet. Even there will you find the hidden line whose unsuspected presence serves to make more exact the sweep and force of the line first seen.



TOLEDO — S. CHATWOOD BURTON

So I say, get *Spain Poised* and learn to feel it.

Honorary Societies Announce Initiates

The Minnesota chapters of the honorary engineering societies have initiated a total of 58 new members during the fall quarter. There were 16 juniors, 34 seniors, and 8 graduates.

TAU BETA PI, national honorary all-engineering fraternity, held its initiation on November 23 with **Sherman Finger**, president of the society, welcoming the 18 incoming members. The other officers of the society are **Clark Hook**, vice president; **Alfred A. Anderson**, recording secretary; **Gordon Lee**, corresponding secretary; **Professor E. W. Johnson**, treasurer. The initiates are:

Juniors:

- Leslie Anderson
- William Lowe
- Reuben M. Olson
- Kenneth Sorenson

Seniors:

- Gordon Brierly
- Kenneth Dunning
- Lennard Johnson
- Lloyd Lewis
- Thomas MacKenzie
- Robert Manly
- Charles Mickelson
- Omar Patterson
- Robert Rasmussen
- Rowland Retrum
- Harold Schmidt
- Donald Scott
- Howard Turner
- Earl Wookey

CHI EPSILON, national honorary civil engineering fraternity, recently initiated three new members, all juniors. The officers of the society are **Mark Olson**, president; **Kenneth Person**, vice president; **Elwood McGee**, secretary; **Erling Helland**, treasurer. The new members are:

- Leslie Anderson
- Herbert Gaustad
- Harold Maiers

ETA KAPPA NU, national honorary electrical engineering fraternity, has as its officers this year **Gordon Brierly**, president; **Kenneth Dunning**, vice president; **Gordon M. Lee**, recording secretary; **Nordahl Onstad**, corresponding secretary; **Omar Patterson**, treasurer. The fall initiates were given an examination on October 28 and formally initiated at the Curtis hotel on November 10. There were three seniors and five juniors:

Juniors:

- Erling Hagen
- Jack Hyde
- Robert McDonald
- Joshua Premack
- Vernon Tollefsrud

Seniors:

- Lennard Johnson
- Norman Miller
- Leon Sabine

PHI LAMBDA UPSILON, national honorary chemical fraternity, announces the initiation of 18 new members, 10 seniors and 8 graduates. The officers of the society are **George Mitchell**, president; **John Anthes**, vice president; **Robert Carlin**, secretary; **Webster Benton**, treasurer. The new members are:

Seniors:

- Lawrence Berglund
- Jack Clayton
- Carroll Dobratz
- Walter Gensler
- George Land
- Charles Mickelson
- Taito Soine
- Joseph Sprung
- Aldrich Syverson
- William Trutna

Graduates:

- Cyril Evans
- Frank Hurd
- Albert Marsh
- John McCool
- Edgar Painter
- Robert Scheiderbauer
- William Stone
- James Watters

PI TAU SIGMA, national honorary mechanical engineering fraternity, initiated four juniors and seven seniors this fall. The officers of the society are **Harley Hughes**, president; **Alfred A. Anderson**, vice president; **John G. Davies**, recording secretary; **Rowland Retrum**, corresponding secretary; **Wallace Lien**, treasurer. The new members are:

Juniors:

- Willard Hoagberg
- Roland Meyer
- Reuben M. Olson
- Donald Reed

Seniors:

- Wilfred Cadwell
- Roger Freberg
- John Kordish
- Robert Manly
- Harold Ostdahl
- Edward Pierson
- Daniel Shotwell

Officers of the professional societies for this year are:

A.I.CH.E.

- **Charles Berger**, president
- **George Piercy**, vice president
- **Harold Kemp**, recording secretary
- **Robert MacDonald**, corresponding secretary
- **Ralph Van Hoven**, treasurer

A.I.E.E.

- **Don Erickson**, chairman
- **Erling Hagen**, vice chairman
- **Nordahl Onstad**, secretary-treasurer
- **Professor J. H. Kuhlmann**, councilor

ARCHITECTURAL SOCIETY

- **John Wenzel**, president
- **John Folsom**, vice president
- **Martha Holt**, secretary
- **William G. Waters**, treasurer

A.S.A.E.

- **Ray McVeety**, president
- **George Ridings**, vice president
- **Quentin Erlandson**, secretary-treasurer
- **Nelson Dingle**, scribe

A.S.C.E.

- **Kenneth Person**, president
- **Ray Huebscher**, treasurer
- **Donald Hook**, secretary

A.S.M.E.

- **Allan Paine**, president
- **Willard Dye**, vice president
- **Wallace Lien**, secretary
- **Edward Pierson**, treasurer

I.A.E.S.

- **Bertil Lindquist**, president
- **Robert Moore**, vice president
- **Robert Schoonmaker**, secretary
- **Robert R. Burns**, treasurer

SCHOOL OF MINES SOCIETY

- **George Neuberg**, president
- **Kenneth Bickford**, vice president
- **Ward Simmons**, secretary-treasurer

Are You Worried About Your Job?

by James J. Ryan

Assistant Professor of Mechanical Engineering

Recently I have casually overheard, and at other times entered into, discussions about the prospects which graduating seniors have for finding jobs this spring. The discussions are usually brought about in an attempt to answer certain questions relative, first, to immediate business conditions, and second, to the more general problem of obtaining employment.

I would like to present, in a personal way, a few of the fundamental factors that have been assembled from these discussions. Suppose we sit across the table, as in a seminar, to discuss employment objectively—what you would like to do, and how you may go about doing it.

I assume your willingness to work and your interest in achievement. You know yourself as well now as you ever will. You may use this knowledge to good advantage in your present search for the occupational activity which will be in reality only the continuation of the mental growth stimulated in college.

First, we might dispel this fear about business. You will hit several rebuffs as time goes on; so the first one you meet will not sharpen your wits to take those following in stride. In general, this is an age of engineering and engineers and their training will control the future much more completely than in the past. Enough engineering projects already have been set down on paper to keep you fellows humming until you are sufficiently mature to set down a few yourself.

Specifically, by next summer the need for new equipment in the heavy machinery fields will be so great that replacement and expansion will be withheld only under great stress. Construction work follows this lead. The development of several chemical industries has continued this winter without the slightest reduction in engineering personnel. There has been no halt in the progress of aeronautical development and other transportation. Unsettled conditions have created a temporary lull in manufacturing activity, but you will be there and ready at the break. A little fear doesn't hurt, you know, for it makes a fellow try a little bit harder, and it is that little bit that may count the most.

Now jobs may be classified in several ways. How about working for a big company? Say a company with a training course of from six months to two years. You certainly get a world of experience in that time. Work is usually offered in three fields—sales, engineering, and manufacturing. Of course, everybody goes to sales schools, something like a convention away from home. Advanced courses in engineering are usually a more serious matter. And especially if you can tie them up with a local university and get that master's degree which is worth three years of anybody's experience.

You are known as a student engineer and allowances are made for you all along the line. You work with the regular workmen three to six weeks in a department, both shop and engineering, and time is allowed for you to investigate anything in the plant that you desire. All students are placed for a period on the test floor. After completing the course, in a short time a man is made an assistant foreman in manufacturing, a junior engineer in an engineering department, or a sales engineer in the main office until transferred to a district office or assigned as an application engineer between sales and engineering. There are other outlets too numerous to mention that may be called to his attention. A man usually finds the type of work in which he is interested and checks up on the opportunities. Many fellows stick; others roam away with a good log of experience.

Smaller companies usually have a means of developing and training students also. A student in a smaller concern becomes a more important cog in the system earlier since there is less need for a broader basic experience, and more need for specific application. He is not quite so free to choose his particular vocation and must be guided by the general products that are the stock in trade of the company. More personal ingenuity is required in the smaller company since not so many experts are available for consultation.

The very small companies are matters of individual consideration. Ofttimes a connection with a smaller unit provides a variety of problems and business relationships not commonly encountered in larger organizations.

Other positions are available in civil service, state and local government departments, educational and functional institutions, and a host of business enterprises employing engineers. Or you can start out for yourself on some project of your own, which, even though it may be hard at the start, will eventually lead to a successful undertaking, or into other fields of endeavor where the experience will be useful.

A thought relative to the immediate continuation of your education should not be omitted. A year of graduate study is rapidly becoming more important in the requirements for advanced engineering work. Course work should be taken in broad fundamental subjects, with a major emphasis on the development of self-reliance, personality and adult growth.

You still may ask how you can get a job after you have analyzed your interests.

Well, the representatives of the various companies will be along this winter and spring for interviews. They hire fellows that are interested. Find out about their companies by seeing their local managers, their advertising and descriptive literature, and send to the main offices for further details. Then write to the educational or personnel departments about your particular interests, your capabilities and plans, and the representative will be looking for you when he comes.

And THEN you must put the stuff on the ball. I'd say under ordinary circumstances if you really want the job you will get it! But you must want it 100 per cent.

There are enough jobs to go around. So take an inventory of yourself, lay the groundwork, and be on your toes. You can do it!

The Thermodynamics of Alchohol

Below appears a report on the operation of the McSwiggen power plant under emergency conditions, as submitted by the chief engineer, D. P. McSwiggen, B.M.E., formerly chief engineer of the United Brewing Corporation, and transmitted to us by Donald P. Frankel, Aero. '39.

I. Introduction

This report shall include a brief synopsis of the operation, maintenance, and efficiency of the different departments of the McSwiggen power plant during the period of emergency operation which took place in the latter part of December 31, 1937, and extended into the early part of January 1, 1938. It will be noted that during this period over 50 per cent of the power plants within the vicinity, both major and minor, were operating under similar conditions with, perhaps, the exception that some did not have to contend with quite the amount of "trouble" that the McSwiggen power plant encountered.

II. The Stoker Division

The stoker division of the McSwiggen power plant is completely automatic, being able to feed itself with the greatest accuracy and efficiency and making use of the automatic chute system of feed to the grates.

At 10:13 p.m., December 31, the first symptoms of the emergency were noted. The third assistant engineer in charge of stokers reported to the chief engineer that the stokers were taking on fuel in liquid form. Under normal conditions the stokers handle only solid and semi-solid fuels, the semi-solid fuels being mixtures and compounds of water. The chief engineer was informed that the stokers were carrying 32 per cent liquid fuel, which by proximate and ultimate analysis proved to be mediocre grades of hard cider, corn whiskey, and bath tub gin.

Through constant contact with the third assistant engineer, it was found that the percentage of liquid fuel increased to the alarming maximum of 68 per cent liquid and 32 per cent solid at 1:42 a.m., January 1. This condition continued until a sudden complete cut-off of all fuel occurred at 4:03 a.m.

III. Effect on Boilers and Furnaces

Immediately after the symptoms were discovered in the stoker division, symptoms of abnormal and subnormal operation of the furnaces and boilers were noted consecutively and alternately. At 11:59 p.m. the chief inspector of the secondary drum reported three blow-offs within the past hour due to increased sediment in the boiler feedwater. The total number of blow-offs during the emergency period was eight and probably would have been more if the plant hadn't shut down (see "Results").

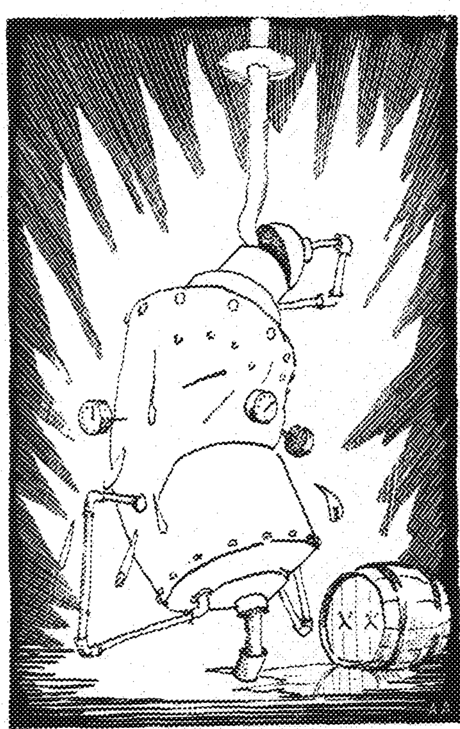
Boiler pressures recorded during the period read as large as three times the capacity of the boiler and as small as below atmospheric. It was found that the stack gases given off by the furnaces contained such a high content of alcoholic fumes as to cause the surrounding plants to register complaints.

By 3:59 a.m. furnaces and boilers were overloaded to such a point that they endangered the lives and property of the McSwiggen plant and surrounding plants. Drastic action had to be taken by the chief engineer immediately. At exactly 4:03 a.m. the chief engineer reversed the stokers, thereby discharging the sub-standard fuel in the feeding system. No immediate relief was forthcoming.

IV. Results

Due to the reversing of the stokers, the furnaces began to die isothermally and the boilers to lose pressure adiabatically. At 5:22 a.m. the circulation department reported high velocities in the communication room and adjacent offices, zero pressure in the propelling department, and extra high circulation about the air intake ports.

At exactly 5:34 a.m. the climax was reached with a general shutdown of all departments and a sit-down strike on the part of the personnel.



A. Arneson

V. Conclusions

After extensive tests it was found that the average over-all efficiency of the plant during the emergency was 3.29 per cent, a decrease of over one-half the normal 7.5 per cent efficiency of the plant.

The emergency was not profitable to the plant. No little expense was encountered in redressing, reorganizing, and reconditioning the plant. The reconstruction is still in progress, but the plant should be in normal running condition by the beginning of the fall term, which, incidently, is the rush season. In the future, emergency operation periods will cease to be part of the policy of this plant.

OF INTEREST TO TELEPHONE USERS

I think many people have only a vague idea of how our company functions within the Bell System, and how a unique business philosophy is operating to make your telephone service increasingly dependable and economical. This advertisement is the briefest possible statement of the philosophy that guides the Western Electric Company.

[signature]
PRESIDENT

In 1882 the Bell System became convinced that the best way to assure uniformity of equipment necessary for universal telephone service was to control its manufacture through *one* organization. To this end it acquired the Western Electric Company, which operates under this three-fold policy:

1. *To make telephone apparatus of high quality.*

This in itself is not unusual. What *is* unusual is that every item of equipment in the vast network of the Bell System must coordinate so perfectly that from any Bell telephone you can talk clearly with any one of the millions of others. Can you think of any other product which must meet such an extraordinary test?

2. *To work for efficiency and lower costs.*

Whether it be in purchasing materials—or in manufacturing the 43,000 items of telephone apparatus—or in distributing all this equipment to the Bell companies, Western Electric is always seeking the better way. As a result it has a progressive record of methods developed, products improved, economies effected, and costs lowered.

3. *To keep prices at the lowest possible level consistent with financial safety.*

Western Electric furnishes most of the telephone equipment used by the operating companies of the System. By combining their requirements it is able to manufacture more economically; and it eliminates selling expenses and credit losses. The resulting savings it passes along to its telephone customers in the form of lower prices.

On these sales the policy of the Company is to set the lowest prices which will enable it to pay fair wages to its employees, to earn a fair return on the money invested in the business, and to maintain the Company's financial stability.

This policy of voluntarily limiting profits is reflected in the Company's financial record. In recent years it has earned on its investment a rate of return only about half as large as that of a representative group of comparable manufacturers, and over a period of twenty years this rate has averaged less than 7%.

This set-up within the Bell System results in low costs to your Telephone Company, and thus Western Electric contributes its part in making Bell Telephone service dependable and economical.

Western Electric

BELL SYSTEM SERVICE IS BASED ON WESTERN ELECTRIC QUALITY

FACULTY SKETCHES

By Robert C. Becker, Ch.E. '40

Dr. Samuel C. Lind

Dean of the Institute of Technology

DEAN LIND, who has been head of the Institute of Technology since it was first formed in 1935, was born in McMinnville, Tennessee, and lived there until he matriculated at Washington and Lee University at the age of 16. His early interests were in languages and science, but during the senior year he majored in chemistry and received his B.A. in 1899. Dr. Lind continued his education in chemistry at the Massachusetts Institute of Technology and received his B.S. in that field of science. One year later he went abroad to the University of Leipzig, where he received his Ph.D. in 1905, after two years of study. While on a year's sabbatical leave from the University of Michigan in 1910, Dr. Lind did research work, first at the Madame Curie Institute in Paris, and later at the newly opened Institute of Radium Research in Vienna.

His first educating experience was at the Massachusetts Institute of Technology, where he served as an assistant in quantitative analysis, just after receiving his B.S. Upon returning from the University of Leipzig, Dr. Lind became an instructor of physical chemistry at the University of Michigan, which position he held until 1911. After working for 15 years for the government in various capacities, he was called to the University of Minnesota to be the Director of the School of Chemistry; and in 1935 he was placed in charge of all the technical schools, which had just been combined as the Institute of Technology.

Dr. Lind's experience in the industrial field has been spent in government service. Shortly after leaving Michigan, he went to Denver, Colorado, to take part in radium research for the U. S. Bureau of Mines. The government hoped to extract radium from the mines of Colorado, and eventually a process was worked out and a plant built which yielded 8½ grams. Half of this radium is still in the Memorial Hospital in New York, and ½ of a gram is now used for research purposes at our own University. The remainder is at Kelly Hospital in Baltimore. In 1916 this work was moved to Golden, Colorado, and was operated in conjunction with the Colorado School of Mines. Two years later Dr. Lind was made superintendent of the station, and in 1920 was moved with it to Reno, where it was worked in coöperation with the University of Nevada. In 1923, Dr. Lind was transferred to Washington, D. C., as chief chemist of the U. S. Bureau of Mines, and in 1925 he became associate director of the Fixed Nitrogen Research Laboratory (Department of Agriculture).

Dr. Lind is a member of Alpha Chi Sigma, Phi Lambda Upsilon, Gamma Alpha, and Sigma Xi fraternities. Although he is not now active as an instructor, he does do research work and superintends graduate study in the gaseous reactions under ionizing influences (radium rays and electrical discharges). Dr. Lind and Dr. Glockler have just finished writing a book, *Electrochemistry of Gases*, under the auspices of the National Research Council.

Trout fishing offers the best means of "mental relaxation" to Dr. Lind, who angles for the gentlemen of the fish tribe in both Northern Minnesota and in the Rockies. He says that he is a poor golfer, which may or may not mean anything; and that he started skating too late to do much good, for he had never seen ice thick enough to skate upon until he was 18 or 20 years old.

MAGAZINE REVIEWS

By C. Vernon Olson, E.E. '39

WORLD'S WONDER

Called the "World's Greatest Engineering Wonder," the harnessing of the mighty Columbia River in Washington is a prodigious enterprise. Note a few statistics.

The cost of the project, including Bonneville Dam, Grand Coulee Dam and powerhouse, and an intricate network of irrigation ditches, is $469,856,000. This is nearly $100,000,000 more than the cost of the Panama Canal, formerly the most expensive engineering feat undertaken by any government; and is 31 times as much as Thomas Jefferson paid Napoleon for the Louisiana Purchase.

The power produced will be ample to light two-thirds of the farms in the United States, will be four times the output of Niagara, and will generate a billion more kilowatt-hours than the combined production of Boulder Dam and the seven dams of the Tennessee Valley Authority.

Let's hope it will prove to be worth its cost.

"The World's Greatest Engineering Wonder," by Richard L. Neuberger, from *American*, January, 1938.

NO MORE RIVETS

The phenomenal increase in arc welding applications in the last few years will continue, authorities believe, until riveted construction is eventually entirely displaced by arc welding. This trend should be particularly interesting to engineers concerned with metal fabrication, including bridge and building steelwork, auto and airplane frames, ships, radio towers, and so forth.

Two major difficulties had to be overcome before arc welding became practical. First, the fused metal absorbed enough oxygen and nitrogen from the air to leave the weld-metal weak. This was overcome by coating the electrodes with a flux which shuts out air by enclosing the arc in an incandescent vapor. Second, the uncertainty due to the "human element" in welding was great. Strict welding codes and periodical examination of welders has minimized failures due to incompetence.

"Arc Welding" by H. S. Card, from *Armour Engineer and Alumnus*, December, 1937, p. 15.

ALUMNOTES

'05

The Pittsburgh Award for 1937 was conferred upon **Dr. Francis C. Frary** by the Pittsburgh section of the American Chemical Society. The formal presentation will be made at a meeting of the section on February 24. Dr. Frary received the degree of analytical chemist here in 1905 and his master's degree a year later. After studying at the University of Berlin, he returned here to teach, and his postgraduate work resulted in a doctor's degree, received in 1912.

In 1915, Dr. Frary joined the staff of the Oldbury Electrochemical Company, as research chemist. There he acquired special experience in the production of phosgene, which led during the war to his selection to build and operate a phosgene plant at Edgewood Arsenal. At the close of the war, Dr. Frary was a major in the Chemical Warfare Service.

In December, 1918, he became director of research of the Aluminum Company of America. In the past nineteen years, Dr. Frary has made important contributions to the chemistry and metallurgy of aluminum. Among his many achievements are the production, for the first time, of very pure aluminum (99.98 per cent) by an electrochemical process, and the production of pure aluminum oxide by an electrothermal process.

'19

Donald E. Marshall, E.E., formerly with the Proctor and Gamble Company as home coördinator for all plants, is now production manager for the Kellogg Corporation in Battle Creek, Mich.

'23

The Civil Engineering class of 1923 held a reunion at the St. Paul Athletic Club on January 21. At the meeting, **Walter Villaume**, now with the Minnesota Macaroni Co., was elected chairman; and **Arne Aasland**, working with the Harrison & Smith Printing Co., was made permanent secretary. Also at the meeting were: **W. H. Batchelder**, with the Minnesota Highway department at Stillwater; **Swan P. Berg**, with the Soo Line Railroad Company in Mineapolis; **Lester M. Bergford**, with the Cutler Manger cement manufacturing company in Minneapolis; **Frank Christlieb**, with the Highway department in St. Paul; **E. W. Draves**, with Williamson & Williamson, patent attorneys; **Hibbert Hill**, superintendent of the St. Anthony Water Power Company; **Nels Johnson**, with the Highway department in St. Paul; **M. D. Judd**, with the Mason City Brick and Tile company; **Walter Kotz**, with the Highway department in Isle, Minn.; **Irvin S. MacGowan**, selling steel in Minneapolis; **John J. Schlenk**, with the Northern States Contracting company in St. Paul; **Prof. Otto S. Zelner** was also at the meeting as a guest and representative of the faculty.

'32

Appearing in the December 1937 issue of the Proceedings of the Institute of Radio Engineers was the paper, "The Clarification of Average Negative Resistance with Extensions of its Use," by **Dr. Cledo Brunetti**, E.E. This paper, which was Dr. Brunetti's thesis for his Ph.D. degree, is the first doctor's thesis to be published from the Institute of Technology, as Dr. Brunetti received the University's first Ph.D. degree in Electrical Engineering last June. Dr. Brunetti is an instructor in the department of Electrical Engineering at Lehigh University.

'33

We have received an announcement of the marriage of **Clayton Ebert**, M.E., to Miss Margaret Weber in October. Clayton received his master's degree in Metallurgy in 1934 and is now employed in the research laboratory of the U. S. Steel Corporation in the plant at Gary, Indiana.

J. Boyd Tyrrell, M.E., is now chemist and plant superintendent at the Hubbard Milling Company. He is married and lives at Ambridge, Pennsylvania.

'34

Tom Rogers, M.E., ass't manager of *Product Engineering*, was on the campus recently and reported that **Bob Orth**, M.E., is associated with him as assistant editor.

'35

Richard O. Jacobs, Aero. E., is now working in the maintenance department of the Pacific division of the Pan American Airways system. He recently returned to Alameda, Calif., from a tour of inspection to Honolulu, Midway, Wake, Guam, and Manila.

'36

Tom Cooper, M.E., was on the campus recently. Tom is in the Cincinnati office of the Air Reductions Sales Company.

'37

Edward G. Dobrick, E.M. (Geology), worked for the Anaconda Copper Company in Butte, Montana last summer. He is now back at school working toward his master's degree.

Arnold C. Matthies, M.E., recently went to Baton Rouge, La., as Junior Engineer with the Standard Oil Company.

Paul Thomas, C.E., dropped in a couple of weeks ago and told us that he is working with the Crane Company in Chicago, and is taking its student training course.

Don Erickson is in Moose Lake doing construction work for a contracting company.

In Chicago with the Container Corporation is **Reynold Bjork**. Ray was married to Miss Peggy Wolfe last fall.

PICK AND PAN

By M. A. Troxell, M. '39, and H. A. Larson, M. '39

Now that the Miners and Engineers are just one scrappy family, it won't hurt to turn back to the time when there was a little dissension in the ranks. One Engineer's Day the Miners were feeling particularly spry, so they kidnapped the Queen and held her prisoner in the School of Mines the entire day; they then ground the Blarney Stone to an impalpable powder under her horrified eyes. Their chuckles of merriment suddenly subsided, however, when they found out the day after the Shindig that some Engineer had skillfully adulterated the punch with Pluto water.

Backsight Berkner wants to know if capacity reactance has anything to do with the reason why you can't get WDGY while your washing machine motor is running.

The patrol wagon isn't much of an automobile, but it will do in a pinch.

Sometimes we are inclined to believe that lawyers would make good metallographical specimens—they have that case-hardened aspect.

The art students have tea every afternoon for visitors that promise to be sociable. All that's required is initiative and a liking for tea. Have you seen the roller skating parties in their room?

I hear that Prof. Zeleny thinks smoking in bed is dangerous.

Raymond Bass, techuology Senior, is the first man to our knowledge that has been appointed to serve on the Forum Board from the Institute. The Forum is one of the oldest student organizations in the University.

After the TECHNO-LOG dinner we concluded:
1. That Warren Waleen is a man of action.
2. That columnists' jokes are not appreciated.

SLIDE RULE RULES

1. Always carry your slide rule with you. This informs every layman that you are a true engineer with constructive intent.

2. Always sit in the front row and if the professor has any calculations, be the first one to take out your slide rule and "slip it off." This will show the professor that you are an eager, intelligent observer and not to be trifled with.

3. Pay no attention to the instruction booklet which comes with your slide rule—this is merely an advertising medium. You are bound to make a certain number of mistakes before you learn to use your slide rule anyway.

4. Don't bother about the slide adjustments on your "slipstick"—the errors will compensate for themselves.

5. If you are in doubt about the accuracy of your calculations in a quiz, just write "slide rule accuracy"

by the solution. When the professor sees this he will immediately make allowance for your inaccuracy.

6. Sit on your slide rule whenever you can. For working out calculations on curves a curved slide rule is best.

Have you ever wondered as you look at a plate of chow mein as to whether you should eat it, or have?

The train carrying Mussolini and Hitler at their recent conference also contained a drunk who remarked, "Thish is the Fascist train I ever rode."

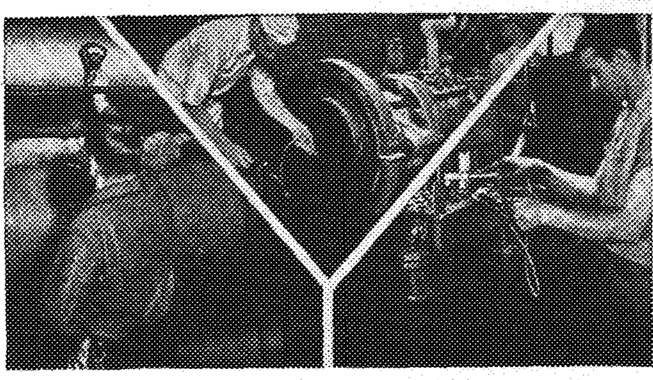
Heard among four Aero's:
First: "Woman's greatest attraction is her hair."
Second: "I say it's her eyes."
Third: "I strongly disagree, it's her teeth."
Fourth: "What's the use of our sitting here and lying to each other."

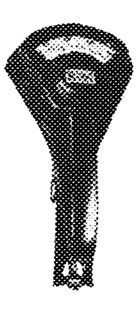
Two head-handkerchiefed young things were strolling along past the "atom smasher" one fine winter day, altogether unaware that ye vigilant news-hound was lurking behind. Suddenly the light of scientific intelligence flashed in the eyes of one, who gushed up like an oil well, "I know what they're going to do—they're going to haul that round thing with the funny face on it up that shaft, and drop it down. That will bust the atoms all right."

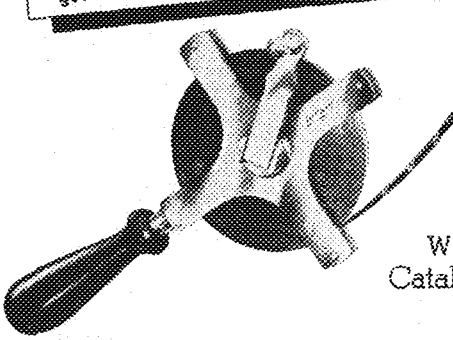
Mary had a little watch,
She swallowed it one day;
And then she took some castor oil
To pass the time away.

Have you heard about the Egyptian girl who didn't know right from wrong? No? Well, she's a mummy now.

The serious thought of the month:
How many of the Institute know just what the Harris system of electing members to the All-U-Council means? The redraft of the constitution is a question that concerns every engineer and affects future representation of the Institute on the council.







TECH NEWS

Dean Lind Will Go To Foreign Meetings

Dr. S. C. Lind, Dean of the Institute of Technology, has been delegated by the National Academy of Sciences and the National Research Council to attend the Tenth International Congress of Pure and Applied Chemistry and the Thirteenth Conference of the International Union of Chemistry. These conferences will be held in Rome, Italy, from May 15 to May 21, 1938. Dean Lind will leave Minneapolis during the latter part of April and will return in July.

Dean Leland Backs Research Fund Bill

Dean O. M. Leland, a member of the executive committee of the Association of Land Grant Colleges and Universities, attended a meeting of the Association held January 10. Dr. Leland was particularly concerned with the introduction in Congress of a bill to provide funds for engineering research similar to the funds now provided for agricultural research.

Profs. Attend Meetings, Give Lecture Series

Dr. J. F. Piccard and Prof. J. D. Akerman were speakers at a recent meeting of the national I.Ae.S. in New York City. "Results of Experiments with, and Possibilities of, Multiple Balloon Aircraft" was Dr. Piccard's subject. "Polar Diagrams for the Solution of the Deflections of Axially Loaded Beams" was Prof. Akerman's topic.

Prof. T. L. Joseph is attending a meeting in New York of the A.I.M.M.E. Among the discussions at this meeting is a symposium on metallurgical education in which both industrial men and teachers are represented.

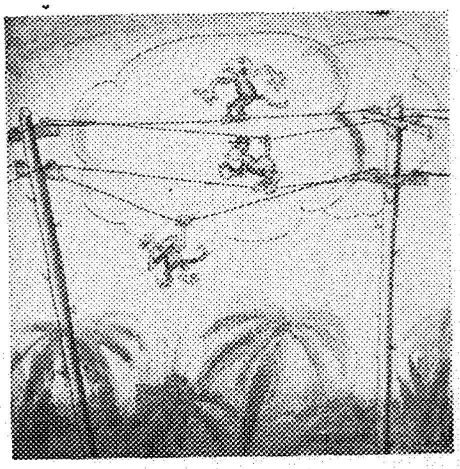
Dr. George Glockler, physical chemist, is making a lecture tour through the Pacific Northwest. He is speaking to ten A.C.S. sections on the following subjects: "Simultaneity and Originality in Human Thought," "Modern Concepts of the Molecule," "The Pseudo Atom," "Activation of Chemical Reaction in Electrical Discharge," and "Chemistry and Spectroscopy."

Engineers Participate In Intramural Sports

The intramural department reports that a large number of engineers are taking part in the various sport activities. In the basketball league the engineers are represented by several teams, among which are the junior Chemists, the junior Civils, the senior Chemists, Triangle, and various teams from the freshman orientation classes. In the hockey league both Theta Tau and Triangle are represented. A great number of men are taking part in the ping pong, handball, squash, and badminton tournaments. Although there will probably be a scarcity of championships won by our entrants, all the fellows are getting a great deal of fun and exercise out of the games.

A. C. S. Hears Lecture By Byrd Associate

At a meeting of the Minnesota section of the American Chemical Society on January 11, moving pictures were shown by Dr. T. C. Poulter, second in command and senior scientist, in charge of the scientific program of the second Byrd antarctic expedition. Dr. Poulter lectured on the subject, "Science in the Antarctic," discussing the biological studies made by the expedition.



"Party line"

Sketch By Meisch Wins in Preliminary

The Society of Beaux-Arts Architects has announced that Francis Meisch, Architecture senior, is one of 20 Americans to place in the first preliminary exercise of the society's 31st Paris Prize competition. Should Meisch be successful in the second preliminary competition he will go east to compete for the grand prize—a European scholarship.

Attention, Juniors!

On March 8 the Technical Commission will select a junior to be *General Arrangements Chairman* for

ENGINEERS' DAY

Each candidate must (1) be a junior in Technology, (2) be eligible (a "C" average and no unremoved failures or conditions), (3) secure a statement of eligibility, (4) have a petition for his appointment signed by 25 juniors, (5) present a plan of operations and organization and a budget, and (6) send his name, address, phone number, and P.O. number to the Technical Commission at P.O. 6308.

Candidates will present petition, plan, budget, and statement of eligibility to the Technical Commission on March 8. Most important considerations are (1) completeness of plan, (2) judgment in budgeting, and (3) leadership, experience and apparent ability. Engineers' Day will be May 13-14.

Room 343 of the Chemistry Building, formerly a class room, has been converted into a laboratory for organic micro-analysis. Balance cases along the wall have been mounted on rubber to eliminate outside vibration. The equipment in the laboratory is so sensitive that minute quantities of gases can be isolated and their weights determined to the nearest 1/100 of a milligram. One piece of apparatus, designed by Dr. W. M. Lauer, and the best of its kind, is used for determining quantities of carbon and hydrogen.

Aero's Take Off at Annual Ball

The annual Aeronautical Ball, sponsored by the Flying Club and the I.Ae.S., is again scheduled for the eve of Washington's birthday. Co-chairmen Don Frankel and Al Raudenbush with their assistants have arranged for floor show of campus and professional talent. The take-off is scheduled for 9:30 p. m. in the Union runway.

The latest journalistic achievement of the Aeros is the I.Ae.S. *News*, a small mimeographed newspaper published every two weeks and distributed to members. The paper originated with Robert Schoonmaker, and the present editors are Don Crowley and Bob Brattvet. Three issues have already come off the presses.

The first meeting of the winter quarter featured the showing of two motion pictures through the courtesy of Pan-American Airways. One described the new Transatlantic service and the other showed the sights seen on a South American air cruise.

John D. Akerman, head of the department of Aeronautical Engineering, has been appointed an associate fellow in the British Royal Aeronautical society. He is the only foreign member of that society in this section of the country.

Dean Lind, Fixen Address A. I. E. E.

Dean S. C. Lind spoke on the evening of Wednesday, January 19, at a meeting of the local chapter of the A.I.E.E. in the Saint Paul Athletic Club. The subject of the talk was "The Work and Organization of the Institute of Technology."

The local branch of the A.I.E.E. sponsored an inspection trip for all electrical students on January 21 to the Electric Machinery Co. of Minneapolis. The plant is equipped to make nearly all the parts used in its machinery, and the electricals were able to see all the steps necessary in producing electrical equipment.

Mr. Fixen, E.M., L.L.D., addressed the A.I.E.E. January 26. In his lecture Mr. Fixen discussed "The Practical Engineer," in relation to the engineer after graduation. Plans for a senior inspection trip during spring vacation to some out of town plant were discussed after the meeting.

February 2 the A.I.E.E. made its annual inspection trip to the Riverside Power Plant in North Minneapolis. One week later the junior electricals sponsored a lecture and demonstration on photography.

Miners Lured By "Shindig", Lectures

The twentieth annual Miners' Shindig, to be held Saturday, February 19, at the Commodore hotel, St. Paul, will feature the music of Jimmy Pidgeon and his orchestra. Each couple attending the Shindig will receive an aluminum souvenir ticket.

Speakers have presented interesting topics at recent meetings of the School of Mines Society. On January 13, Dr. George Theil spoke on the subject, "Chasing Meteorites." He described the usually fruitless examination of fragments brought to the laboratory as possible meteorites. On January 20, E. P. Barrett of the Bureau of Mines Experiment Station discussed the subject, "A New Tool for Research Workers," a description of a revolving high frequency induction furnace useful in the study of slags.

Civils to See Film Feb. 23

Pictures of the Golden Gate Bridge will be shown Wednesday evening, February 23, in the Chemistry auditorium by the A.S.C.E. This will be the first showing of the pictures on this campus. The society has extended an invitation to all Institute students to attend the presentation. There will be no admission charge.

Are We Cultured?

It is often said that the engineer is a fact-minded person, lacking in culture and not possessing the vocabulary of a well-bred gentleman. We offer the following quotation from a recent technical periodical as evidence to the contrary. What do you make from this collection of English words?

"The sciuroid rodent, of the Marmota family, known to the erudite as the Arctomis Monax, emerging from his condition of seasonal torpidity, and, perceiving his adumbrative projection, resumes his wintry seclusion, thereby prognosticating an additional sextuple hibernacular period."

LINDQUISITION

By Bertil H. T. Lindquist, Aero. E. '38

"Kewpie" Raudenbush tells me that the difference between amnesia and magnesia is that when you have amnesia you don't know where you are going—but when you've got magnesia you know darn well where you're going . . .

It is this old scrivener's earnest contention that you can definitely tell the extent of a man's breeding and social development by the amount of amusement he gets out of seeing a derby. Ye olde editore had to see four in a row before bursting into uproarious laughter.

In Scotland, a dead end street is one with a toll bridge at the end.

Speaking of good breeding and such, take our hallowed All-University Council, (no, you take them—I certainly don't want them). They are certainly aces in the art of consummate egotism. In drawing up their vaunted merit system they graciously award the president of W.S.G.A. 5 points, and then crash through with their triumph—*they award themselves, as members of their All-U council, seven points!*

The Aeronautical Take-Off is getting all set to roar into action the 21st of this month. This affair always seems to be the high spot of the year—and it's always followed by a holiday. . . .

Lapsing into sentimentality for a moment, may your old raconteur offer the strange fact that in no way the least of the multiple benefits you derive from attendance at this old institution is the friendships you develop with your instructors and fellow Institooters—truly the cream of the crop. . . .

Daily Purge

Had a swell bit of "beef" stew cooked up for the *Daily* for screwing up the publicity and misplacing the dates for our recent social functions, but your old scribbler had a talk with Editor Richter and the boys over there, and they kicked the props out from under it—seems they're not villains intentionally. They freely admitted that the deal they've given the engineers lately has been a bit on the over-ripe side, but they want to play ball and you fellows can pitch. Here's how: any Institute of Technology organization that has plans for publicity or news that it wishes to have published in the *Daily* will bring it into the TECHNO-LOG office, room 37, Electrical Engineering, where Bob Moore and myself will take care of it for you. Bob will be the pilot light to keep the heat under the whole thing—and probably under me, too. As soon as we get your material, we'll get a reporter over to pick it up for Crane Rosenbaum, *Daily* science writer. In that way we'll avoid having it kicked around through society, W.S.G.A., Periscope, sports, etc.; the stuff will go straight to the news editor. We hope that this will help straighten out the mess. Give it your earnest consideration—and use your TECHNO-LOG . . . .

And you can definitely determine the sex of a sardine by watching the tin from which it emerges . . .

When your scribe wailed to good Prof. Wilcox (he's the gentleman with the unique and original system of painless math injection) about the fact that when you've been around the school long enough to see the need of a few reforms and a way to put them across—it's time for you to leave. The venerable professor concurred with his old French proverb, "If Youth but knew, and Age but could."

Wish our local theaters wouldn't all run the same show at the same time . . . Said the old maid: "Now I lay me down to sleep—dammit!" . . . Editor Helland's third name is one letter off from "John" and we have never been able to guess it. Any help is welcome . . . Business Mangler Waleen had to sign his name all last summer at camp as "Waloon" because the gov't made a mistake when it put monicker down on the payroll—and it seems they are a bit finicky about changing it . . . and we think maybe they knew W.L.W. pretty well at that . . . Miner Simmons knows a bookful of poetry by heart—you could never tell by looking at 'im . . . . This dope Quigley is a pretty big guy, regardless of the self-disparagement he spews forth in his bi-weekly stint . . . . Never saw such a mild winter—and we with new skis and all . . . .

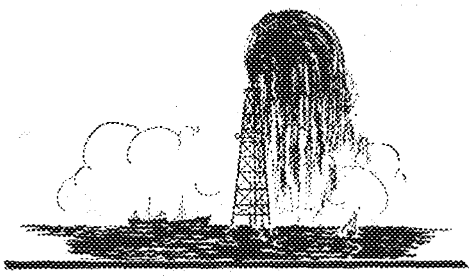
G-E *Campus News*

TEST ALUMNI DAY

TO celebrate the third annual reunion of engineering graduates of General Electric Test, men all over the world gathered in groups to listen to the international radiobroadcast of the reunion at Schenectady, N. Y. Officers and prominent members of P.T.M., or Past Test Men's Association, sent greetings to their fellow Testmen over the General Electric shortwave stations, W2XAD and W2XAF.

More than 15,000 men have graduated from G-E Test—a course which enables them to supplement

their theoretical knowledge with a practical training. Test graduates today hold many responsible positions in the Company. Others have gone into every walk of life—engineers, lawyers, utility executives, farmers, industrial leaders, bankers, and many other professions. There is, however, one tie which binds them all—their experience "on Test," and to many of them that experience is recalled with somewhat the same enthusiasm as days in college.

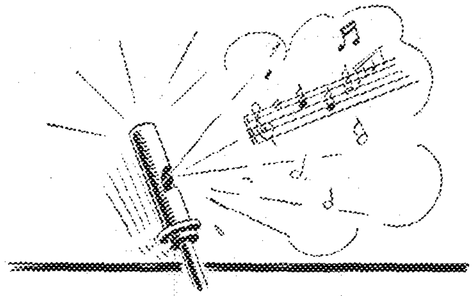


OIL FROM WATER

DOWN on the shores of Lake Maracaibo in the steaming jungles of Venezuela, the Dutch Shell Company owns rights to a fifty-mile frontage. Here it has drilled hundreds of wells to make available the rich oil found in deposits ranging from 1500 to 5000 feet below the lake surface.

The natural gas which accompanies the oil deposits has for years been used to power the wells. In spite of this cheap source of power, General Electric engineers under the supervision of E. E. Thomas, Kansas State '22, were able to convince officials of the Dutch Shell Company that it would be more economical in the long run to use electricity instead of natural gas and gas engines for operating power. As a result, a high-voltage line will be erected along the lake shore, from which step-down transformers will distribute current to the motors in the producing areas.

The Lago Petroleum Company has wells in a section paralleling the Dutch properties and extending ten miles out in the lake, which has already been electrified. The combination of these two companies makes the largest electrified system of its kind in the world, from which 400,000 barrels of oil are shipped daily to refineries in Aruba and Curacao, N.W.I.



WHISTLING GASES

GASES are liquefied to be used as cooling agents and to conserve storage space. Chester W. Rice, Harvard '10, consulting engineer in the Schenectady Works of the General Electric Company, has developed a method of thus processing gases more readily by making them whistle.

To liquefy a gas by this method, it is necessary to compress it to 3,000 pounds per square inch, cool it, and pass it through a series of tubes into a liquefying chamber where the pressure is released through a valve in the form of a whistle, producing a further escape of heat energy. Mr. Rice's whistle is so pitched as to convert the greatest amount of heat energy into sound energy. To be effective, however, the sound energy must be carried away from the liquefying chamber.

Developments such as this are being made by college graduates who were at one time "on Test." Many of them have been off the college campus but a few years and are entering a career in one of the many business and engineering fields in the General Electric Company.

GENERAL ELECTRIC

90-40DH

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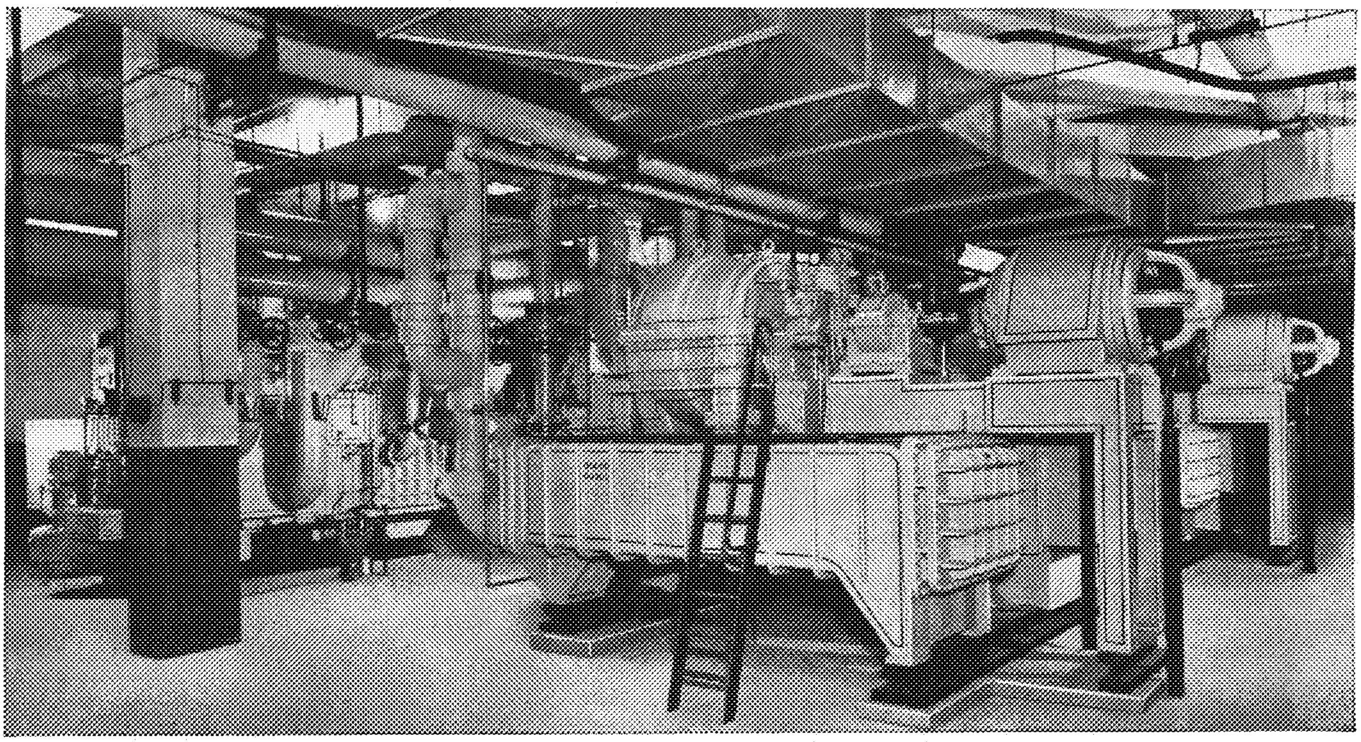
MARCH 1938

MINNESOTA TECHNO-LOG

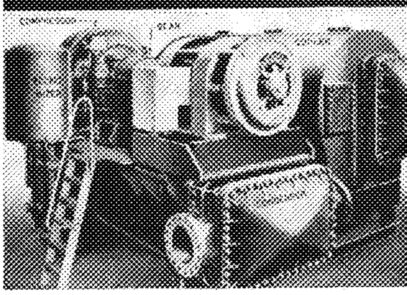


CARRIER CENTRIFUGAL REFRIGERATION—
the development that revolutionized an industry!

IT'S a simple matter to provide refrigeration for air conditioning small stores or buildings. A good conventional compressor will do the work in a satisfactory manner, and at reasonable cost. But it's a different matter entirely to supply the thousands of tons of refrigeration required for cooling skyscrapers—or for industrial processing. Space is costly. Power costs must be controlled. Paralleling the trend toward rotating, high speed, smooth-action machinery, Carrier engineers developed Carrier Centrifugal Refrigeration—a development that literally revolutionized the industry!

Think of a compressor capable of supplying cooling equivalent to melting 1000 tons of ice each day—yet so compact that it can be installed in a fraction of the space required for conventional compressors. So economical that power costs are reduced as much as 25%—yet so simple that no skilled attendants are required. So efficient, the first machine constructed is operating today, as effectively as when installed, 15 years ago.

Above: Carrier Centrifugal Refrigeration machine providing refrigeration for air conditioning of skyscraper. *Below:* Diagram of construction.



Centrifugal Refrigeration . . . Evaporative Condensing . . . safe refrigerants . . . in fact every Carrier contribution to the comfort and efficiency of the world has been brought about through engineering. And the opportunities for young engineers to gain recognition at Carrier are greater now than ever before. At Carrier, young men hold responsible positions—their capacity gauged, not by age, but by ability. Whether that ability is fostered best by laboratory research or field work in the far corners of the world, Carrier enables engineers to progress.

☆ ☆ ☆

During 1937, Carrier trained 300 recent graduates from leading engineering schools in every section of the country. Carrier needs more men. If you had a good school record, and are interested in the world's most fascinating and fastest-growing industry, write us.

Carrier Air Conditioning

CARRIER CORPORATION, SYRACUSE, N. Y.

AN ORGANIZATION OF ENGINEERS

The NEW SPRING *"Minnesotan"** *Model* SUITS

To get the complete picture of "what's what" for Spring in smart clothes for university wear you should see the new "Minnesotans" . . . The curtain's up now on a new selection. Prices start at $29.50.

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**The "Minnesotan" Model*

Minnesota Techno-Log

Volume XVIII — 37 Electrical Engineering Building, University of Minnesota, Minneapolis — Number 6

ERLING HELLAND, Managing Editor — WARREN WALEEN, Business Manager

Published Monthly
from October to May

☆ ☆ ☆

This Month

This month's cover illustration depicts two bridges over the Mississippi river in downtown St. Paul. It was taken by Myron Blumberg.

The Minneapolis Summer Field housing project is described for us by Albert Arneson. Although this is Al's first written contribution, you have seen his work before in the excellent drawings which have illustrated the TECHNO-LOG this year. Al is a junior in Architecture and is a member of Alpha Rho Chi fraternity and the Architectural society.

Gershon Gendler and Joe Flatt enter the ranks of our contributors this month by writing an article on the construction of the atomic observatory. Gersh is a sophomore Mechanical while Joe has the same standing in the Aero department.

Millard Troxell, one of our columnists from the School of Mines, steps out of his column for the second time this year to give us an article on what he did 2,500 feet under Butte when he worked for the Anaconda Copper Company last summer as a general apprentice in the mines. He is a junior and plans to specialize in ore dressing and flotation.

Mr. C. A. Phillips, who writes this month's employment article, is personnel supervisor for the Northwestern Bell Telephone Company. He directs the company's employment policies and is secretary of its Employees' Benefit Commission.

Dr. M. C. Rogers, who wrote the article on engineering societies, is a newly appointed assistant professor in chemical engineering. He graduated from the University in 1926 and was president of the TECHNO-LOG board in his senior year.

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Chairman: PROF. RICHARD W. BECKMAN, Iowa State College, Ames, Iowa

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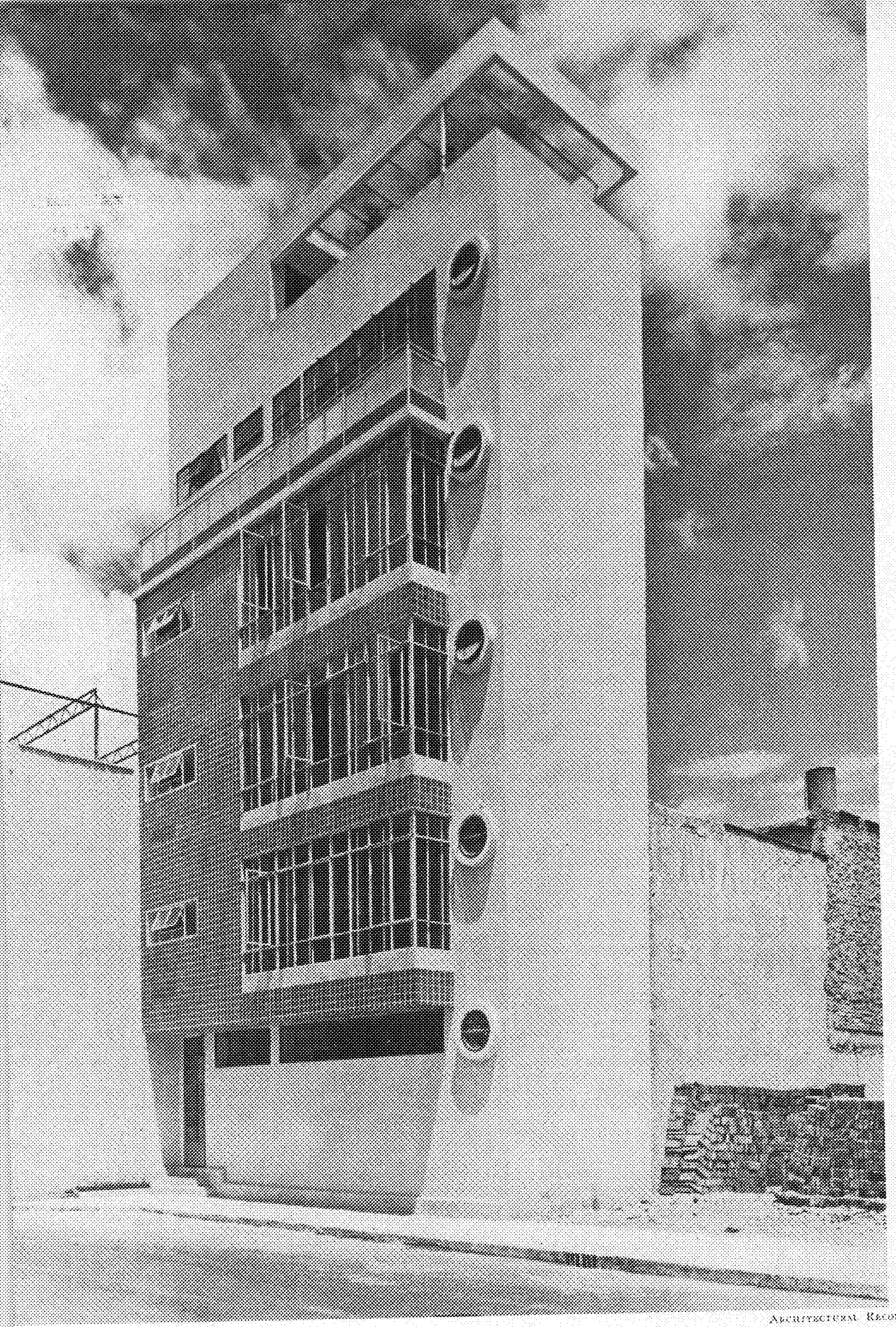

ARCHITECTURAL RECORD

A Mexican Apartment House

From "Worst Slum" To Modern Housing

Minneapolis is the scene of one of the Federal government's attempts to solve the problem of the "ill-housed third" of the population. The Sumner Field project combines questions of architecture, economics, sociology, and politics into the larger question: Is federal housing the best solution?

By Albert Arneson,
Arch., '39

THE Minneapolis Housing Project, better known as the Sumner Field Project, is part of a social movement to supply the lower income classes with adequate, sanitary, and socially acceptable homes. The need for better housing is seen in the prevalence and danger of devastating fires, disease, moral lassitude, and of building collapses with wholesale losses of lives. But where and how are laboring classes going to get better homes? Their incomes cannot afford anything better and landlords cannot operate at a loss. Either an adjustment must be made between the costs of building and wage levels or the providing of low cost homes must be taken out of the hands of private contractors. Since the economic system is not easily manipulated, the government has started a drive to erect thousands of low cost homes to replace slums and "blighted" metropolitan areas.

Although the larger eastern cities are the worst offenders, Minneapolis and other mid-western cities are not without slums. Despite the blessings of a comparatively level terrain, many lakes, a big river, and nearby woodlands, Minneapolis has several slums. The Minneapolis Housing Project at Sumner Field was created to replace a vicious slum. A verbal picture of what existed before the site was cleared is appropriate. Ordinary city blocks 300 feet wide were divided lengthwise by an alley and the lots were subdivided so that they faced both the alley and the street. The dimensions of the average lot were 25 x 72 feet with an area of 1800 square feet, whereas the accepted minimum is 4500 square feet for an average city lot. The lots were hardly large enough to contain a small house, let alone provide room for the other functions of a home. There was little room for trees and none for gardens. What space there might have been for grass was tramped bare by the feet of children who had little place to play. The houses were too close together to allow much sunlight. Amidst such uninspiring surroundings the houses fell into decadence from lack of proper maintenance. The unpainted boards and the general crowding of many houses on small lots made the neighborhood a dangerous fire hazard. A single conflagration could have reduced the site to ashes.

Fortunately, Minneapolis has civic-minded citizens who did not wait for the housing movement to outgrow its growing pains before taking action. They presented to the government in 1933 a tentative plan based upon an exhaustive study of the area. The government accepted the project and authorized its construction under the housing division of the Public Works Administration.

The task of executing the project was not an easy one. The first step was to buy the ground. The government supervised the acquisition, which was done piece by piece in a little over a year's time. The enormous job of completing the working drawings of the 410 dwelling units was accomplished by an office force of 40 men working almost continuously in an office set up in the Foshay Tower especially for the purpose. The project suffered a severe reversal when the bids were turned in. The size of the project had to be reduced because the bids were too high. Part of the excessive cost was due to the fact that certain of the houses were to be built over the old Bassett Creek bed. The necessity of sinking deep footings into the fill at that location made construction prohibitively expensive. After the contracts were let out to private construction companies on a competitive bid basis, work was begun. At present all the framing is done and most of the buildings are ready for plastering. It is expected that the project will be ready for occupancy by next fall.

The buildings are excellent examples of honest architecture. All plans are simple and functional. All trick schemes were discarded for more simple ones. The same is true in construction. The structures are simple wood frames with brick facing, the cheapest and most durable construction under the circumstances. Originally the buildings were intended to be of concrete with brick trimming but this proved to be too expensive. The design is also simple, almost to the point of austerity. The reason for this uncompromising architectural honesty is the underlying principle of the entire project: to give the most architecture for the least money. It is planned and built to give effective service over a maximum number of years.

The rents are computed on a dual basis. One of the things taken into consideration is that the government should get back 55 per cent of its original investment in rents in 62 years. The remaining 45 per cent of the costs is an outright grant from the government. Whether the project will still be standing 62 years from now is a subject of much personal and professional speculation. The second consideration in fixing the rents was an estimate of what the intended occupants could afford to pay. This was estimated from the incomes of the former residents of the neighborhood whose homes the project is replacing. After all important factors were taken in account, the rents have been set at approximately $7.50 per room per month including heat.

It is intended that the new houses will be occupied by as many as possible of the former residents. The project is not big enough to take them all in nor can all of them afford to pay even these low rents. In order to facilitate the influx of these people, no color nor religious lines will be acknowledged because the neighborhood is filled with people of both the white and negro races. And to prevent others from taking advantage of the low cost houses a rule has been set that no family whose total income exceeds five times the rent rate will be allowed in Sumner Field Project.

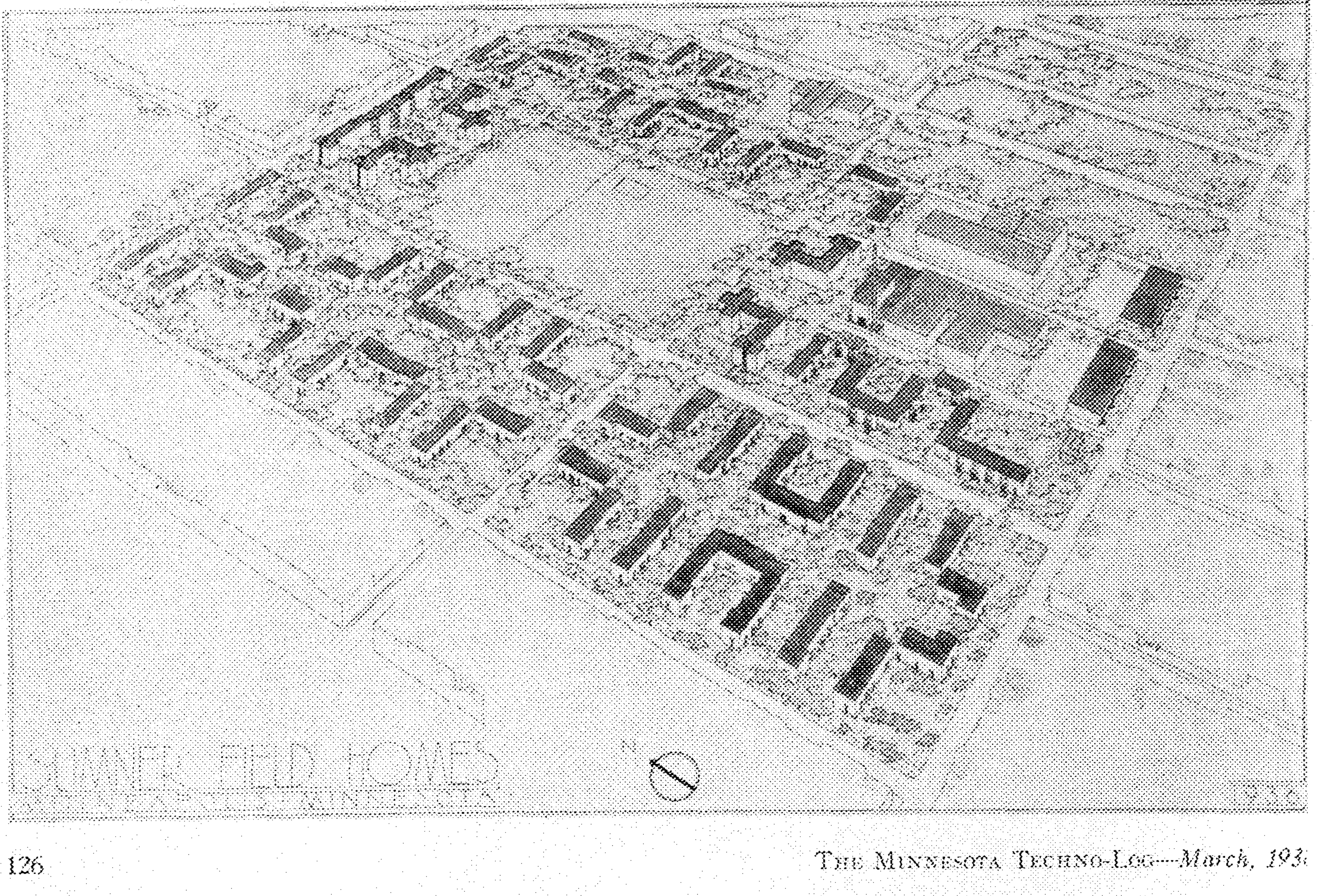
The project is ideally located. It was carefully placed where it would do the most good, in other words, it replaces the worst slum. It embraces a park which offers a place for children to play. It is near enough to the heart of the business sections of Minneapolis so that mothers and housewives can walk to the shopping centers without undue exertion. It is also near the major industrial zones. It is estimated that no worker needs to spend more than thirty minutes in transit between home and job on the Minneapolis streetcars.

Although the future of the Sumner Field is secure, that of a general housing movement in Minnesota is not certain. The benefits of the Wagner-Steagall Bill recently passed in Congress will not be available to Minnesota until it establishes the appropriate governmental machinery required to share in the 320 millions allotted to the bill. There is at present a movement under way to call a special session of the Minnesota legislature in order to create the necessary organization. If this should come to pass, then the administration of the Sumner Field Project will automatically be transferred to this new authority.

To treat the symptoms and then to cure the disease are the approach and the ultimate goal of every practitioner following the first diagnosis. In the ailing case of American low cost housing the government has assumed the rôle of the practitioner because it understands that the small wage earner will never have a decent home under the present social system. Yet the government should not be looked upon as a self-appointed Santa Claus because it is repairing its own health when it eradicates the slums which have been for a long time a pain in its side. Nor should it be overlooked that the present administration is dependent upon the low wage earner for support.

The few futile model projects and the handful of sentimental essays that appeared early in the last decade are proof that a diagnosis has been made. The treatment of the symptoms is under way at the present time. There are 50 projects in 40 cities with an aggregate value of 120 millions or enough homes to house a population of a city of the size of Des Moines. It is a staggering total yet it is only a drop in the bucket. There are still an estimated 10 million families or about one-third of the population that is ill-housed. The disease will be cured only when a significant majority of the slums are eliminated.

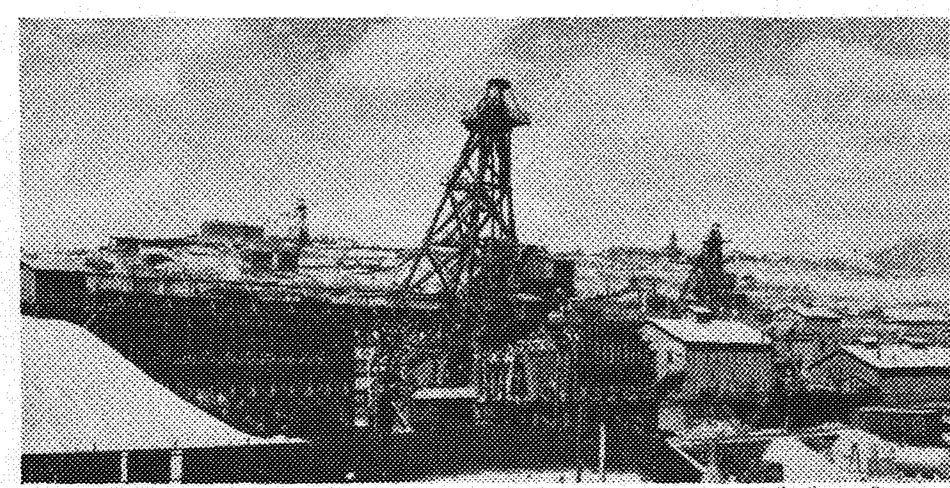
An architect's sketch of the Sumner Field housing project in north Minneapolis. It is hoped that former residents of the rebuilt area will occupy the 410 new dwelling units.



With a Minnesota Miner In The "World's Richest Hill"

By M. A. Troxell,
Mines, '39

What "squooshed" in Millard's boots? What do frolicking miners throw at one another to lighten the day's toil? What is a "mucker"? Stop and read—or forever wonder.



C. Owen Smithers

" . . . Butte has been practically turned inside out in the search for King Copper . . ."

WHY not go West again? The memories of my childhood in the splendor of the Colorado Rockies came back as there rushed to my mind's eye visions of bright blue columbines, brilliant orange "Indian paint-brushes," twisting, spiralling mountain passes, foaming mountain torrents rushing pell-mell down a hillside domain, Buffalo Bill's rock-bound tomb enshrined in the lofty grandeur of vast purple crags.

But now the copper wealth of Montana was luring me onward—the mighty giant which reposes in golden yellow chalcopyrite, dull gray enargite and chalcocite, peacock-purple-filmed bornite, deep indigo covellite, ruby-plush cuprite—an artist's palette chosen from nature's mineral rainbow.

Here was an unforgettable opportunity to glean priceless mining experience from that greatest professor of all—Mother Nature. And at $5.75 a day couldn't I put aside a tidy little sum towards next year's college budget? I didn't hesitate much when my motherly landlady of the past two years regretted, "It's too bad you aren't going to Montana—you could ride as far as the Yellowstone with us!"

At three o'clock one crisp, cool Tuesday morning we were on our way. By noon we passed through Bismarck; by evening we were in the midst of the badlands of North Dakota—our first taste of the west. Here dull clay peaks of red and gray assumed delicate colors in the glow of the setting sun—a fitting sample of western scenery yet to come.

At Laurel, Montana, Max Big Man, educated Indian chief employed by the Laurel Chamber of Commerce, regaled us with his tales of the old West while his family sang Indian songs and tried to sell us leather doo-dads adorned by beads. In Livingston—a modern little cattle town thrown at the foot of a bigger hill than you'll ever see in the middle-west—we received our first glimpse of a cow-hand; in fact there were two or three of these "Vanishing Americans" lolling against store windows and tranquilly eyeing people who passed by. They really had ten gallon hats, fancy shirts, and those odd-looking, big-heeled boots, too.

This was the parting of the ways; my landlady's family went on to the Yellowstone, while I struck out alone on the dusty road to Butte—125 miles away. Blanket, comb, toothbrush, and changes of shirts and socks were stuffed into a knapsack on my back, while a miner's hat dangled ungracefully down my back. Before I had even left the main street of Livingston a kind-hearted soul in a new Ford noticed my hopeful facial expression and heavy pack—he went five miles out of his way to deposit me in a good spot for hitch-hiking.

The very next car which came along was a brand new Buick driven by a very jolly railroad executive. As soon as he heard I was from the Middle-West he began to tell me how grand the West is. "Just breathe this pure mountain air. Better than a million bottles of medicine, isn't it? Yes, sir-ee, I wouldn't live any place else for anyone!" But, alas! He was going only to Bozeman so I was soon on the highway again, with 75 miles still to go.

At this point I must have waited half-an-hour out in the sun watching cars go by. I approached the point where I would gladly have accepted a ride in a hay-wagon, when a nice new La Salle stopped up the road. This time it was an orange salesman who was bound for Seattle via Butte!

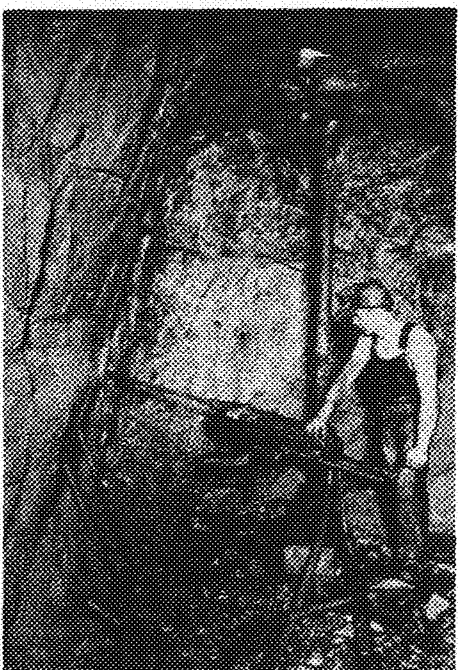
I was settled in my hotel room in Butte at five o'clock.

Bright and early the next morning I watched the arrival of the miners at the Leonard Mine with a good deal of apprehension. Finally, with my heart in my mouth, I was ushered into the office of Mr. Rahilly, general assistant superintendent of Anaconda Copper Mining Company.

"Well, I don't know. We're having quite a bit of union trouble right now and we promised to hire only experienced miners." At this point I timidly extended my letter of introduction from the School of Mines. "Hm-m-m. Well, I'm pretty busy today—come back Monday." I left the office not knowing what to think, but on the way to town who but Mr. Rahilly should stop to give me a ride! "I think it *can* be arranged, all right." Needless to state, my exultation knew no bounds.

Meanwhile I had a week-end to explore Butte—the "richest hill in the world." Butte is cosily nestled in among vast purple mountains marred only by "Kelley for Mayor" and "O'Flaherty for Councilman" signs painted on the bare rock. To take a long walk up the hillsides of the city and visit a few of the thirty-odd mines located in the city itself causes a slight catch in your breath, for the elevation is some 5,700 feet. The tailings dumps of the mines were at first a source of mineral specimens for me but I later accumulated better specimens in the mine.

Everything in Butte was "wide-open" at the time I was there. I confess I don't know how the usual business establishments were sandwiched in between the bars, souvenir shops, games of chance, and the miners' supply stores. I used to derive quite some amusement watching people play roulette at $5 a crack with silver dollars. At irregular intervals "Keeno!" was announced in the routine chant of the back-room gambler, with the excited murmuring of the crowd echoing just afterwards. In one week I saw one man run $5 up to $400 and lose it all again in the course of the evening; two days later he made $600 only to lose it; and the next night he cleared $200, but departed penniless. I nearly became a nervous wreck out of sympathy for the poor chap.



RAY NELSON

"The first stope resembled an oven . . ."

There are more beautiful cities than Butte, for several reasons. To begin with, Butte has practically been turned inside out in the search for King Copper, so that Mother Nature is rather immodestly exposed over a considerable portion of the city. Butte is the only town where I have seen inebriates lying on the sidewalks and sober people spinning yarns while sitting on the curbstones of the business section of the city, but I suppose most western mining towns are like this. There are comparatively few modern buildings in the city, but there are fertile fields for an active imagination in thinking of the intriguing tales hidden in those buildings from the days when Butte was the rip-snorting bad boy of the West. When razed as fire-hazards, several of the older buildings were found to b honeycombed with secret passages.

Monday morning at the mine I was instructed how t obtain a "rustling card," issued by the Butte Mutua Labor Bureau maintained jointly by Anaconda Coppe Mining Company (affectionately referred to by th miners as A.C.M.) and the Miners' Union. I "rustled successfully at noon, and Tuesday morning reported a the mine presumably fit for work. How I hated to ap pear in those nice new overalls with that nice new lunc box! The one consolation was my hard-shelled ha which was a different style from the Butte "derbies. When asked, I explained that the helmet was of th style used in the Minnesota iron mines, but was carefu not to stress my previous mining "experience." "Well, I consoled myself inwardly, "I *have* surveyed a mine!"

Oh, that first shift underground! Never before ha I come so close to the abode of His Satanic Majesty but as far as mental and physical experiences are con cerned, I might just as well have been there. I did m best to run an electric mine locomotive for about an hou until I nearly killed the Shift Boss, who then—to put i mildly—told me my services were no longer needed. argued so persuasively, however, that I finally was pu loading cars from the chutes, which carry the ore awa from the between-level stopes. After I had spent tw hours filling two ore cars from a chute which turned ou to be empty (figure that one out) I was ungraciousl corrected in my error by the long-suffering Shift Bos who directed my activities to the proper chute! Now the principal dangers a loader has to his person are smashed hand or a lungful of silica dust, but he can le the chute run too long and make a nasty mess on th rails, which possibility I of course investigated. He i also supposed to sort out all chunks of gangue "as bi as your fist" throughout the entire car but particularl on top (if the assistant foreman should happen to b along) and still turn out forty cars (320 cubic feet) o ore a day, tramming his own cars. I never did attai the line of demarcation between correct sorting an the proper ore output.

The first few days I was so tired at noon that I fel asleep without eating anything. This didn't affect m thirst though—I religiously drank at least two gallons o water every day in the eight hours I was working i the mine. Practically all of this was perspired away t run down my person and accumulate in my rubbe miners' boots, causing a delightful squooshing noise whe ever I walked. The usual temperature of the working away from the shaft increases one degree Fahrenhe above surface temperature for every 100 feet below th surface and I was stationed about 2,500 feet unde ground. The end of the day would always crawl aroun on leaden feet, however, leaving a much relieved you truly free to go out to the sill and wait forty-five minut for the up-going cage; we were always the last crew go up. This had its advantages from the workers' vie point though; we were also the last to go down in th morning, which meant some fifteen minutes less worki time for the men on our level.

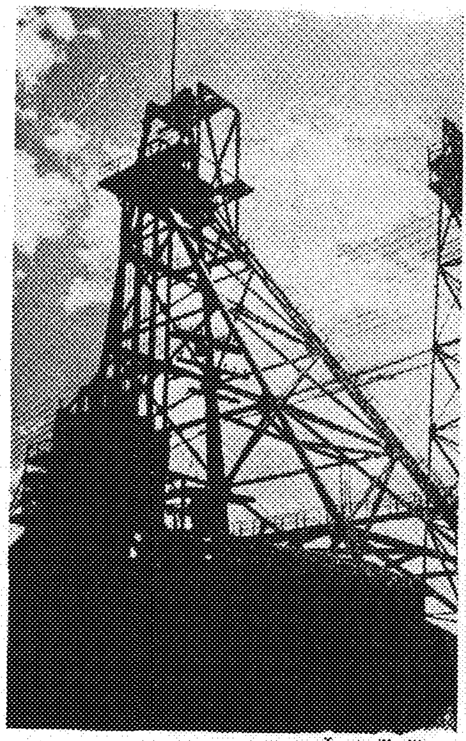
The first few evenings I went directly to bed upo arriving at home after work was over. Later on managed to build up resistance so that I could stay until 9:30 at night and still get up at 6:00 in the morning. As soon as the work became a little easier for me it seems that I was transferred to the muck-stick. Now a muck-stick is merely a miners' term for a shovel and a mucker is a soul-less creature who manipulates the business end of said shovel for seven hours a day—that's me! It's jolly fun—and unless you have rubber-coated gloves the copper water helps you wear out a pair a day—a pair of overall pants lasts about two weeks. One's hands also have "that tired, worn-out feeling" unless they are tough like most miners' hands are (mine weren't). One's spinal column also protests at being straightened out at the end of the day.

The most fun I had down in the mine was at noon hour when the locomotive operators and swampers had water fights at the station. The miners would derive great merriment in poking a water hose in through the frame of a mine locomotive (this would correspond to the radiator of a car) and turning on the hose. A perfectly innocent locomotive would then become the dispensary for a sizeable jet of water—to the satisfaction of all unaffected spectators. Only occasionally would two gallant gentlemen each grasp a hose, face each other, and fight it out. Incidentally, all the bosses ate their lunches on the surface.

Another period in the mine I enjoyed was the interval between the end of the working day and the arrival of the cage. At this time I became acquainted with most of the miners on my level. The topics of conversation ran from the merits of unions to getting what you want in your lunch box when you want it. I became known as the mine high-grader—if this is possible in a copper mine—because I always had a mineral specimen or two in my lunch box at the end of the day. If any of the miners had left-over lunch the proper disposal was by the aerial route in the direction of another miner—this was all right until soft-boiled eggs entered the scene. When we were being carried to the surface in the triple-deck cage the miners would invariably scrape their feet, loosing a small avalanche of pebbles on the miners below. For diversion, partially-empty water sacks would be completely emptied on these unfortunates. The miners on the lowest cage always got it in the neck.

After about a month in the mine I was put with a "pardner" who knew as much about things as I did. We were supposed to muck up to the scene of attack, tear up the rails, drill shallow holes with a jack-hammer, and blast. Despite the slight irregularity of being caught in the act of unscrewing the bolts on rail connections instead of knocking them off with an axe, we progressed nobly until it was time to blast—and neither of us had blasted before! There were twenty-one sticks of dynamite all dressed up and no place to blow! We finally lit the last fuse leading to a load on the last notch of the spitting fuse—if this hadn't happened, the night shift would have had some unexploded dynamite to dig into. But our shots went off all right and we left for the sill bursting with pride only to find that the A.C.M. no longer desired the services of those who try to unbolt rail connections instead of knocking off the bolts.

At this point I was sorely tempted not to ask for my job again, but reason eventually prevailed. After all, I wanted the mining experience. This time they decided to put me on "contract mining." "Contract" gives you the opportunity to make more than the standard day's pay if you have a decent stope or raise. But if you are given a "wild hole" you can work like a machine all day and still not make a day's pay. Now just guess what sort of places they put me in. The first stope, or room, resembled an oven except that an oven has atmosphere. The second stope looked as if it would cave in if you dared to say "BOO!"; the last six men who had worked there had all quit. The third and *last* stope I was in had rotten timbers on the deck just above so that I was continually expecting pennies from heaven to come raining down. I did get some peachy mineral specimens though. I remember casting a defiant look at the Shift Boss out on the sill that night.



Joan E. Howe

A head frame silhouetted against the sunset.

The next day I packed my possessions — that didn't take long. I remember paying the Post Office $2.50 to mail my mineral specimens and luggage home, but it was worth it. I wrote Mr. Rahilly a letter of gratitude for this opportunity to gain mining experience. After packing my lunch box as full as possible with food I hopped the Minneapolis-bound freight. When I finally arrived in Saint Paul even my best friends wouldn't have told me, but a three-hour shower fixed that.

During those three days and nights on the freight I naturally made some acquaintances. One of these was a young Finnish lad from Michigan whose main ambition in life was to join a carnival—his pal was a boy his own age who had worked in a carnival. The former insisted that I went to college somewhere no matter how I tried to disillusion him—the latter insisted as firmly that if he were to thoroughly inspect my person he'd "find a greenback somewhere." Shrewd analysts, these young vagabonds—they were both right!

While sitting up at night freezing in a box car—the nightly temperature in Butte during July and August last summer was about 40-45°—I had time to mull over my summer's experiences. With a viewpoint as impartial as possible, I concluded that I had gained valuable mining experience and knowledge of mine operation which can never be taken away, a greater ability to meet with and understand the working class which I intend to contact in my chosen profession, and a little more of that base medium of exchange which makes our educations possible.

Why Technical Societies?

By M. C. Rogers

Ass't Prof. of Chem. Eng.

THE average college student is perplexed by the long list of campus organizations supported by his fellow students. He finds himself at a loss to know which of them should be considered by him, but soon learns that he is expected to assist in supporting at least a few of them. Frequently he makes his decision on the basis of the relative amounts of pressure which have been exerted on him by his friends and classmates, and his choices are not always as helpful to him as they might have been if he had been given some sort of guide to follow.

The imposing number of organizations to which a student is eligible is really not much greater than the number which desire his attention after he leaves college and takes up his place in the competition of industry. In fact, it is entirely possible that this number may be even greater, and certainly the financial requirements are more severe. A wise selection of society memberships will be of great benefit to any young professional man, and it is the purpose of this article to present a few of the reasons why each student must seriously consider membership in technical societies in particular, if he is to be of service to his profession and moderately successful himself.

The formal professional training given to an engineering student cannot be expected to supply him with more than the fundamentals which will be required by him when he enters competition with other men in industry. Each industry expects to make specialists in its field from its technical men because specialization is very important to the industry if it is to function effectively. It cannot, however, assume the role of a college graduate school in the sense that it supplies its employees with course outlines for study and examination. The employee must do this for himself. Any engineer or other technical man who feels that his diploma is a certification that his professional training is complete is doomed at the start. He must consider that his collegiate training is basic training preparatory to the more complete training he will receive in his professional work later on. He must also realize that he can hope to get only a portion of the necessary additional professional training during the eight hours each day he is in the service of his employer.

A man's value to his employer is measured first by the amount he produces, and second by his ability to get along with his fellow workman. Both of these requirements must be met if he is to be successful and is to attain a level of responsibility above the bottom. The amount he produces is of course dependent on a number of factors, among which is his inherent ability, but his knowledge of his subject, and his ability to keep himself informed of current advances in the profession are exceedingly important in improving and maintaining high productivity. The impression he makes on others and his ability as a leader are in some respects associated with his personality, and personality cannot always be altered. It can, however, be improved and it is necessary that attention be given to its improvement. Men in executive positions must command the respect of those with whom they come in contact and in addition must be able to handle the necessary technical details of their positions. This feature of technical and professional training does not receive the attention which its importance deserves in the college curriculum.

Every man who has any ambitions and desires to improve his status wants to have a feeling of independence and a certain sense of self-confidence which will give him a feeling of personal security. These are important factors in producing happiness for men employed by industry. Men want to feel that, when fortune appears to be neglecting them, they have sufficient independence, obtained through contact with others in the same profession, to permit them to look toward other fields of opportunity. This is more important than is usually believed, because no ambitious man is ever satisfied. He is constantly looking for something which is better for him, and he wants to feel that he is independent of any individual industrial organization. Independence and this feeling of self-confidence and security are obtained by contact with others in the same field of work whose experiences are wide and whose judgment can be utilized by others.

If professional advancement, value to one's self and to one's employer, independence and self-confidence, and general improvement as an individual are important to an engineer, then there is no better source to which he can go than the technical society representing his profession. The technical societies might well be called professional graduate schools even though they do not confer formal degrees.

The several technical societies may have been formed at different times and under somewhat different circumstances, but they all have in common the fact that they were formed by groups of individuals who were primarily interested in improving themselves professionally, in promoting fellowship within the profession, and in the professions themselves. The major societies have developed until today they are in many respects highly specialized educational organizations offering professional advancement to their members. The most important professional function is the publication of journals containing current contributions to the profession. These journals afford members and others a means of continuing their professional education at a nominal cost.

Regular national and regional meetings are held at which members may meet and discuss the newer developments with leaders in the field. They afford an opportunity to members to meet with others in the same profession, thereby establishing the feeling of independence and friendliness which is so necessary to an individual's welfare. The experience of presenting papers at these meetings is one which no alert engineer should miss, because they furnish him with invaluable experience. Industrial organizations generally are quite liberal in encouraging employees to attend and take part in these meetings.

The publications and meetings alone are sufficient to justify membership in a technical society, but the advantages are not by any means limited to them. The other activities of the several technical organizations are varied, but each has something which is intended to advance the profession or science it represents. Awards of various kinds, either monetary or otherwise, are almost universally given to encourage or reward outstanding work by students and professional men. In the industrial centers where large numbers of younger engineers are located, the societies arrange and sponsor graduate courses in cooperation with local educational institutions. These courses are specialized to suit the needs of the group concerned and frequently are offered for college credit. Local sections are particularly active in the industrial areas, and the meetings of the sections are addressed by men whose work in the field has been outstanding.

Codes of ethics serve as guides for the conduct of the engineers who are engaged in consulting work particularly, and they establish the basis on which the relations between the consulting engineer and his client can be conducted. Many states have enacted licensing laws governing the practice of engineering, and the engineering societies have been active in guiding the drafting of these laws to make them consistent with good engineering practice.

THE problem of technical unemployment has been given much study. Engineering societies have done a great deal to relieve unemployment among their members and have opened the classified columns of their publications to employers and members who wish to use them. They have organized employment bureaus and have made serious efforts to locate possible employers for members. They have not to any great extent acted in the sense that labor unions act in industrial relations problems. Their general policy has been to promote the welfare of the profession and improve the quality of their members, allowing the industrial relations problems to take care of themselves. In general this has been a wise policy for them to follow.

There are, as has already been pointed out, many organizations with which a graduate may become affiliated. If all of those which are non-technical and those which are closed organizations requiring invitation to membership are excluded, there remain two general groups of technical societies which must be considered. They are the group containing the general or fundamental engineering societies for each of the branches of engineering and the special interest societies which confine their activities to specific phases of the work of one or more of the fundamental branches of engineering or science. Certainly, first consideration should be given to the fundamental society representing the branch of engineering in which a man is working. After his experience and work have progressed sufficiently, he may choose to associate with a specialized society. It may be that the specialization in his work will not require his affiliation in more than one society.

Membership is generally divided into four classifications: student, junior, active, and honorary. The specific titles may vary from one society to another, but the privileges will be roughly the same. Student membership is usually open without restriction to regularly enrolled students in a professional course. The dues are nominal and generally go directly to the treasury of the local student chapter to finance its activities. Student membership is intended to acquaint the student with work being done in his profession and to give him some contact with the national society. Junior membership includes those younger professional men from college age to about 30 or 35 years. The dues requirements for the junior member are somewhat less than those for the active member and his privileges are somewhat restricted. He is required to resign or apply for active membership when his age reaches the limit prescribed. Active membership is open to those whose age and experiences are such that they make them qualified for this grade of membership. In some societies an associate membership is available to those whose experience is not sufficient to justify active classification. Honorary members are chosen because of their prominence in the field, and their number is limited. In all cases, excepting student and honorary membership, it is necessary that application be made to the society giving pertinent details of education and experience from which the membership committee may obtain information on which to base its report on the applicant's fitness for the class of membership for which he has applied.

The list of societies given below is divided into the Fundamental and Special Interest Groups already mentioned. It is not pretended that this list is complete. Certainly, there are more societies, particularly in the newer fields, which should be mentioned; but these are not so well known and were not listed in the sources from which the lists here were obtained. The names of the organizations given here are such that they give sufficient information about the field of engineering covered and no further explanation is needed.

Fundamental Group

American Society of Civil Engineers
American Society of Mechanical Engineers
American Institute of Electrical Engineers
American Institute of Chemical Engineers
American Institute of Mining and Metallurgical Engineers
American Society of Agricultural Engineers
American Chemical Society
American Physical Society
American Institute of Architects

Special Interest Group

American Ceramic Society
American Institute of Consulting Engineers
American Leather Chemists Association
American Oil Chemists Society
American Society for Metals
American Society for Testing Materials
American Society of Biological Chemists
American Society of Heating and Ventilating Engineers
American Society of Refrigerating Engineers
American Society of Sanitary Engineers
Society of Automotive Engineers
Society of Industrial Engineers

Undergraduate students in engineering can do themselves no greater benefit than to associate themselves with the student chapters of the fundamental societies which exist on the campus. They should plan to transfer their membership to regular junior membership in the national society as soon as they enter industrial work.

The Minnesota Techno-Log

MARCH, 1938

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Learning Scientifically

Last month the scientific method was considered with regard to its applicability to fields other than the natural sciences. This month, let us consider how it affects us who are students of the natural sciences.

A given subject may fall into one of two divisions. It may require principally memory work, or it may be best attacked with logic and mathematical analysis, that is, by the scientific method. Considerable effort is being expended at the present time towards bringing courses from the first division into the second. Refined statistical technique has been developed for the sole purpose of bringing social, economic, and psychological studies into the field of science.

We in the Institute are fortunate in that our studies naturally fall within the realm of the scientific method. However, do we take the fullest advantage of this opportunity? Do we always use this method? Sad to say, no. How often have you heard students complaining of a professor who "wastes" times deriving equations. A great many students seem to feel that all they need to know to be successful engineers are the end products of someone's mathematical analysis. Nothing could be farther from the truth. A practicing engineer faces many problems for which there are no formulæ in which he may substitute to get the answer. In situations such as this he must be capable of developing his own method for treating the problem, and his method must be right. For a student it is more important that he become familiar with the ways and means of arriving at a concise mathematical statement of the relationships involved in a given problem than that he know the statement itself.

Objections have been made by students to this method of study on the grounds that it takes too much time. To study a derivation thoroughly may take 10 or 15 minutes, whereas to learn the formula might take two minutes. This is not a noted objection because a formula merely memorized is readily forgotten and must be relearned every time it is used, whereas one properly understood for the first time need never be relearned. Look back over your own experiences for verification of this truth. Those things that you have really understood fully and completely are still a part of your knowledge. Those that you memorized for that quiz were forgotten the day after. In considering how you shall train yourself remember that there are two types of engineers: those who live by remembering things that others have done, and those who do things for others to remember. Which kind do you want to be?

WHY & HOW

Each month as you look through your TECHNO-LOG you find from three to five feature stories, an editorial, a book review, several pages of news, and other departments. You wonder, "How is the material for these pages gathered? Why are there some kinds of stories and not others?"

First, let us consider feature articles. They develop from ideas which come from the general editorial policy of the magazine, from suggestions of interested students and faculty members, from the daily news, from exchange publications, and from other sources. Occasionally unsolicited articles are received, but the bulk of the features are written on assignment.

Editorial policy this year has been to try to obtain articles which are, as much as possible, written by students for students, with the emphasis on activities and developments which directly concern the Institute, the University, or the State, as opposed to news and articles on projects or situations which are national in interest. If we do wander from the local scene, we attempt to have the author write in the first person in order to strengthen the connection with the Institute.

As for editorials, they are usually written by the feature editor, and are direct expressions of the TECHNO-LOG editorial viewpoint, with the exception that they are not restricted to local questions.

News is gathered by reporters assigned to the various divisions of the Institute; their job is to keep in regular contact with departmental offices, instructors, students, and the officers of the technical societies.

The production of columns is something else again. Never having been a columnist we're not quite sure how the work is done, but we do know that every month we receive a batch of neatly typed copy made up of items of various lengths and varying degrees of—shall we say—propriety.

Alumni news items are gathered from letters received by the TECHNO-LOG, from alumni who stop in at the office, and from the placement office, but the most prolific source of this type of news is the faculty.

There is a place for you in the editorial department, if you are interested and if you are willing to work.

NOW HERE'S A BOOK

By C. I. Haga, Instructor in English

THOUGH the book I offer this month, Lancelot Hogben's *Retreat From Reason*, is the shortest of those I have recommended that you read, it is by far the most weighty and important. That it will appeal to technology students and to all who are impressed by the values of scientific method is obvious. Hogben, himself a scientist, sees in the more general application of the natural sciences the only practical salvation for us in our present "retreat from reason" caused by the disillusion into which we have fallen through our short-sighted misapplication of science. Whatever soothsayers, Utopia-peddlers, and newspaper column prophets may say, it is not less science that we need. What we need is more science, says Hogben: more applied science, more science that gets things done—and he quotes with approval Huxley's dictum: "The great end of life is not knowledge but action."

Now we can have action without knowledge, but no one would welcome a return to such brutish conduct, nor do even our most dangerous princes of folly propose such a program. And we can have knowledge without action other than the barely vegetative, a miserly hoarding of private wisdom, which, however rare and fine, is as incommunicable in its crude idiosyncrasy as an oyster's pearl—but hermits are dying out and no school now gives special training for that profession. The problem is one of determining which actions are better than others, and then trying to discover which of those it is in our power to effect. Having made our decision, we have but to learn how we may direct those actions. In plain engineering terms, it is simply a matter of deciding what the optimum efficiency of a given device is, and then, by using such tested knowledge as experiment has provided, furnishing the appropriate operating conditions for the machine.

Some imagination is necessary, and much common sense as well, to extend that over-simplified principle applicable to Diesel engines and apply it to combinations of forces more various and far vaster—say to society as a whole. Hogben has both imagination and common sense, as well as a third virtue in a prophet, a zealous eagerness to transmit to others that passionate conviction his own experience with science has given him. The imagination necessary is of the same kind and amount as Galileo used when he disproved the established truth that the speed of a falling body is proportional to its weight. It is the ability to think only of the relevant factors in a problem and to disregard the irrelevant despite their sentimental attractions. Our thinking about social institutions and about human problems, Hogben would say, is rendered unfit for wholesome action because so much of it is thinking about the wrong things. For our present purposes and hopes, it is as unimaginative as the caveman's personification of the winds and lightnings, which, though it fathered poetry and theology, could never lead directly to meteorology or electro-technology, two out of the many divisions of knowledge by which men today guide (or may guide) their efforts to humane ends. As for the common sense, that can take care of itself. Given imagination of the kind illustrated, common sense is not far away.

Let us see just what Hogben has to offer us in these 77 pages. The five section headings are more suggestive than descriptive: The Responsibilities of Middle Age, The Astrologists of the Machine Age, Politics and the Science of Human Affairs, The Great Instauration, and Blue Prints for a Modern Institute for Social Enquiries. You will guess from the wording of these titles that Hogben seeks to describe a problem and to suggest the best methods of attacking it, rather than to present us with a ready-made solution. The problem is that of living like human beings on, and with, what we have and shall have. Generally that problem has been stated in crisp formulas of varying attractiveness as times and places have changed—"The Good, the True, and the Beautiful," "Two Chickens in Every Pot," "The Good Life"—but most of these formulas have suffered by their virtue of being specific. People can agree that "The Good, the True, and the Beautiful" is a sound principle, but scarcely any two persons can agree on what is actually good, or true, or beautiful. Just as Mark Twain said that what makes a horse race is a difference of opinion, so would Hogben say that philosophy is bred of a difference of opinion—and since race horses plow no fields, that class of opinions is not the one to evolve the knowledge we need. His statement of the problem is more simple and subtle than any of the above. With all the cool impartiality of an algebraic formula it is simply this, "It is whether most people can get what most people most want."

Nothing can be more simple than that—and nothing can be harder to work out if our imagination is pre-Galilean, and we call knowledge that which is created out of irrelevant data. Today, says Hogben, we have the scientific techniques by which we may describe and measure what most people most want (I ask you not to make *want* synonymous with *desire*) and we even have the experience and skill to give it to them, to ourselves. "Broadly," he says, "the wealth of nations depends upon (a) the material resources of man's environment, (b) the biological resources of social personnel, (c) the social resources for mobilizing the common will to make the fullest use of the first two." Materials, men, methods—we may summarize the problem in three words.

What then holds us back? Hogben points an accusing finger at the schools and the parliaments and dictators' cabals by which the product of the first is led and brought to nothing. As an Englishman viewing at close range Britain and Europe, he is bitter: "We have inherited from the Reformation an educational system which has no relevance to the immediate social tasks of our generation, and our political leaders are products of that system." I wish I knew if he includes American education in that condemnation.

But, you say, why should a credit-hoarding, job-hungry, technology undergraduate read Hogben's *Retreat From Reason?* My answer is another question, "Are you mice or are you men?" In a democracy the more serious a problem is, the more truly is it every man's problem.

100,000 Watts Required To Weld Minnesota's "Blimp"

By Gershon Gendler, M.E., '40, and

Joseph Flatt, Aero, '40

Have you met "O. B."? Although you may not have met him yet, you have probably seen him because he was foreman in charge of the assembly of the "blimp," "silo," "atom buster," or whatever you wish to call the protuberance (officially called the atomic observatory by the knowing physicists) behind the Physics building. No matter what you call it, here are a few of the features of the fabrication of this all-welded job.

"IT WON'T be long now," began O. B. Williams in answer to the first question of your inquiring reporters. O. B. is the foreman in charge of the construction of the atomic laboratory behind the Physics building. The assembling of the steel tank, or "blimp" as it was commonly referred to by the workers, began the last week in December and was completed about the middle of February.

Here are a few of the facts concerning the "blimp." It is 36 feet high and 18 feet in diameter. The total weight of the steel tank is 95,038 pounds. It was assembled from plates of rolled and dished boiler steel of 5/8-inch, 3/4-inch, and 1 1/4-inch thicknesses for the top dome, bottom shell, and vertical sides respectively. Eighteen hundred pounds of welding rod were used in assembling the tank.

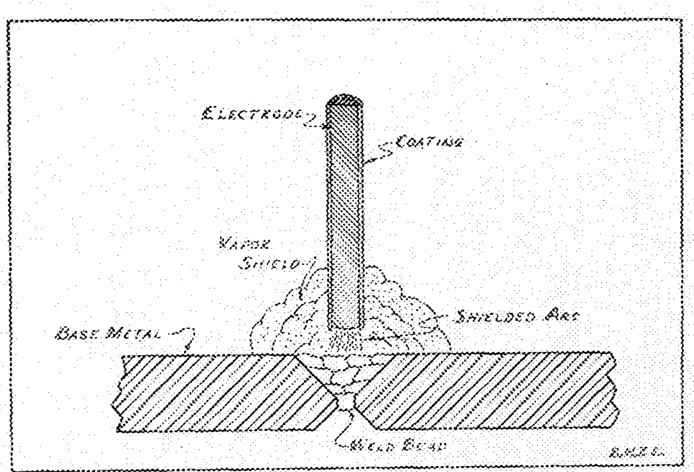
The tank is an excellent example of an all-welded project. Every connection and fastening used in its construction was arc-welded.

Electric arc welding is a fusion process in which the resistance of an ionized gas to an electric current between an electrode and the material to be welded produces heat to melt a pool of metal on the steel base and also to melt the welding rod. A very high amperage and low voltage direct current generator furnishes the electricity. The electrode, manipulated by the welder, most commonly constitutes the positive terminal, or anode, of the circuit; and the material worked on constitutes the negative terminal, or cathode. The temperature produced in the arc is about 7300 degrees F.

The current used in this job varies from 250 to 300 amperes and from 55 to 65 volts and is taken directly from a gasoline engine-driven generator. The six-cylinder engine develops 40 horsepower at high speeds. There is one motor and generator for each welder. Each engine consumes 20 gallons of gasoline every eight hours.

The current is carried from the generator to the electrode by a heavily insulated, multi-strand, copper cable, 7/8 inches in diameter. The necessity for such a large cable can easily be realized when consideration is given to the high amperage which it carries.

The electrode holder is a type of spring pliers with grooved jaws which hold the welding rod firmly in place. It is constructed of a copper alloy of bronze or steel and is about one foot in length. The welding rods which furnish the metal for the joint are used in several different sizes according to the thickness of the steel being welded. The rods are 14 inches long, and about 12 inches of each rod is used. The rods are made of steel containing 0.18 per cent carbon and about 0.40 per cent manganese. This rod produces a weld metal of high ductility, having a tensile strength of approximately 70,000 pounds per square inch.



Sectional view of the welding of a horizontal seam.

Each rod is covered with a coating which forms a slag for protecting the metal from harmful impurities and oxidation. This coating serves several distinct purposes:

1. To form a vapor cloud which prevents the formation of oxides and nitrides in the weld.

2. To provide slag which retards the rate of cooling and thus makes the steel more ductile.

3. To prevent the oxidation of the carbon and manganese content of the electrodes. With bare electrodes 40 per cent of the carbon and 50 to 60 per cent of the manganese would be oxidized.

4. To prevent contamination of the electrode before it is used.

There are several materials which are used for this coating, such as ferro-manganese, aluminum-silicate, calcium-silicate, wood flour, and asbestos. The coating on the rods used on the "blimp" is patented by an Ohio company.

The erection and welding of the "blimp" required extreme care because of the nature of its use and because of the 100 pounds per square inch pressure to which it will be subjected. Key-plates 6 x 8 inches, keys, and 5/32 inch spacers were used temporarily to keep the sections in position during the welding. Small nuts were spot-welded to the surface of the sections; then the plates were set in position and the keys fitted into place.

While welding was being done, the negative electrode was held in contact with the tank section, and the current flowed from the rod, or anode, to the section. When the rod was withdrawn, the current ceased to flow. During the welding the rod was moved to within ¼ inch of the surface, and the current jumped the gap, forming an arc. A small pool of molten metal formed in the work, and the molten rod fused with the metal, forming a bond which is as strong as the steel itself.

There was a cavity between two adjacent plates, as is shown in the diagrammatic sketch, which was filled with the weld metal. The 5/32 inch space between the plates and the beveled edges of the plates formed this cavity. To fill the cavity the welder made 10 or 12 "passes" or beads completely around the horizontal seams. The scale deposited with each bead was removed and the surface of the metal cleaned before another bead was applied. Each vertical seam was filled by building up a column, which was made by forming the bead into a shape similar to that of a flattened helical spring.

About three-fourths of the plate thickness was filled from the outside. The remainder was filled from the inside of the tank. The work was welded at a rate of one to two feet per hour, depending on the thickness of the plate. The inside welded surface was trimmed with an air hammer. The hammer, operating under a pressure of 100 pounds per square inch, chipped off some metal and removed all the scale. A portable, electrically operated, emery wheel then ground the welds flush with the steel surface. The inside surface was then covered with an anti-corrosive paint.

Besides the foreman, there were five welders, one motor tender, an air hammer operator, and two general assistants employed during the construction of the tank. Mr. Williams, the foreman, has had extensive experience in tank welding, much of which was obtained on large gasoline storage tanks in the Texas oil fields. He is regarded as one of the best welding men in the country today. The five welders in his crew are also highly skilled in their art. Two of the men working on the tank were from Minneapolis, while the others were employees of the Chicago Bridge and Iron Company. They have been working on similar jobs all over the country.

The motor operator kept every engine in perfect running order. The air hammer man had charge of cleaning the slag deposited during the welding of each bead before further welding was done inside of the tank. The two assistants were needed to keep the equipment in order and to tend to odd jobs such as cutting steel sections with the acetylene torch and erecting scaffolds.

The highly skilled welders must take many precautions, because the electric arc emits ultra-violet and infra-red rays which are harmful to the eyes and skin. Consequently, they are required to wear heavy underclothing, outer garments made of deer skin, leather gauntlets, and helmets fitted with number 10 Dovelwell glass, which filters out the harmful rays of light. The complete outfit used by the men costs about 22 dollars and is purchased new for every nine months work at welding.

The tank is insured by a well known company against fracture under a pressure of 100 pounds per square inch and a temperature of 650 degrees F., and against all other possible risks. Before assuming such risks, the company required that the men working on the tank pass rigid examinations.

One of the crew of skilled welders at work on the atomic laboratory.

Edgar E. Hardy

ALUMNOTES

Professor Cutler passed on to us some news he has received about Civil Engineering graduates who are working for the Chicago, Milwaukee, St. Paul & Pacific Railroad Company. **H. B. Christianson,** '15, has been transferred from La Crosse, Wis., to Savanna, Ill., where he will serve as division engineer. **Curtiss Crippen,** '30, was transferred from his position as division engineer at Savanna, Ill., to the office of chief engineer in Chicago. **L. R. Shellenberger,** '30, has been promoted to the position of train master at Marion, Iowa. **Loran Pohl,** '27, has been transferred from Clinton, Iowa, to Miles City, Mont. **Tauno Pojari,** '27, is now located in Seattle, Wash. **C. E. Cutts,** '36, is in the office in Minneapolis. **Milan Johnston,** '37, is located at La Crosse, Wis. **W. P. Blohr,** '36, has been transferred from Miles City, Mont., to Milwaukee, Wis. **T. H. Strate,** '01, is now division engineer at Chicago.

'25

"Can an Engineer get Rich?" was the subject discussed by **George Shavor,** E.E., when he spoke at the Founders' Day banquet of Kappa Eta Kappa, professional electrical engineering fraternity.

'27

Charles Burmeister, E.E., is in Redwood Falls, Minn., where he is manager of the Redwood Falls Motor Company.

'34

Thomas Clark, Ch.E., has been transferred from the Rock Island Arsenal to the Federal Agricultural By-products Laboratory at Ames, Iowa.

Lawrence Jilk, Ch.E., who received his Ph.D. degree in Chemical Engineering in 1937, is now with the Du Pont Company in Charleston, West Virginia.

Andrew Carlson, M.E., is now with the South Side Plumbing and Heating Company. His work consists of surveying, laying-out, engineering, estimating, and supervising air-conditioning jobs.

'35

In the design and research department of United Sound Engineering of St. Paul is **Clayton D. Mullin,** E.E. Clay has been with this organization since his graduation. With Clay is **Redwood E. Jones,** E.E., '31.

'36

John Loye, E.E., has been with the Oliver Iron Mining Company in Hibbing since graduation. Hibbing is John's home town.

The assistant chief engineer for Wright DeCoster, Inc., in St. Paul is **Arthur Jenkins,** E.E. Art is still single and comes around to the campus whenever possible.

Neil Herman, M.E., is technical representative for Minneapolis Honeywell and at present is located in New Orleans. Neil attended night school at the University in '36 and '37 doing graduate work in heating and ventilating. He was once a columnist for the TECHNO-LOG.

'37

A letter from **Frank S. Parker,** E.E., was relayed to us from Professor Kuhlmann. Frank is working for the General Electric Company and is taking its training course.

He writes, "At present I am in the Philadelphia plant testing large oil circuit breakers. I was put on a development test which promises to be a good place to pick up some valuable bits of information. It is a lot better than the regular test.

"**Orville Becklund** is working his ears off on the 'A' course and at present is situated in the sound laboratories. **Vincent Stewart** (E.E. '37) is on transmitter test in Schenectady and is living with Orville. **Dick Longfellow** (E.E. '37) was up at Erie the last I heard but should be just about ready to be transferred again. **Dean Johnson** (E.E. '37) has taken a sign-up on induction motors and is also one of the company firemen. They pay the fellows about six dollars a week to stay at the fire house and they have to be on duty every other night. **J. J. Mangen** (E.E. '33) is off test now and is being shifted around quite a little. He spent six weeks on industrial control engineering on some patent work of some kind, but is now in the meter department of the central stations department." Frank is now living at 44 Marlborough Road, Upper Darby, Penn.

Ben Polin, Bernard Seeger, and **Ernie Johnson,** all Aeros, are working for the Douglas Aircraft Company in Santa Monica, Calif.

Civils in the Minnesota highway department include **John Merrell, Arvo Lepannen, Robert Carlson, Si Leonard, George Johnson, John Boehlke, Woodard Thorstenson, Harold Norton,** and **Don Mark** in the construction department. In the bridge department are **Loren Frickland** and **Delroy Peterson. Eugene Woodfill** and **Larry Rollin** are in the soils department.

Richard T. Baselo, Aero., is test engineer for Pratt and Whitney Aircraft Corporation in Hartford, Conn.

Albert Bridges Driscoll, Aero., is with the Braniff Airlines in Oklahoma City, Oklahoma.

Rural telephone wire—*not in cables*—can now go underground where bad weather and grass fires can't harm it.

To make this possible, an entirely new kind of wire had to be developed. Special insulating compounds, special splicing methods were devised. Then a simple, economical method of burial had to be found. A special plow solved this problem—one that digs a furrow and tucks away the wire in a single operation.

Just one more step in the process of making Bell System service constantly more dependable.

BELL TELEPHONE SYSTEM

Why not telephone home tonight? Rates to most points are lowest any time after 7 P. M. and all day Sunday.

Fitting Jobs to Personalities

By C. A. Phillips

Secretary, Employees' Benefit Association
Northwestern Bell Telephone Company

The second of a series of employment talks sponsored by the Placement Service

When an employer or personnel man interviews you, he asks many questions which seem to have no direct connection with finding your ability to handle the job in prospect. In this article Mr. Phillips describes the purpose of these questions and the methods by which they are applied.

MY ACCEPTANCE of the invitation to come over and talk with you folks today is based on just that I want to talk *to* you and then *with* you. I shall be satisfied if I am able to leave with just one of you some thought that will help you to enjoy more fully the fruits of your years of study and hard work here at school which will soon be at an end. I appreciate fully that some of the thoughts which I shall express will be in conflict with some of your ideas, but I hope they will be accepted in the spirit in which they are offered. I have been around long enough to be convinced that few matured heads are found on twenty-two year old shoulders. When I was twenty-two years old, I didn't think that, any more than most of you boys do today, but experience has taught me that it is generally true. With that as a premise we shall proceed.

We Are Usually One or the Other

Scientists tell us that all people may be roughly divided into two classes, introverts and extroverts, and that there is a place in the scheme of life for both classes. Our job as individuals is to determine in which class we fall. This theory or scientific fact, call it what you will, apparently has considerable merit. I say merit for the reason that experience has proved it in many ways to the satisfaction of those who have tried it in everyday practice. Experience and tests prove much of it true. Now what is the distinction between an introvert and an extrovert, and what importance is attached to the proper classification in which we, as individuals, place ourselves? I should like to quote from Donald A. Laird's "How Personalities are Found in Industry," which, I believe, expresses the opinion of many who make sincere efforts to avoid mistakes in the placing of individuals in jobs that will result in dissatisfaction to the individual and to the employer.

"Introverts are characterized by their emotional outlets being expressed within themselves; that is, their emotions are introverted. Day dreaming is an instance where the emotional outlets are introverted.

"Extroverts, in contrast, express their emotional outlets in action and association with others. They might be called men of action, while the introverts are men of thought.

"An outburst of temper is an emotional outlet. So are blushing, laughter, likes and dislikes, wanting to be alone, preference for various kinds of amusements, and in some cases the occupation one enters, emotional outlets. In some instances, however, an occupation is entered which cannot provide emotional outlets, resulting in dissatisfaction, turnover, faultfinding and poor work. In such a case some recreations may be found which will provide outlets for the individual's own makeup, thus giving him greater expression of his real nature and possibly giving him self-realization.

"Theodore Roosevelt, Sr., is usually considered an extrovert, Woodrow Wilson an introvert. It is possible that their divergent political policies can be explained on this basis.

"How to Tell an Introvert or Extrovert

"*Personality Signs revealed in action:*

"(1) The introvert blushes easily, the extrovert rarely blushes. (2) The extrovert laughs more readily than the introvert. (3) The introvert is usually outspoken; the extrovert is usually careful not to hurt the feelings of others. (4) The extrovert loans money and possessions more readily than the introvert. (5) The extrovert moves faster than the introvert in the routine actions of the day, such as walking, dressing, talking, etc. (6) The extrovert does not take particular care of his personal property, such as watches, clothes, etc.; the introvert is found continually oiling. (7) Introverts are usually reluctant about making friends with the opposite sex, while extroverts are attracted by them. (8) Introverts are easily embarrassed by having to be in front of the crowd. (9) The extrovert is a more natural public speaker. (10) The introvert likes to argue. (11) The introvert is slow about making friends. (12) The introvert rewrites his letters, inserts interlineations, adds a postscript, and corrects every mistake of the typist.

"*Personality signs revealed in thinking and attitudes:*

"(1) The introvert worries; the extrovert has scarcely a care in the world. (2) The feelings of the introvert are easily hurt; the extrovert is not bothered by what is said about him. (3) The introvert deliberates in great detail about everything—what to wear, where to eat, etc., and usually tells one why he decided to do what he did. (4) The introvert rebels when ordered to do a thing; the extrovert accepts it as a matter of course. (5) The introvert is urged to his best efforts by praise; the extrovert is not affected by praise. (6) The introvert is suspicious of the motives of others. (7) The introvert is usually radical in religion and politics; the extrovert—if he entertains any opinion—is usually conservative. (8) The introvert would rather struggle along to solve a problem than ask for help. (9) The introvert would rather work alone in a room than work with others. (10) Extroverts follow athletics; introverts—books and "highbrow" magazines. (11) The introvert is a poor loser. (12) The introvert day dreams a great deal. (13) The introvert prefers a fine, delicate work (die making, accounting) while the extrovert prefers work in which details do not bother. (14) The introvert is inclined to be moody at times. (15) The introvert is very conscientious."

Proper Self-Classification

You will note that both groups have different qualifications or characteristics that are needed to maintain a balance.

Now what about the importance to us, as individuals, of properly classifying ourselves? First, I think, we must get firmly fixed in our minds that both classes are positively necessary for the successful operation of any legitimate enterprise and to a well balanced society. If we are placed in a job requiring the qualifications of an introvert and we are, by nature, an extrovert, the chances are that we will be unhappy, our progress will be disappointing to ourselves and the employer. Both will lose.

It is your responsibility to inform your prospective employer of your honest conclusions with respect to your ideas of the kind of work in which you believe you will be happiest, produce the best results, and receive the most satisfaction.

It is the prospective employer's responsibility to decide whether or not, in his opinion, your conclusions are right so far as his requirements are concerned. This is accomplished by various checks and investigations, questioning, etc. Now right here, let me say that so far as our company is concerned, there are no trick checks, investigations, or questions involved. It is a question of ascertaining the facts in as honest a way as we know how. We believe some guide or yardstick is necessary to the best interests of the applicant and to ourselves. Industry can better afford to make an occasional mistake on an individual than the individual can himself. We like to help the individual do the best possible for himself, and we do not want to be a party to his future unhappiness and possible failure. Many times this is accomplished by not employing the applicant but advising him that his success will probably be in some other endeavor. This conclusion is based on the employer's own knowledge of the type of jobs which he has to fill.

It may be interesting to you right at this point to know that generally the employer who has a job to fill does not fill it with the first applicant or the second, for the reason that he wants to be sure he has the right man. Therefore, it seems only wise that the applicant should not necessarily accept the first job that is offered unless he is convinced that it is the job that will make him happy, give him abundant satisfaction, and place him in a favorable position with his fellow men and associates whom he considers to be on his level. Just getting on somebody's payroll is not of the most importance for the long pull, although we will admit that in most cases it is important at the moment.

Most of you young men know more about football than I do, but I wonder if it isn't a fact that the coach has more difficulty in successfully filling the quarterback's position than any other position on the team. Admitting that all positions are important, that coöperation and coördination are essential, isn't it true that the quarterback calls the signals after the situation has been analyzed? He is the man who is "on the spot" when quick, clear thinking is necessary in critical situations. He is the man who is expected to make decisions in emergencies, the effect of which may lose the game, may make or break the whole team, or at least some of its members. Granting that you agree with this, I should like to compare an industrial organization with an imaginary football team. he operation of most businesses requires individual workers and leaders just as it is necessary to have good centers, fullbacks, guards, half-backs, ends, and quarterbacks. But the difficult task in business is the finding of men who are versatile enough to develop into good quarterbacks; men whose judgment can be depended upon in emergencies, men who have the ability to obtain the coöperation and coördination so necessary for successful business operations. In other words, men who are able to utilize the ability and talents of the organization's individuals to the best advantage and in the best interests of the majority.

Now, I do not wish to be misunderstood. There are, and will be, places for all. Many of us do not want to be quarterbacks. If everybody wanted that, there would not be enough quarterback jobs to go around and, even if there were, a team of quarterbacks would be a failure. We can't all call signals. The point I wish to make is, decide whether or not you are a quarterback and if you think you are, go out and be the best business quarterback there is, providing, of course, that you are able to convince the coach, or employer, that you are a quarterback to begin with. He has had a lot of experience and you won't fool him much.

Industrial "Quarterbacks" Rare

If you are not the type, or do not have the qualifications, to be a successful quarterback in business, find it out as soon as you can, give up the idea, and start being happy in the job you are fitted for. But I wish to leave this thought with you, that at the moment, in my opinion, quarterbacks or leaders in industry are the most difficult to find. Business looks to colleges and universities for much of this kind of material.

Now, I have rambled considerably in attempting to lay a background and do a little spade work for you boys, knowing that it won't be long until you will be walking out of here with your degree, looking for a job. Make an analysis of yourself along the lines I have outlined, if you have not already done so, soliciting the help and advice of others who are in a position to pass intelligent judgment on your qualifications, and then make a sincere effort to find the job that will give you the most satisfaction and enjoyment. As a parting word, let me say that occasionally industry finds an extrovert in introvert's clothing and vice versa. We don't bat a thousand per cent by quite a margin in making selections. And further, the knowledge which you have gained here in college will be valuable to you only to the degree in which you learn to use it to your employer's advantage, through practical experience. College training is capital. It represents the labor of years, earnings foregone, and a large outlay by persons and institutions. The money cost alone is a large sum, but beyond this is the value created by the workmanship of the student and his teachers. Capital is a trust to be invested for the production of social utilities. Investing the fruits of an education wisely is more difficult than investing a sum of money. Security, substantial income, and enhancement of value are important considerations, but the human satisfactions at stake are even more fundamental.

How Employees Are Appraised

I should like now to give you a few of the considerations which may be used in the appraising of men either for promotion or for selection as a new employee.

(1) What is his reputation as a man in general among his associates? (2) Is he the type of man to whom you would lend money with confidence that he would pay it back? (3) Does he manage his personal affairs in an economical and satisfactory manner such as paying his bills promptly and saving money? (4) Does he do his share in making his home life happy? (5) Is he inclined to state facts as he sees them or does he minimize or exaggerate? (6) What is his attitude toward life generally? Is he of a happy disposition, looking on the bright side of things, or is he inclined to be gloomy and moody, looking on the dark side? (7) Does he set a good example for others? (8) Comparing him with others in relatively the same occupation, is he considered unusually bright, average, or only fairly so? (9) Does he understand readily and retain information given him? (10) Does he give evidence of planning for the future not only as to his work, but his personal affairs? (11) Does he have ideas of his own and is he able to convey them intelligently to others? (12) At first acquaintance does he appear more or less intelligent than when well known? (13) What activities does he engage in outside of working hours relating to self-improvement in order to improve his knowledge of the business and things in general, thus permitting him to keep up with the progress of the business? What kind of reading material does he seem to favor according to your best knowledge? (14) How much confidence can be placed in his judgment or opinions? (15) Does he seem to know what to do in unusual and difficult situations? (16) What peculiarities has he that are a handicap or are annoying to or looked upon unfavorably by his associates? (17) Does he dress appropriately and is he neat in the care of his person? (18) Do others frequently come to him with their difficulties for advice and assistance and is he considerate of their problems? (19) Does he seem to get the job done without friction or resentment? (20) Is he receptive of new developments or does he prefer to leave things as they are? (21) Does he take hold of tasks willingly and see them through? (22) Does he report to work on time generally and keep his appointments? (23) How does he conduct himself when under pressure or during times of emergency? (24) Is he recognized as an outstanding individual among his associates? If so, as a thinker, a doer, or both? (25) Does he generally give you his opinion promptly without lengthy deliberations? (26) When giving his opinion does he frequently qualify it by admitting the necessity of checking? (27) Are his offhand opinions usually sound? (28) Does he generally refrain from giving his opinion until after he has studied the question in detail? (29) Is he inclined to include in his study only the essential details? (30) After studying the question are his conclusions generally sound? (31) After the details of the job are developed, does he display interest in its completion? (32) Which interests him more, the development of a plan or its execution? (33) Is he inclined to be impatient with delays that interfere with the prompt execution of the work? (34) Does he take considerable time to develop a comprehensive plan? (35) Does he ask others to help him or is he inclined to work by himself? (36) In assigning work to others does he select those best qualified? (37) Is the work that he performs himself well planned? (38) Does he prefer one assignment or is he capable of keeping several tasks going at the same time and bringing them to a satisfactory conclusion? (39) Do you feel that in his present line of work he is able to use to the fullest advantage the natural ability which he has? (40) In which, if any, of the six classifications that follow, do you feel he would find the best opportunity to give expression to his natural ability? (A) Administrative, (B) Executive, (C) Physical Engineering, (D) Scientific Engineering, (E) Staff Analyst, (F) Statistical. (41) Is he capable of developing new men and maintaining an efficient organization? (42) Is his judgment of men based on a good understanding of human beings or is it limited to those things which are self-evident? (43) If you were seeking a man of certain qualifications, how much confidence would you place in his judgment? (44) Does he seem to favor work which requires close study and lengthy observations involving new developments and improvements? (45) Is he fair, considerate, and broad-minded in his dealings with others?

Thank you and my best wishes for your future success.

FACULTY SKETCH

By Robert C. Becker, Ch.E. '40

Dr. Lorenz G. Straub

MINNESOTA CHATS

DR. STRAUB received his preliminary schooling at his birthplace, Kansas City, Missouri. He then went to the University of Illinois, where he now holds the Bachelor, Master, Ph.D., and Professional degrees.

In 1927, Dr. Straub became the first recipient of the Freeman Traveling Scholarship of the A.S.C.E. This permanent scholarship was provided by John R. Freeman; its purpose is to allow the fellow to study hydraulics works, both educational and commercial, in Europe for a period of one year. The fellowship was renewed for Dr. Straub, and was spent in visiting engineering structures, particularly in Austria, Czechoslavakia, and Switzerland; and in attending the technical universities at Danzig, Berlin, and Karlsruhe.

Professor Straub is a member of Gamma Alpha professional fraternity, and of Tau Beta Pi, Sigma Tau, Chi Epsilon, Sigma Xi, and Phi Kappa Phi honorary fraternities.

Before receiving the fellowship, Dr. Straub worked for engineering firms on the designing of dams, water purification plants, and bridges; and after returning from Europe in 1929, he worked on a special hydraulics investigation of the Missouri and Mississippi Rivers. This research was completed at the University of Minnesota, and a report was submitted to the International Association for Hydraulic Structures Research, of which Dr. Straub is the American representative. Other projects in which Professor Straub carries on coöperative research at Minnesota are: study of plumbing fixtures (in conjunction with the State Division of Sanitation); and investigations of sand dams and of sedimentation at the junctions of rivers. The more important of his numerous professional activities are memberships in the Minnesota State Drainage Basin Committee (appointed by Governor Benson) and in the Permanent Executive Council of the International Association for Hydraulics Research Structures, and chairmanship of the Special Committee on Floodwaves (set up at the request of government bureaus).

Dr. Straub is editor-in-chief of the *Manual on Hydraulic Laboratory Practice* (to be published by the A.S.C.E.), and he has translated from the German an exhaustive study, *Hydraulic Structures.* In addition to these publications, Dr. Straub has written many miscellaneous hydraulics articles and committee reports, and is contributing editor of the *Bulletin of the Minnesota Federation of Architectural* and *Engineering Societies.*

Dr. Straub is president of the Northwestern Section of the A.S.C.E.; a member of the Society of Military Engineering, and, incidentally, a commissioned officer in the Officers Reserve Corps; consulting engineer in direct charge of the design and construction of the St. Anthony Falls Hydraulic Laboratory; and, lastly, treasurer of the Minnesota TECHNO-LOG Board.

TECH NEWS

A.S.C.E. Sees Golden Gate Bridge Movies; Hears Planning Expert

Motion pictures, portraying the construction of the San Francisco "Golden Gate Bridge," were presented in the Chemistry Auditorium, Wednesday evening, February 23, by the A.S.C.E. This first campus showing of the pictures was open to the public.

A complete story of the building of the largest bridge in the world was shown in pictures. The erection of the towers, the swinging of the cables across the bay, and the men working high above the water in constructing the bracing and flooring were pictured in the movie.

Carl Halvorson, chairman of the all-sophomore committee in charge, acted as introductory speaker. Other members of the committee were Marvin Warner, Harold W. Hansen, and Guillermo Reina.

"More engineers should enter the public service," Herman Olson, Engineer with the Minneapolis Planning Commission, stated when he spoke before the A.S.C.E. at their meeting early last month.

"More and more the problems confronting communities of today must be met by technically trained men." Mr. Olson said. He illustrated by describing the traffic problem in Minneapolis and discussing possible solutions.

"The western suburban district of Minneapolis is the fourth largest population center in Minnesota, and it is economically tied in with the city. To carry traffic from the loop to the suburb, a Southwest highway was suggested as early as 1924, but the proposal was dropped for lack of funds. Now this problem is being discussed again."

A short business meeting was held before the talk. The meeting was held at 7:30 p. m. in the Minnesota Union.

Chem. School Adds Freundlich to Staff

Dr. H. Freundlich, formerly assistant director of the Kaiser Wilhelm Institute in Berlin, and professor of colloid chemistry at the University College of London, has come to the University of Minnesota under a permanent appointment to hold a professorship in the graduate school of colloid chemistry. Dr. Freundlich has visited here twice before, in 1925 and in 1937, as a speaker before the colloid symposium, a division of the A.C.S. He will direct graduate students in their researches in the fields of chemistry, bio-chemistry, and physiological chemistry.

A.C.S. Holds Election, Hears Lind, Tabern

The newly constituted student affiliate of the American Chemical Society held an organization meeting Wednesday, February 23. Dean S. C. Lind spoke to the group on the subject, "The History of the A.C.S." Officers of the affiliate are: Loeman Hamilton, president; Eugene Hass, executive secretary; Warren Hanson, corresponding secretary; and Elias Amdur, treasurer.

Dr. D. L. Tabern, of the Abbott Laboratories, Chicago, spoke on February 10 to the local section of the A.C.S. on the subject, "Barbiturates and Their Newer Uses in Medicine." The discussion was illustrated by slides and moving pictures.

A.I.E.E. Visits Ford Plant; Seniors Plan For Vacation Trip

The A.I.E.E. conducted an inspection trip to the Ford Plant early in March. The group inspected the hydro-electric plant, the steam plant, and the main assembly plant.

Several members of the senior class are planning to make an inspection trip to Chicago and Milwaukee during the spring vacation. Plans for this trip are not completed as yet. Members of the senior class also received their class pins on February 24.

Election of officers for the next year will be held early in April to allow the incoming chairman of the A.I.E.E. to represent the organization at the annual convention.

Willard Dye Tells Group About Foreign Travels

Willard Dye, at a recent meeting of the A.S.M.E., told about his experiences in the Mediterranean and the Far East. Also featured at the meeting were moving pictures showing the manufacture of Ford automobiles.

25 Students Sign For Pistol Class

Sergeant Wm. E. Bowen has started a class in pistol practice at the armory indoor range. Over 25 students have already registered for the voluntary instruction. Sergeant Bowen hopes to organize a team for intercollegiate pistol competition. The class will practice at the Fort Snelling outdoor range later in the season when the weather permits.

Bookstore Expands Trading Facilities

The Engineers' Bookstore recently removed the partition between its main store and storeroom and is now

12 feet wider than before. A part of the main engineering sub-basement has been partitioned off for the new storeroom.

The Engineers' Bookstore was organized in 1920 and has always occupied the rooms in the North end of the main engineering building. In 1923 the bookstore annexed the small room adjacent to it and converted it from a shower room into a storeroom. This room was used for a storeroom until the present removal of the partition. When the store was first organized, a five dollar deposit was required from each member in order to provide a working fund. As time passed a reserve fund was built up from the store profits, but the deposit (no longer needed) was collected from all new members and held in a dormant trust fund. In the spring of 1937 the bookstore board voted to return all deposits and establish the present membership fee of $0.25. The store originally handled only engineering books and instruments. In 1934 it carried medical supplies for the first time. The store has always acted as a used text exchange, conducting the greatest part of its business in the hallway at the beginning of the quarter. The new window added to the store has bookshelves beneath it and will be used as a used text-book counter at the beginning of the quarter. During the quarter it will be used for a display window.

Professors Active In Research Work

Dr. R. S. Livingston, physical chemist, has been granted a leave of absence to work at Johns Hopkins University under Dr. Franck.

Dr. R. E. Montonna, on sabbatical leave at the University of Birmingham, England, is giving a series of lectures on chemical engineering economics at the request of Dr. Haworth, recent winner of a Nobel prize, under whom he is working. Dr. Montonna left the United States in August, 1937, and will return sometime next summer.

Dr. W. Heller, here on a fellowship for nine months, is continuing his researches on magneto-optic effects on orientation of particles. Dr. Heller, a former assistant to Dr. Freundlich in Berlin, studied five years in the Institute of Physics at the Sorbonne, Paris.

Professor Tse-Gung Djang, of the Central University, China, is studying new types of research in analytical chemistry here until summer.

Dr. D. V. Nightingale, of the University of Missouri, and Dr. H. M. Crawford, of Vassar, have been appointed honorary fellows in the graduate school. They are both here on leave of absence to carry on organic research.

Chemistry Profs Give Lectures

Dr. S. C. Lind spoke on February 16 to the Midway Club about the research projects of the Institute. He discussed projects for the production of alpha cellulose from now useless aspen wood, of iron from low grade ore, and of hydrogen from lignite.

Dr. L. H. Reyerson spoke on February 17 before the chemistry colloquium on "Sorption of the Halogens by Silica Gel and Charcoal."

Dr. I. M. Kolthoff recently spoke at Madison, Wisconsin, and at Urbana, Illinois, on "The Aging of Crystalline Precipitates." Dr. L. I. Smith, on a speaking tour during the week of February 13, discussed the subjects, "Reactions Between Enolites and Substituted Quinones" and "Rearrangements of Poly Alkylbenzenes," at Kansas City, Lincoln, Omaha, and Iowa City.

Aeros, Ch. E.'s Plan Spring Field Trips

Arrangements are now being made for the annual senior inspection trip of the Aeronautical Engineers. Their plans include visits to the National Headquarters of the Institute of the Aeronautical Sciences, New York City; the leading aircraft plants in the East; the Government Research Laboratories; the Naval Air Base at Anacostia; the Naval Academy at Annapolis; and sightseeing trips through New York and Washington.

The group, including two faculty members and 35 students, will leave during final week and return during the first week of the spring quarter.

The senior chemical engineers will start their annual inspection trip on March 16 and will return March 27. About 62 men will inspect paper, cement, soap, glass, steel and many other industrial plants. Dr. C. A. Mann, Dr. Marvin Rogers, and Mr. C. S. Grove will be in charge of the trip.

PICK AND PAN

By M. A. Troxell, M. '39, and H. A. Larson, M. '39

While five School of Mines Sophomore Field-trippers were returning to the Cuyuna Range from Minneapolis last spring, a murderer, the blood of his victim not yet cold, gained admission to the automobile by feigning accidental injuries. He then took the car by force, leaving five very crestfallen miners in the ditch. The police were led a merry chase, but finally captured the culprit after several months. This tale was chosen for dramatization over the "Gang Busters" program a few weeks ago. The chief of police and the detective made the trip to New York to broadcast, leaving five very crestfallen Miners in the ditch back in Minneapolis.

Have you heard about the Aeronautical Engineer who took decriptive geometry and worried every time Professor Eggers passed a couple of planes through each other?

When a blast furnace is plugged up, does it have the flue?

The Metallurgists are up a tree. Professor Comstock's course in mine plant is now closed to them because the *entire* class registered for the wrong course.

"Thanks for the candy."
"Don't munchon it."

Engineers are prone to stress their classwork, to slight activities. Yet in their later years at school, many Tech students cast around for a worthwhile college activity—that's where the Lodgers League comes in. Here is an honestly-managed, cosmopolitan organization sincerely aiming to better the lot of the average lodger on the campus, giving him the representation he deserves. There are vast opportunities awaiting the Lodgers in every field of campus activity—veteran athletic and political organizations had best look to their laurels in the future.

The scholar's lament: I think I'll stay in and cerebrate tonight.

The other day in the flotation lab one of the students had a hen's egg for personal experiments in the realm of frothers for the flotation of minerals. He put the egg in the flotation machine and in a few minutes had all the dishpans in the lab full of beaten egg and frantically hunted for more receptacles. The whipped egg finally subsided, and even the student had a beaten look.

The trouble with geologists is that they are always finding faults.

And then there was the girl so knock-kneed that she took two steps and her boy friend said, "Come In."

Lines to a Lady, the Donor of a Princely Heating Pad

Oh tell me, Muse, what can I say,
When after such a long delay,
I sing the praises of that pad
Which makes me well when I feel bad.

As often now as twice a week
My senile joints all groan and creak;
But then I lie and scan the news
While amperes turn to B.T.U.'s.

Oh blessed pad, so soft and hot,
What if each hourly kilowatt
Has cost the sum of three whole cents?
Thy worth is treble the expense.

L'Envoi

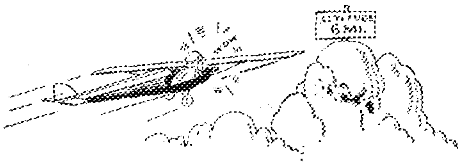
And when at last I'm laid to rest
This pad shall lie upon my breast
One terminal stretched toward the sky,
The other grounded well near by.

So may some tithe of floating power
Be snared to warm my darkest hour.

Jack Ess.

Talking about the recent slump in business, we wish to warn the miners that a geosyncline is a bad investment.

G-E Campus News

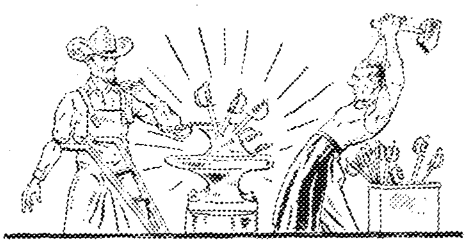


"SOUPED" ENGINES FOR SIX-MILE HEIGHTS

AS THE bellows is to the forge, so is the supercharger to the airplane engine. Because of the rarefied atmosphere at high elevations, airplane engines require superchargers which operate like fan blowers, maintaining air pressure in the engines and permitting the motor to operate at normal efficiency.

Today, twelve-hour flights from coast to coast at an average height of six miles are the objective of transport airlines. Experiments in this field have been successfully conducted by Transcontinental and Western Air, Inc., and the U.S. Army Air Corps with very encouraging results, using G-E turbine-driven superchargers.

Military, transport, racing, and transoceanic planes are equipped with G-E superchargers which increase motor efficiency, speed, and flying distance. The superchargers were developed by Dr. S. A. Moss, of General Electric and are built in the River Works in Lynn, Mass. Student engineers on Test at Lynn have an opportunity to inspect and test these devices as a part of their training course.



BEATING SWORDS INTO PLOWSHARES

WELL, not exactly swords into plowshares, but rather discarded rails, superheaters, and boiler tubes into steel for the overhead system of an electrified railroad line. In this manner the old steam railroad of the Witwatersrand Gold Mining Area was replaced by a completely electrified line.

Because of the rise in gold prices during the last few years, an increased suburban passenger traffic in that section of South Africa necessitated an enlargement of the railroad.

Mercury-arc rectifiers made by the British Thomson-Houston Company, an affiliate of General Electric, supply the power for the "Reef Scheme," as it is called, while 115 four-motor, multiple-unit car equipments were furnished by G.E. through the International General Electric Company.

The engineering and sales work on this project was done by several former G-E Test men. Many such opportunities are open to graduates of college engineering schools who have successfully completed the G-E Test Course.

AMERICA'S OUTSTANDING YOUNG ELECTRICAL ENGINEER

DR. CHAUNCEY GUY SUITS, research physicist of the General Electric Research Laboratory, in Schenectady, has been named by Eta Kappa Nu, honorary electrical engineering fraternity, as the outstanding young electrical engineer for 1937.

Born in Oshkosh, Wisconsin in 1905, Dr. Suits graduated from the University of Wisconsin in 1927 and from the Technische Hochschule in Zurich, Switzerland (Sc.D. '29). An ardent skier, he spends most of his spare time on the snowy slopes around upper New York State.

As a member of the Research Laboratory staff, his work has been on the fundamentals of electric arcs, showing how arc temperature can be measured by sound, and it was for this work that the Eta Kappa Nu award was given him. Other activities for which Dr. Suits is noted include the investigation of non-linear circuits, high-pressure arcs, and the development of automatic tuning for radio receivers.

Last year the award was given to Frank M. Starr, U. of Colorado '28, G-E Test '29, who is employed in the Central Station Engineering Department of General Electric. The Test Course, of which Starr is an alumnus, provides a practical education supplementary to the theoretical knowledge obtained in college.

GENERAL ELECTRIC

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n This Issue:

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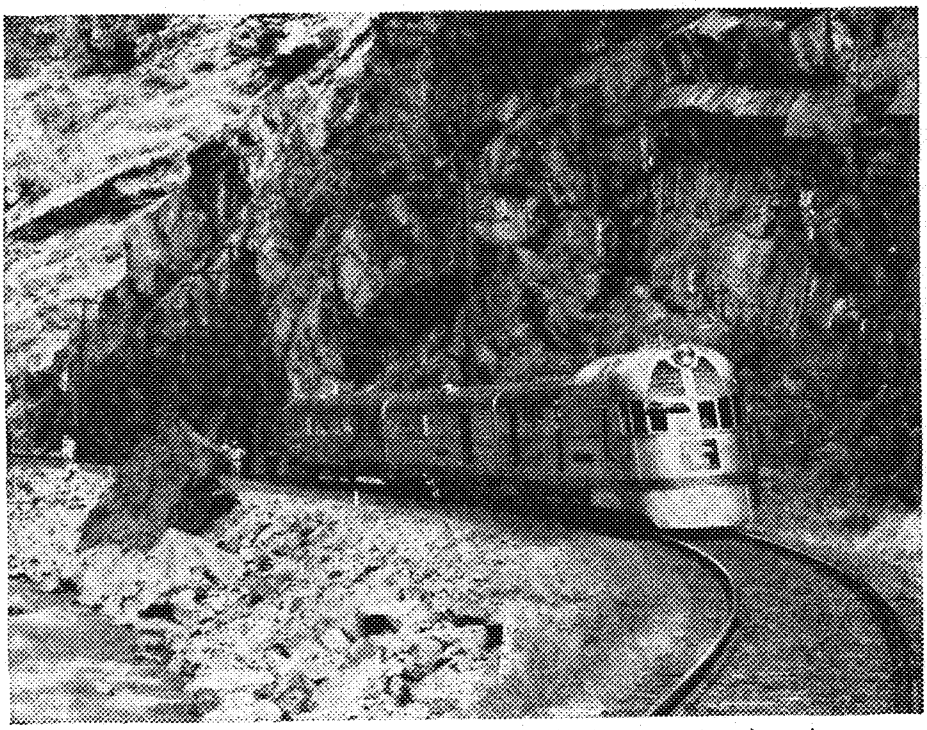
MINNESOTA TECHNO-LOG



WELDING is responsible for a majority of the streamliners now racing about the country. Burlington's Zephyrs, the Boston & Maine's Flying Yankee—all made of stainless steel—and the Pennsylvania's new super-electric locomotives, all owe their form and much of their efficiency to welding. Welding makes possible tremendous savings in weight without sacrificing strength and rigidity.

Streamlining . . .

Demands smooth, unbroken surface and strong, light frames—both attained by welding

"STREAMLINING" is more than a word to catch popular fancy and assure sales. This design trend, in automobiles, trains, ships and a vast variety of equipment items, has several extremely sound reasons for existence. Smooth mass-distribution and unbroken surfaces mean ease of operation and savings in power for moving objects. This smoothness of design also results in easier handling of portable objects, as well as cleanliness, simplicity and efficiency.

Streamlining involves the method of construction, the theory behind the design. Streamlined articles are unit-built of strong, light materials. The entire product is designed to be one-piece and to develop the maximum strength of each individual member with the minimum of added weight.

Welding is the most practical, least expensive and surest means of attaining permanent strength in metal fabrication. A welded article is a single unit when assembled, and always remains so. There are no mechanical joints to jolt, jar or work loose with the passage of time. Various members can be depended upon to develop their full, assigned reactions now or ten years from now. Welded construction, therefore, means more than adequate economy in design and construction. It means confidence in the permanence and adequacy of the product.

Welding allows the designer to specify any shape or combination of shapes without limitation. By welding, complex forms can be built up from simple units. Metal can be cut away or added. Projections, lugs, ears, rods, bars, any member—can be added to the foundation. Dissimilar metals can be joined. Long-wearing or corrosion-resistant alloys can be used to reinforce or build up at sections subject to special wear or abrasion.

In fact, welding relieves the designer of many limitations, of most of the old inhibitions and joint problems of old-fashioned design. It makes possible the fabrication of a better, more serviceable, longer-lived product at lower cost. The essential advantages of modern design are obtained by welding with convenience, economy and assurance.

Welding Savings

The New Haven "Comet" uses cromansil steel engine beds and car trucks, all welded. Cromansil, a high-tensile mild-alloy steel containing chromium, manganese and silicon, was chosen as best for high-strength, rigid members. Welding was specified because it develops the full strength with minimum weight.

* * *

Stands for automatic vending machines are now stronger, better, more permanent. They used to be made by screwing lengths of 1½-inch pipe into cast iron bases. They are now bronze-welded at less cost with obvious improvement in strength, durability and ease of fabrication.

* * *

Welding makes stainless steel beer barrels practical. Strong, light, smooth inside and out, these barrels have no crevices or corners in which fungi and bacteria can breed. Welding makes them all one-piece and prevents bacterial and mold action and chemical off-tastes. Further, because of welding, they outlast all others.

* * *

Welding produces gas-operated refrigerators at a reasonable production cost. After making exhaustive tests involving every method of fabrication possible, the manufacturer standardized on welding 100 per cent. Results include a better product, more flexibility in design and lower manufacturing costs.

* * *

Welding makes modern metal furniture production possible. Faced with tremendous competition, this new industry capitalized the advantages of welding in the production of light, strong, modern designs and has grown to a sound and healthy state. Welding in this case means mobility in design as well.

* * *

Every day welding is being used in the production of different articles. For instance, an order was recently received for 2000 window display fixtures. Welding was specified because welding permits any design, gives neat appearance and a strong sturdy assembly at low cost.

* * *

Tomorrow's engineers will be expected to know how to take advantage of this modern metalworking process. Many valuable booklets describing the oxy-acetylene process are available without obligation. For further information write any Linde office.

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The reception university men have accorded them indicates another landslide for the Minnesotan model. So get into Herringbones . . . but be sure it's a "Minnesotan". . . . Color tones and new weavings that are irresistible. Priced $25 and up.
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Minnesota Techno-Log

Volume XVIII — 37 Electrical Engineering Building, University of Minnesota, Minneapolis — Number 7

ERLING HELLAND, Managing Editor — WARREN WALEEN, Business Manager

Published Monthly
from October to May

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This Month

The photograph of the speeding train on this month's cover was taken in St. Paul by Myron Blumberg.

Our first article is by Leslie Anderson. This is Les' third contribution to the TECHNO-LOG this year, his other two articles being published in November and March. Les is a junior in Civil Engineering.

Charles V. Berger, who writes Part I of our discussion of the relationship between the Engineer, Labor, and Capital, is a senior in Chemical Engineering. He is president of the A.I.Ch.E. and a member of the Technical Commission.

The writer of Part II of this same article is C. Vernon Olson. Vernon is taking the 5-year Engineering-Business course. He is a member of the American Management Association and claims photography and books as his hobbies.

George G. Bower, writer of the article on WLB, is a sophomore in Electrical Engineering. His hobby is photography.

Our authority on chemical research, Walter J. Smoleroff, is a senior in Chemical Engineering. Walter is a member of A.I.Ch.E., and plans to go into production work (not research) when he graduates.

And last, but very important, we have plans for the biggest and best Engineers' Day on record, as presented by Wilson Brown, C.E., '40, this year's chairman.

CONTENTS for April, 1938

MEMBERS OF ENGINEERING COLLEGE MAGAZINES ASSOCIATED

Chairman: PROF. RICHARD W. BECKMAN, Iowa State College, Ames, Iowa

Arkansas Engineer
Colorado Engineer
Cornell Engineer
Illinois Technograph
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Iowa Transit
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Pennsylvania Triangle
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Wisconsin Engineer

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MINNESOTA ALUMNI WEEKLY

Campus Scene

Subterranean Sleuthing For Better Engineering

Do you realize the value of geology to the engineer? If you don't, this article will probably surprise you. Les shows us in an interesting way just how important it is. He also gives a brief survey of the geological conditions in and around the Twin Cities.

By Leslie A. Anderson, C.E., '39

All Illustrations from University of Minnesota Press

THE present era of enormous governmental and private engineering projects embracing the fields of drainage, river and harbor improvements, dam and reservoir construction, and water-power development has served to emphasize, more than ever before, the importance of the geologist to the engineer. In order that the engineer be capable of recognizing and aiding in the solution of the problems he will encounter which involve geological principles, it is necessary that he himself acquire adequate training in at least those fundamentals of geology which are pertinent to engineering work.

This geological knowledge need not be limited to the civil engineer alone, even though it is in his field that it will prove must useful. The electrical engineer interested in hydro-electric power; the chemical engineer concerned with organic processes or water purification; the mechanical engineer working with water, gas, or oil; the agricultural engineer pursuing a study of irrigation or soil erosion—each of these may discover that a knowledge of the geology of the region in which he works is helpful, even vital, in this age of competitive services.

It is therefore important for us, as future engineers, to become cognizant of the relation of geology to engineering work in its various aspects. To acquaint the reader with these aspects, specific illustrations of the more important of the geologic-engineering problems arising in Minnesota, and especially in the Metropolitan Region of Minneapolis and St. Paul, will be cited.

A major problem in the Metropolitan Area concerns foundation conditions for buildings, bridges, and dams. This assumes importance because of the large number of heavy structures in the region and the type of underlying formations. Most of Minnesota has been subjected to glacial action at one time or another in geologic history; consequently, the present surface conditions present troublesome problems. A characteristic of a glaciated region is that the surface topography is not always indicative of the bedrock formations. Pre-glacial valleys and old stream channels filled with unconsolidated material may underlie the site of a proposed skyscraper. A bridge site with bedrock exposed at each bank may have upwards of 100 feet of gravel, silt, and unstable material in midstream.

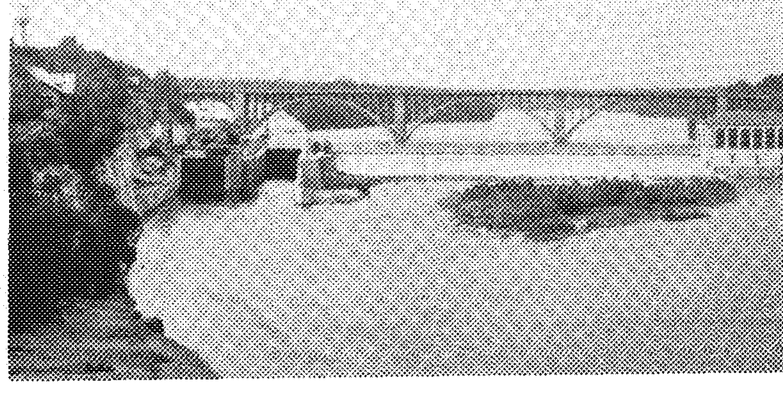
Accordingly, it is necessary, when working in such a region as ours, to determine three factors: (1) the depth to bedrock, (2) the kind of unconsolidated material, and (3) the character of the bedrock. This is accomplished by means of well and test borings and even geophysical measurements. The assemblage of a series of these borings makes it possible to obtain the bedrock contour with fair accuracy.

An interesting example of the results of not making an adequate foundation study before construction is the case of the old Minneapolis Armory on Kenwood Parkway between Lyndale and Bryant Avenues South. Located in a pre-glacial valley which had been filled with unconsolidated organic and mechanical sediments that softened further under the action of water, the building settled unevenly and eventually had to be torn down.

Similar difficulties were encountered at the Dunwoody Institute located in the same pre-glacial valley. Some of the piling actually settled away from the building and threw it as much as three inches out of plumb. The engineers saved the structure, however, by driving piling with hydraulic jacks and constructing trusses to restore the building to its original position. In the construction of the First National Bank Building in St. Paul, it was necessary to drive 84 piers because of poor foundation conditions. Although the depth to the first sandstone was only 30 feet, this formation had become so softened by water erosion that some of the caissons had to be sunk through 50 feet of soft sandstone, until a hard sandstone was encountered.

In foundation work, another factor to consider is the amount of water which will probably be encountered. This

The Twin City lock and dam. Geological knowledge was essential for the design of this structure.



depends on the character of the material to some extent, but also on whether the foundation extends below the water table. Most excavation trouble from water is due to this latter reason. The need for drainage by pumps may easily double the cost set by the unwary contractor, with a resultant loss and even bankruptcy for him.

Below the present channels of the Mississippi, Minnesota, and St. Croix rivers are often found pre-glacial stream channels, which have been filled with unconsolidated material. A knowledge of the origin and history of these gorges furnishes the engineer with a fair idea of what may be expected in any place. An engineer trained in geology will also obtain a complete record of test borings so as to determine the advisability of the site or the type of foundation to employ. Whether he shall use piers which pass through the unconsolidated material and rest on solid rock, as in the case of the Mendota Bridge, or whether he shall use spread foundations which bear weight because of the large surface area covered must be determined in advance of bridge construction.

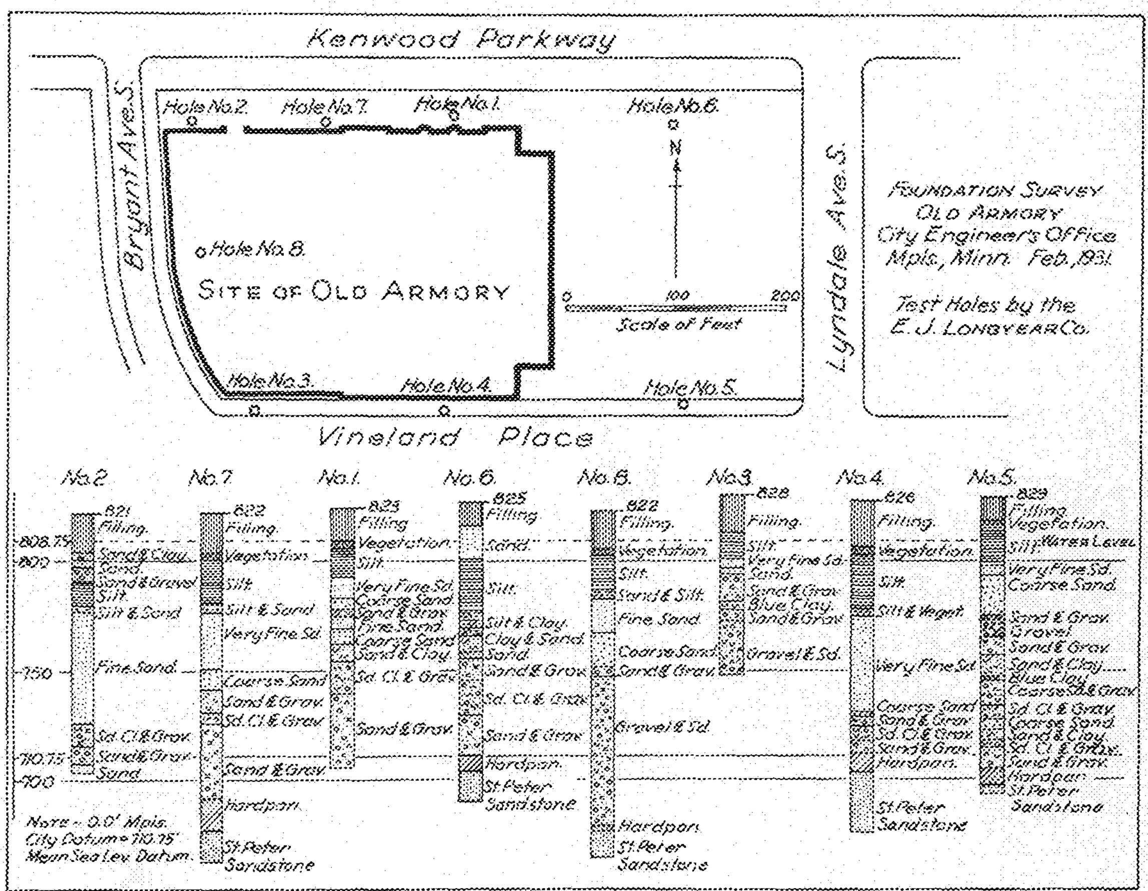
A study of geologic formations is necessary in tunneling operations, if costs are to be reduced and results obtained. In Minneapolis and St. Paul, a subsurface formation known as the St. Peter sandstone has been almost exclusively used for sewer, telephone, power, and heat tunnels because of its softness and ability to stand without support. It has been found that this sandstone formation is most favorable for tunnelling in those places where the overlying layer of Platteville limestone has not been eroded, since this acts as a protective covering to the sandstone.

In not all cases, however, has the St. Peter sandstone proved desirable. If it is located in running water, erosion will occur quite rapidly. The trunk sewers of the Twin City Sewage Disposal Project have encountered eroded caves and running water in the sandstone from time to time.

Equally as important as foundation study is the comprehensive problem of water resources and the relation of the geologist to the engineering work being done in this field. The almost continuous period of drouth in Minnesota since 1920 has aroused public interest in the conservation of the water resources of the state, and has focused immediate attention upon specific problems of maintaining lake levels, conserving wild life, insuring adequate municipal and industrial water supply and sewage disposal systems, developing water power, and so forth. Simultaneous with this, national interest in the problem has been awakened with the national drainage basin study conducted by the Water Resources Committee of the National Resources Committee in 1936, which proposed patterns of water development and specific projects for the various drainage basins of the United States.

In the meantime, in Minnesota, the water of the state was being dealt with constructively for the first time by the Division of Drainage and Waters of our Department of Conservation. Over 300 projects had been constructed and approved for construction by the beginning of 1937, and many more are now being built and planned. The method of attack employed is that of conserving our lakes by storing waters during times of flood to tide over periods of deficiency. This is done by the operation of small control dams and structures at lake outlets.

Foundation conditions at the old Minneapolis Armory were revealed by borings which showed the depth of a filled preglacial valley.



To more fully understand the great wave of interest in water conservation in Minnesota, a thorough study of the geology of the region is necessary. It is possible to present here only a brief outline of the chief geologic principles involved, as applied to the Metropolitan Area.

Most of the lakes in the Metropolitan Area are basins which have been formed by the irregular deposition of glacial material. These lakes maintain their level either because their basin is underlain with an impervious clay, or because their bottom is below the groundwater table (or natural subsurface water level) of the region. Lake Minnetonka, as well as most of the lakes of the area, is of this second type. Accordingly, it becomes apparent that the maintenance of lake levels in this region is largely a matter of preventing great fluctuation of the ground-water table of the region.

Lake Minnetonka furnishes an excellent example of the aid given the engineer by the geologist in this field. Because of its type of basin, it was shown that the level of Minnetonka could not be raised simply by pumping from adjacent wells. This would prove useless inasmuch as the artificial raising of the lake above the adjacent water table would promote greater seepage down to the water table, with the result that much more water would be needed to maintain the new level than to fill the entire basin.

Perhaps the best recommendations for the state as a whole are those given by the Minnesota Geological Survey. In Bulletin 27, *The Geology of the Minneapolis-St. Paul Area*, by G. M. Schwartz, it is proposed that water in swamps be retained as much as possible and drainage by ditches be discouraged so as not to lower the water table of the state and consequently the lake levels. A second remedy is to keep the soil covered with vegetation so as to prevent soil erosion and to allow the soaking up of as much rainfall as possible.

The National Resources Committee in *Drainage Basin Problems and Programs*, 1936, cite the necessary plans for the Upper Mississippi basin. Primarily, this plan necessitates the correction of the present low flow in the river, prompted by three factors: (1) the small excess of the minimum flow of the Mississippi River over the demands of the Twin Cities for water, (2) protection of the large investments made by the United States for navigation improvements, (3) present and potential water-power development on the river.

They suggest that such a plan be supplemented by a complete treatment of wastes discharging into the main stream, which would lead to the promotion and expansion of the recreational facilities of the state, and an increase in tourist traffic. The treatment of river wastes has been partially met by the construction of the Twin City Sewage Disposal plant which will begin operation about May 1.

The proposals for the remainder of Minnesota are similar, with the correction of varying stream flow, the preservation and increase of recreational and wild life areas, and the development of minor water-power projects being the chief objectives. In addition, along the western tributaries of the Mississippi, the further problem of excessive soil erosion in times of heavy rains and floods must be met by the engineer, with the aid of the geologist.

Controversial in nature is the problem of future water supply for the Twin Cities. When it is noted that the present peak demand is 50 per cent of the minimum flow of record in the Mississippi river, it is evident that sometime in the near future, if the present drouth and increase in population continue, it will be necessary to go to Lake Superior, the St. Croix River, or some other place for our future supply. Knowing that the Twin Cities are located in an artesian basin, some individuals have suggested the use of artesian water for the cities. It is true that the largest amount of underground water in the Metropolitan region is artesian in character, but whether or not the local supply is adequate for even Minneapolis is doubtful.

Studies made to date tend to support this statement. An understanding of the factors necessary for artesian water will prove helpful in determining for oneself the feasibility of such a water supply. These factors are: (1) an adequate source of supply, (2) a porous formation to conduct and store the water (called an aquifer), (3) an impervious overlying bed to retain water in the pervious bed, (4) a source of pressure—the aquifer exposed at the surface at points higher than where the proposed well is to be drilled.

The author is indebted to George M. Schwartz, Associate Professor of Geology at the University of Minnesota, for his assistance and for his permission to use material and information from Bulletin 27 of the Minnesota Geological Survey. This bulletin, entitled "Geology of the Minneapolis-St. Paul Area," was written and compiled by Professor Schwartz and was published in 1936 by the University Press, Minneapolis, Minnesota.

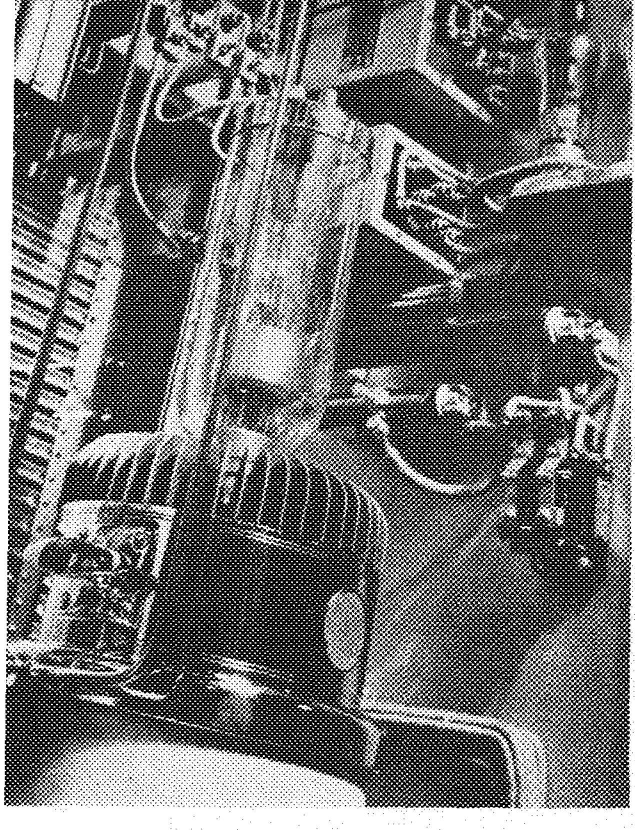
It is true that this region possesses the last three characteristics. The Metropolitan Area is a huge basin of subsurface formations with Minneapolis and St. Paul in the center. The most important of the porous formations under the area is the Jordan sandstone, because it is comparatively porous and highly permeable and underlies almost the entire region at not too great a depth.

The first factor, an adequate source of supply, provides the problem. The source of artesion water is rainfall and ground water flowing into the pervious bed. It is apparent that the larger the area of the porous bed outcropping at the surface, the greater the amount of water soaking into the layer will be. The actual exposed area of the Jordan sandstone at the present time is about 400 square miles. With our small amount of annual rainfall and the steadily increasing demands on the supply by wells for domestic and industrial purposes, it would only be a matter of time before the entire artesian basin would become so depleted as to necessitate abandonment of many of the wells. Without the work of the geologist on this and similar problems, it is entirely possible that a needless expenditure of time and money might have been made.

In conclusion, the information and assistance given the engineer by the geologist in the location of economic deposits such as sand and gravel, building stone, foundry sands, and clays for bricks and pottery, should not be overlooked.

Sand and gravel for roads, concrete, and other purposes are readily located by the geologist through his knowledge of glacial activity in Minnesota and types of deposits. In highway construction work, especially, the location of good deposits near at hand is important if haulage charges are to be reduced. The geologist's knowledge of the bedrock formations enables him to inform the engineer of the location and suitability of various kinds of building stone for a certain use.

Numerous examples of the dependence of the engineer upon geology for the successful completion of his assigned project may be cited. The thoughtful engineer, however, without further study, will readily recognize and appreciate the work of the geologist in making the engineer's work easier, more safe, and more economical.



View of new 5 kilowatt tube showing cooling fins. The two tubes in upper right hand corner are rectifiers for the grid bias potential.

W L B Expands for Improved Service

Last October the Federal Communications Commission granted WLB a new license, which allowed the University station to change its wave-length, increase its power, and to broadcast more hours per week. On the basis of the new license WLB made numerous changes in its equipment. These changes, together with an outline of the station's plans for an enlarged broadcasting program, are described in this article.

By George G. Bower, E.E., '40

THE place of radio in our lives is becoming more and more important as the time passes. From the time that commercial broadcasting began in the early part of the last decade, we have become more and more dependent on the radio for entertainment, news, and general information. The ability of the radio to reach a great number of people is recognized equally well by dictators, politicians, and advertisers. The fact that the field covered by radio is so large has led many universities and colleges to establish their own stations and to present material that not only appeals to the mass of the people, but also endeavors to educate them at the same time.

A World University was recently established by Harvard through the Rockefeller Foundation. Lectures on music, art, science, and literature are broadcast on short wave through the facilities of the World Wide Broadcasting Company and station WIXAL. Other contributing institutions are Yale, Amherst, Wellesley, Mount Holyoke, Columbia, and the Universities of Michigan and Wisconsin. Replies to broadcasts have been received from Africa, Australia, and Ireland. These lectures are available to almost anyone in the world who has a short wave receiver and who understands the English language.

The maximum effectiveness, however, is believed to be obtained from a locally owned and locally controlled station, such as our own University station, WLB. The increased time available on the new frequency and major changes now being made in the equipment will render this part of the University's educational program far more effective and complete than it has been in the past.

Extension of Programs

Under the new arrangement, WLB will have an average of 30 to 40 hours a week on the air instead of the 8½ hours allowed under the old arrangement. According to Burton Paulu, assistant director of radio broadcasting, the new allotment of time will be used in broadcasting such programs as the following: (1) musical programs, (2) special University convocations and lectures, (3) dramatic programs, (4) classroom lectures, and (5) programs to the elementary and secondary schools. The musical programs will be somewhat the same as before, in that recordings of symphonic and operatic music will be broadcast. WLB has received favorable response toward this type of program, which agrees very well with the response shown the National Broadcasting Company for its Saturday afternoon broadcasts of the Metropolitan Opera, and the Columbia Broadcasting System for its Sunday afternoon broadcasts of the New York Philharmonic orchestra. Further evidence that this type of program is gaining popularity is shown by the fact that large companies are paying for time on the air to present similar programs. Studio broadcasts of the University band, orchestra, and other musical organizations on the campus will also be featured under the new arrangement.

The broadcast of special convocations and lectures will include those coming in the late afternoon. The field for this seems very great, for there are a large number of speakers from here and from other colleges, talking on a variety of subjects that would be of interest and benefit to the general public.

The dramatic programs will be presented to help satisfy the public's interest in programs of this type. Mr. Paulu mentioned the success of the soap, flour, and hand lotion daily broadcasts over the commercial stations as sufficient evidence that the public is interested in dramatic programs. The WLB broadcasts, however, will be comparable in quality of material presented to that of the musical programs. A great step in improving the dramatic programs over the commercial stations was made last summer when a series of Shakespearian plays were presented. They were well enacted, and sound effects supplied the proper atmosphere. It is usually easier for the public to understand and enjoy plays, when they are presented in this manner, than it would be if they were to read them.

The broadcast of classroom lectures (a subconscious dream of every student) is to be an experiment. KSTP tried a few specially prepared programs in the last two years, when they broadcast from different classrooms around the campus. Their method was not quite as direct as the WLB method will be, since they used a short wave transmitter to pick up the lectures and then converted them to their own broadcast frequency at their station. Much can be accomplished by these lectures in familiarizing the public with the methods that are used and the material that is presented in the college classroom. The lectures to be broadcast would be limited to those that appealed to the majority of the people, making it necessary for students taking "Functions of the Complex Variable," "Exact Gas Analysis," or "Introduction to Theoretical Physics" to come to class as usual.

The broadcasts to the elementary and secondary schools would consist of programs originating at the University which would be received directly in the schools as part of their educational program. The National Broadcasting and the Columbia Broadcasting System have been experimenting slightly with such things, but a locally controlled University station can do much more in this respect than a national hookup. So far, however, the subjects have included music, geography, the social sciences, and many others suitable for the purpose. It is quite easy to see that the student would probably receive a more vivid picture of a Shakespearian play, a Patrick Henry oration, or a trip to Europe, if it were dramatized to him, than he would otherwise. Although this venture will be the University's first attempt at this type of a program, it is evident that there is a wealth of talent and material that would be available for such purposes. The general trend in this direction is also evident in the fact that most of the new schools have been built with some arrangement of intercommunication between rooms, making such programs very convenient to handle.

The outline for the programs given above has necessarily been very general and very brief; but, as the station nears completion, a specific program will be worked out to utilize the increase in time to the best advantage.

Changes in Equipment

The new equipment, which will replace the 1 kilowatt transmitter, consists essentially of a 5 kilowatt transmitter, built by the Radio Corporation of America. The transmitter is made up of a number of component parts, each of which is housed in a separate compartment. The compartments contain the exciter, the amplifier, the modulator and rectifier, and the switchboard. A door next to the switchboard leads to the back of the transmitter. Instead of using the familiar shelf construction, the manufacturers have used a vertical chassis on which to mount the parts. The advantage of this arrangement is that it permits a lighter assembly, and also simplifies replacement of parts because there are no shelves to block off the interior into small inaccessable compartments.

Another feature of this transmitter is that it is the first one of its size to use all air cooled tubes. When one thinks of the number of electrons that are being evaporated off the cathode and drawn to the high potential plate, it is evident that there is a large amount of kinetic energy being converted to heat when these electrons are brought to a stop. Although the mass of the electron is small, the velocities may approach 100,000 miles per second; and since the kinetic energy is proportional to the square of the velocity, and the number of electrons traversing the path is very large, enough heat is generated to raise the temperature of the circulating air 10 degrees Fahrenheit.

The cooling surface for the plate of the tubes to dispel this heat is provided for by radiating fins as shown in the picture. The actual working portions of the tube-cathode, grid, and plate are covered by the fins, while the glass part above incloses the leads. The plate of the tube is connected to the fins by a concentric copper cylinder. It is the high conductivity of the copper that makes such a tube possible. A stream of air is filtered and blown through the fins by means of the fans, as shown in the second picture.

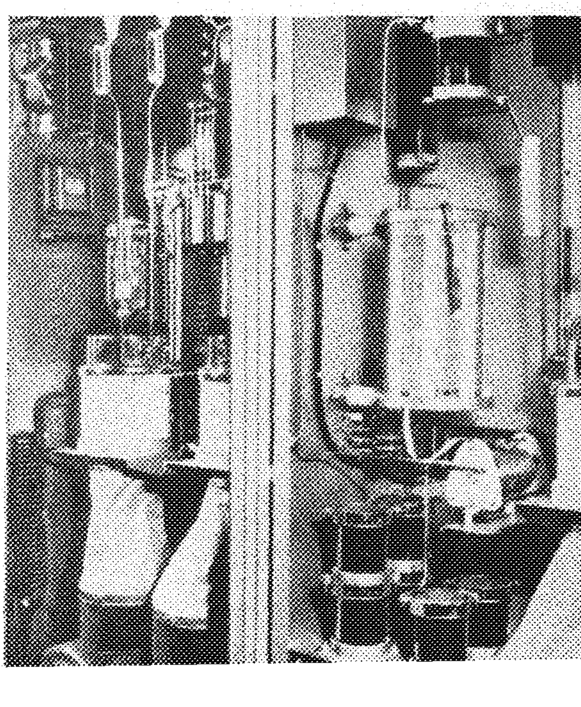
Air cooling has many advantages over watercooling. In the first place, it is more efficient because the heat is transferred directly to the air, while in the watercooled type, the heat is transferred to the water in the jackets surrounding the plates, and the water then has to be cooled by circulating through copper air cooled radiator cells. Another advantage is that there is no possibility of scale forming on the plate, a formation which reduces the heat dissipation, and causes the tube to operate at a much higher temperature. The air cooling also eliminates bubbles forming on the anode, which would result in local "hot spots" which are likely to cause the tube to fail by gas. A third advantage is the reducing of maintenance cost necessary to repair leaks that might occur in the water cooled type. An air cooled tube operates much faster and is easier to replace, in case of failure, than the watercooled type.

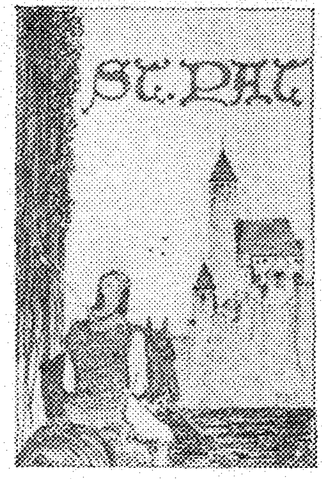
The circuit, according to the manufacturers, is one of the simpler types, with all parts operating at a conservative rating. The manufacturers claim that the operating costs are about half of those of the older types of 5 kilowatt transmitters. This is largely due to the more efficient plate circuit of the air cooled tubes in which only 25 per cent of the power is lost in heat in comparison with the 77 per cent loss in the older types. Circuit breakers are used for the important elements of the transmitter, so it isn't necessary for the station to be off the air for long periods of time while the engineer hunts for a fuse. In case lightning should arc across the antenna or line, the transmitter automatically shuts itself off to break the arc, and then comes back on the air. Meters are used freely throughout the circuit, and each is fused to prevent damage in case of excessive current.

Another factor, beside the increase in power, that extends the range of the transmitter is the change of frequency from 1,250 kilocycles to 760 kilocycles. A crystal-controlled oscillator under constant temperature insures reliable frequency control. A frequency of 760 kilocycles is a better frequency because the ground wave is not absorbed to the same degree as it would be at 1,250 kilocycles.

The transmitter is housed in a roomy addition to the older station on the University golf course. Telephone lines connect the station with the present studios in the Electrical Engineering building. Trunk lines extend from here to other points on the campus, so that programs can be picked up from a number of different sources.

Back view of exciter and amplifier showing the fans used to force air through the fins.





Engineers' Day, May 13-14

It won't be long now before the Engineers take over the campus for the biggest Engineers' Day ever planned in the history of the University. Each one of you should have an integral part in the success of this gala event.

By Wilson C. Brown

1938 Engineers' Day Chairman

Again the time is nearing for all loyal engineers to gather 'round the Blarney Stone to pay homage to their patron saint. Each year the announcement of Engineers' Day plans recalls the colorful history and tradition behind each celebration, and brings forth memories of the celebrations that have gone before. Engineers' Day has grown from year to year until it is now one of Minnesota's finest traditions.

It all started back in 1903 when the Blarney Stone made its appearance in the form of an omen from the skies, or what will you. At the time, excavation for the Engineering Annex was being rushed to completion when the crew stumbled on a large stone bearing the inscription, "Erin Go Bräugh," which means, in our language, "St. Patrick Was an Engineer." A group of senior engineers decided that this must be a message from St. Pat, himself, and with all due awe and respect for omens, dedicated the day to the honoring of St. Patrick, the patron saint of all engineers.

The year 1910 marked the turning point for Engineers' Day activities. Until this year, the only means of celebration was the annual All-Engineering dance in honor of St. Pat. Under the leadership of Prof. George C. Priester, then in his first year as an instructor, the plan of activities as used since that time was devised, including the parade, the open house, the brawl, and the dansant. Prof. Priester also holds the distinction of being the first St. Pat. In the last two years an attempt has been made to add several field day events to the program. This year will bring two minor changes toward the further enlargement of Engineers' Day program. The date has been moved up to May to increase the chances of good weather. Also two days will be set aside for the celebration so that all due respect and honor can be paid to our patron saint. For St. Patrick was an engineer and he would have it so!

General Plans

Before I discuss the plans we have made for this year, I would like to present my executive committee. The following fellows will be largely responsible for the success of Engineers' Day: Paul Feyereisen, E.E., Athletic Program; Herb Gaustad, Civil, Publicity; Don Lampland, Aero, Parade; Frank Larson, Chem. E., Buttons; Ken O'Brien, Civil, Treasurer; Millard Troxell, Mines, Open House; and Robert Wolfe, M.E., Brawl.

Showing again the indomitable courage and uncrushable spirit that was St. Pat's, and defying superstition, Engineering activities will begin on Friday the 13th of May and continue through Saturday the 14th. Dean Lind has graciously given his official consent to the two-day holiday so classes will be dismissed both Friday and Saturday.

Here's the program for the two days:

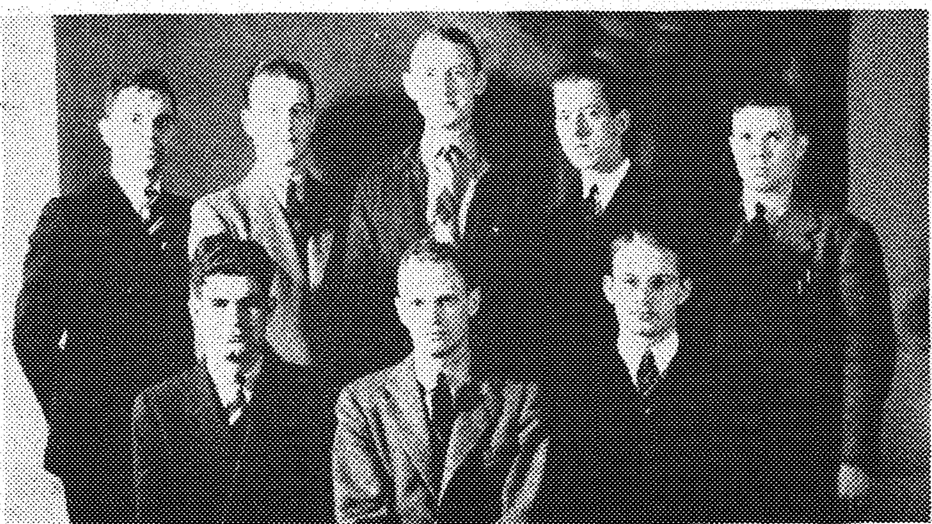
Friday:

10:30 to 11:30	Parade
11:30 to 12:30	Knighting Ceremonies
3:30 to 5:30	Dansant at the Union
2:00 to 10:00	Open House

Saturday:

9:30 to 3:00	Field Activities
9:30 p.m.	Brawl

Engineers' Day executive committee: front row, left to right: Wolfe, Brown, Troxell; back row: Larson, Feyereisen, Lampland, Gaustad, O'Brien.



That's what you engineers are going to be doing, and that means all of the engineers, for Engineers' Day will not be a success until you can look back and realize that the biggest event of the year has given you the most fun of the entire year.

Buttons

In order to put on a successful Engineers' Day it is necessary to spend a good deal of money. Our major sources of revenue are the sale of

Now that the miners are with us, it takes more than a cop to stop the parade.

buttons and the sale of Brawl tickets. The success of the day will depend a great deal on the coöperation you students give in buying buttons and tickets.

Extensive plans are being made this year for a button campaign which will be irresistible. As usual, the campus will bristle with sales girls, out after your quarters. They will be striving to reach a goal of 100 per cent of the Institute. Let's make our motto, "Every Engineer with a Button and a Brawl Ticket." It is the least you can do in honor of St. Pat and for the glory of the engineer.

Parade and Knighting Ceremonies

Our policy for this year calls for something new in the line of Engineers' Day parades—a clean parade. Well, at least fairly clean, or perhaps just reasonably clean, but anyway comparatively clean. Of course the risque stuff, a la Esquire (something clever and subtly dirty), is all right; but the backhouse float is definitely out!

Starting at the engineers' parking lot the parade, headed by a police escort, and complete with St. Pat and his Queen, marching seniors in the garb of St. Pat, student floats, and bands, will follow its traditional route to the knoll. Here in the historic Knighting Ceremony the seniors will pay their respects to St. Pat by kissing the Blarney Stone. The seniors will then be knighted and dubbed "Knights of the Order of St. Pat" by the Queen.

Open House

Open House is probably the largest and most important feature of Engineers' Day. It is here that the off campus visitors learn of the activities of the student engineers, while students have a chance to observe the workings of the other divisions of engineering. Exhibits of the various departments will be set up by the various societies to exemplify their respective fields. These displays will vary from the routine to the spectacular and should present enough variety to meet the interests of all. I would like to make a special plea to you fellows to invite your parents to our Open House. Give them a chance to see what you have done or will be doing during your University life. The faculty will be present to meet all parents who come. Refreshments will be served during the evening, and the Open House will come to a brilliant climax with a gigantic display of fireworks.

Field Day

In an effort to increase the success of the field day activities, we have finally decided that a combined picnic and athletic meet will be the best means of arousing enthusiasm. The event will be held on the river flats, beginning on Saturday morning and continuing into the afternoon. Tug of war, egg catching, and greased pole contests, together with several other activities, will be the features of the day. A kittenball tournament will be held among the engineering societies with prizes for the winners. It is rumored that a faculty student kittenball game may be held. Think of throwing "bean balls" at your favorite professor; or maybe you faculty men would like to show some particular student how the game should be played? Concessions will serve the usual picnic delicacies while the more advanced students may find an opportunity to relax completely with "a loaf of bread and . . ."

> **Hear Ye! Hear Ye!**
>
> **St. Pat hereby calls all his loyal subjects to the support of the kingdom, to submit designs in the button contest so that he will have a fitting emblem to celebrate his day.**
>
> **To the loyal engineer submitting the best design will go a notebook, donated by the Bookstore. Second prize will be a ticket to the Brawl.**
>
> **Submit all designs to the Engineers' Day office, 102 Union, by Wednesday, April 20.**

Dansant and Brawl

In previous years, the engineers have tried to lure the fairer sex from the Arts college into the Main Engineering building for the afternoon dansant. Always elusive, women have simply refused to be ensnared by the wily engineer—at least in very large numbers. But this year we make a bold and strategic move; the engineer goes to the women. In other words the dansant will be held in the Union in an effort to draw girls from the Arts college. Now, we'll see how the "shagging" instead of the shaggy engineer looks.

The hilarious, gala festivity of the year—the Engineers' Brawl—pulls up the zipper on the celebrations. To be held again at one of the downtown hotels, the Brawl promises to be an event which will top off the day's activities in such a way that Engineers' Day of 1938 will live long in the minds of every engineer in the Institute.

It is traditional for the seniors to kiss the Blarney Stone and be knighted by the Queen.

The Minnesota Techno-Log

APRIL, 1938

"Activities" vs. Inactivity

When the average engineer is asked why he doesn't participate in extra-curricular activities, he gives one of two reasons. Either he says that he hasn't the time or that he doesn't see that they are worth-while. Of these two reasons, the first may be partially valid, but the second shows a very short-sighted viewpoint on the part of the one giving it.

It is true that engineering courses do take time and lots of it. What with experiments to perform in the laboratory and reports to write, an engineer is kept busy. But these things don't take all of his time. If the average week of the average engineer were analyzed, it would probably be found that he had time for at least one bull session, a movie or a dance, an evening of listening to the radio, and probably a little plain ordinary loafing. Or he may have a part time job to which he devotes 10 to 20 hours a week. Now, a student who is working hasn't much opportunity to participate in extra-curricular activities, but students who aren't working should certainly take advantage of the chance such activities offer for self improvement.

A student who works on the TECHNO-LOG, or is active in his particular engineering society, or serves on an Engineers' Day Committee, or is active in campus politics gains much valuable experience. He learns how to work with other people and how to get other people to work for him. Work of this nature develops his originality and his sense of responsibility. It teaches him to budget his time and how to work with a maximum efficiency. These things are fully as important to his future as the technical knowledge he gets in the classroom. The further he climbs the ladder of success the more he will have to handle people and the less he will have to handle things. The sooner he acquires the ability to work with and handle people, the sooner he will be ready to ascend the ladder. Collegiate activities furnish him an opportunity to acquire these skills early in life.

So engineers, get out and participate in Institute activities. You'll have a lot of fun, you will widen your circle of acquaintances, and you'll gain experience that will be a valuable supplement to your technical knowledge.

WHY & HOW

Last month we described the TECHNO-LOG'S methods for gathering material for the various parts of the magazine. Now we shall take you through the sequence of production which follows our receipt of copy.

First, the manuscripts are read by the managing editor, the copy-editor, and the make-up editor, who may make changes in the length of the story to accommodate it to the space to which it has been assigned, and other adjustments.

The manuscript is then given to copy-readers, who read it carefully and make corrections in grammar, punctuation, spelling, capitalization, etc. From their hands it passes to the copy editor, who again reads it, makes any necessary corrections, and, after approving it, submits it to the managing editor, who also reads it, corrects it, and marks it with instructions for the printer.

The printer sets up the material on a linotype machine and prints it on long sheets of paper, known as proofs, each wide enough for just one column of print. These are returned, together with copy, to our office. At this point the copy-readers, together with most of the rest of the editorial staff, are transformed into proof-readers. Working in pairs they read the proof and copy simultaneously, searching for errors in typesetting and for errors that escaped the original copy-reading.

The corrected proof is returned to the printer while another set of proof along with proof of illustrations, etc., is cut up and pasted into a blank magazine known as the dummy. At the same time, proofs of illustrations, headlines, captions, advertisements, and other items are pasted in their proper places.

The dummy is marked with page numbers, carefully examined, and submitted to the printer. From the dummy the printers make up full pages of type and illustrations and from them print page proofs. After the page proofs have been corrected and approved the magazine is printed, bound and delivered to us. Then we (the business staff) distribute it in the P.O. to you. Simple, isn't it?

A New Victory For Chemical Research

Instead of our usual book review, this month we have asked one of the senior Chemical Engineers to describe an epoch-making saga of research recently brought to a successful conclusion by students of the department of chemical engineering. We trust his description will give you a fuller appreciation of both the difficulties and the possibilities of chemical research.

By Walter J. Smoleroff, Chem. E., '38

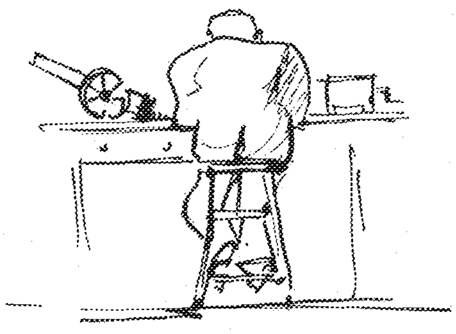
IN ORDER to keep up with the rapidly advancing front of theoretical research, a secret group of undergraduate chemical engineers, known as the Dirty Six, have been working feverishly 24 hours a day for the last 52 years on a problem which they believe is the first practical application of classical science. The aim to which this group tenaciously clung was to manufacture a product that would be in most demand by the largest percentage of the public at a minimum cost. Now a product which is to enjoy sustained economic success must naturally have a real or potential market and be manufactured on a technically sound basis. Keeping these views in mind, they made an extensive survey of the markets and saw that the biggest void lay in the lack of a suitable beverage.

When they had established their goal, they bent every talent and resource at their command toward reaching it. It is not necessary to enumerate all the hardships and trials they suffered during the ensuing years—the ridicule of classmates, years without food or drink, the disheartening interruption of final weeks, the agony of a semi-yearly bath, and even the missing of an occasional Saturday night out. Let it be sufficient to say they had the courage to carry on.

The ultimate achievement, which has been named Chemifizz, is manufactured by the proper coördination of several unit operations. These include fluid flow, heat flow, pipe-fittings, transportation of fluids, evaporation, plumbing, diffusion processes, humidity and air conditioning, plumbing, drying, gas absorption, pipe-fitting, distillation, extraction, plumbing, crystallization, filtration, pipe-fitting, mixing, crushing and grinding, plumbing, size separation, conveying, pipe-fitting, appendix, and index. The proper sequence of these operations was determined by the mathematical law of probability. The names of the operations were written on separate slips of paper, mixed up in a hat, and drawn out one by one. The proper combination would have been determined 23 years ago, but with only two slips of paper left to go the drawer peeked a little and spoilt the whole darn thing. Gyping the public is one thing the Dirty Six would not tolerate. So for 23 more weary years they toiled before fortune smelled upon them. Then, success! Success at last! But, let us describe the drink.

Chemifizz contains a minute quantity of a very rare element, No. 93, which is found only on Mars, Pluto, and in Dr. Mann's Bulgarian Buttermilk. After condensing 1,026,321.001 tons of the milk, the students succeeded in obtaining 0.00001 grams of this mysterious element. It has the curious property of emitting particles that travel in an upward direction only and have accordingly been named upitrons.

In partaking of Chemifizz the continual bombardment of the upitrons on the upper part of the anatomy gives a person that well-known lift without the detrimental effects of alcohol. It is seen that a number of mental states are at once possible. By lying flat a person feels normal; by standing on his head, depressed; and any desired mood by standing at angles varying from 0 to 90 degrees. No doubt the public will clamor for this drink when they learn that immediate and complete soberness can be obtained by inserting a strong magnet in the seat of the trousers. This holds the upitrons in a state of rest. No embarrassing sagging due to the weight of the magnet need be feared for the upward pull of the upitrons counteracts the gravitational pull of the magnet and holds it securely in place. However, one must remove the magnet with care or he will suffer the experience of Chemical Engineering Instructor Gordon who was lifted so high by the sudden release of the upitrons that, according to calculations of Student Bill Trutna, he will still be floating 66.6 feet above the Chemistry Building entrance at the beginning of final week. The students offered him a pull down to the entrance level so that he could assume his proctorial duties during this week, but he graciously declined. "No matter what the occasion is, I hate to be a ceiling flower," he said.



". . . they had the courage to carry on."

Here are some of the more intelligent comments made by some of the persons who were privileged to sample Chemifizz.

Student Lundborg: "Chee!"

Chem. Eng. Instructor Grove: "I find that by throwing my head back and gargling Chemifizz, the upitrons stream through my moustache and straighten out the whiskers better than any comb can."

Student Clinard: (censored).

Prof. Einstein: "By mixing Chemifizz with mineral oil, I find that it is the best hair-stay I have ever used."

Student Halvorsen: "I find Chemifizz of great assistance in climbing from the basement to the fourth floor."

Chem. Eng. Instructor Gordon: "The weather is fine up here."

Student Shapiro: "It's de nuts!"

And so another link has been forged in the chain of progress. By combining the impossible with the improbable they accomplished a feat beyond the wildest dreams of science. May their work be carried on.

Industrial Relations

And the Engineer

Here are presented two views of the way the engineer can help promote industrial peace. One author sees him as a mediator of strife; the other sees him as a force to prevent discord from arising.

Illustrations by Albert Arneson

I Mediation

By Charles V. Berger, Chem. E., '38

ONE of the most critical subjects an engineer encounters in industrial employment at the present time is that of the increasing strife between capital and labor. Never before has this subject played such an important part in industry, nor has it ever been of such vital import to the engineer. Concurrent with this increase in industrial strife, the federal government has expanded its labor arbitration facilities greatly in the last few years. The need for trained men in these governmental arbitration functions has been great because of their rapid growth. Lawyers, accountants, economists—all were needed in this rapid expansion; and each did his part well. It is my contention, however, that the engineer is as capable and as competent as any to act as an arbitrator, if I impose a restriction upon his selection. This restriction is simply that he must not have joined the ranks of either labor or capital. To clarify this statement, I shall trace the engineer's position from the time he enters an industrial plant, soon after graduation, to his position some years later.

When the young engineer first enters the industrial plant he is ambitious; perhaps he aspires to hold an administrative position in the industry rather than a laboring one. In this case he aspires to be capital. Yet, he is haunted by the spectre of fellow workers in the plant who graduated years before him, who still wear overalls, carry wrenches, punch time clocks. Will he be carrying his dinner pail in 1950 as he is now? Confronted with these conflicting visions, the young engineer may remain aloof from all organization and strive to lead instead of follow, or he may choose the course of unionization and labor, since that is the only way he can better his conditions as a laborer.

If he has taken the latter course, that of unionization, he is definitely labor and will receive no further consideration in this article because he cannot act as a mediator. The other course, the one in which he remains aloof from organization, can be further subdivided. If he is able to realize his aspirations for capital, if he abandons engineering, he would be classified as capital. As such his position would be untenable as a mediator from labor's viewpoint. However, if he remains an engineer in the true sense of the word, perhaps he can do his part in reducing the continual strife that exists between an industrial employer and his employees. I propose to demonstrate that the engineer, if restricted by these requirements, can use this unique position to mediate or otherwise offer service in an effort toward conciliation.

First, let us investigate the history of labor and business conditions for the past nine years, with emphasis on their influence upon industrial arbitration. We must recognize recent labor trends and recent labor legislation before we can determine the engineer's problems and his value as a mediator.

In 1929 the well known crash occurred. In the years immediately following, circumstances were such that wages were decreased and hours lengthened. Furthermore, jobs were so scarce that labor could not risk strikes; hence it was in a poor position to demand that its grievances be arbitrated.

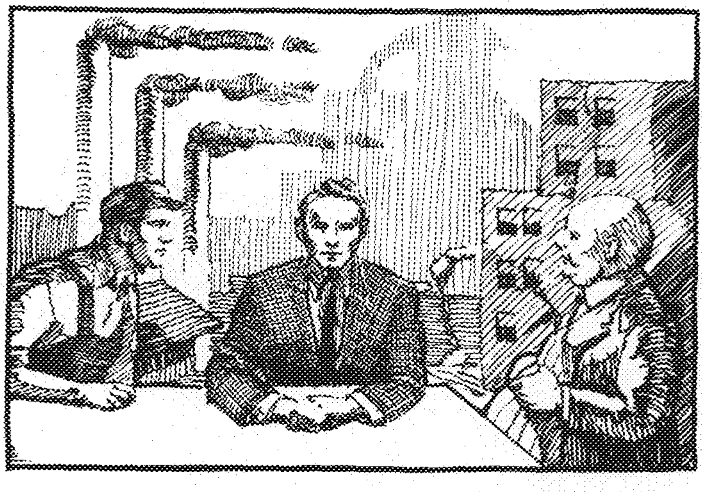
With the advent of the Roosevelt administration new laws were passed by Congress guaranteeing collective bargaining and arbitration between employer and employee, so labor unions began to increase in membership. Prices were raised artificially by mild inflation, and by production curtailment. For a time, they rose out of proportion to the increase in wages, with resultant strikes, as labor lost its fear and became more aggressive.

Then, in 1935, the Wagner Act was passed. This act provided for complete freedom of organization for the worker; it penalized any employer who discharged an employee for union activities; it provided for a closed shop agreement in the event that a majority of the employees voted in favor of a union as their sole bargaining agent; it outlawed company unions; it provided for contracts on wages and hours between companies and unions; and it extended the scope of the National Labor Relations Board, which was established by the National Recovery Act, by giving it almost judicial powers. By this act labor was given its greatest opportunity for collective bargaining. What would they make of it?

The act affected both the C.I.O. and the A.F. of L., but in different ways. The C.I.O., by organizing the laborers according to their industries (i.e., auto industry, steel industry, etc.), was able to enlarge its membership rapidly and consequently increase its power. However, the A.F. of L., whose men are divided according to craft (i.e., painters, carpenters, plumbers, etc.), was able to effect no such expansion. Consequently, its power did not increase; it even decreased relative to that of the C.I.O. Moreover, these organizations had conflicting policies. The A.F. of L., headed by William Green, remained conservative in nature, whereas the C.I.O., headed by John L. Lewis, became somewhat radical.

Turning again to the subject of arbitration, a pertinent question may now be raised. Has arbitration between la-

bor and capital been improved by the passage of the Wagner Labor Act and the institution of an effective N.L.R.B.? This may be answered in the affirmative if we consider the question only from the labor standpoint. Theoretically, the board is empowered to restrain either side from breach of contract. But since a corporation can be more readily restrained in legal proceedings than an organization such as a union that is not incorporated, the action of the board has been confined chiefly to restricting capital. Consequently, the employer cannot agree that arbitration has



The engineer is well equipped to settle differences between capital and labor.

improved, because he does not know whether he could ever bring suit against his employees' representatives in case the latter broke the contract illegally. In spite of such a defect, the act shows promise and should improve relationships if it is altered somewhat and properly administered. Incorporation of labor unions would necessarily be an alteration of prime importance.

After this brief survey of the period leading up to the present relationship between the employer and the employee, we shall turn our attention to the position of the engineer. What are his qualifications as a mediator?

First of all, let us consider his qualifications from a labor viewpoint. The engineer, particularly in the beginning of his career, has worked among laborers, usually as one of them. He can understand and appreciate labor's desire for shorter hours and higher pay. He is familiar with the physical hazards that labor faces. He can readily understand labor's desire to unionize in order to better its condition. He is aware of labor's fear of unemployment, lockouts, blacklists, and exploitation.

From an industrial standpoint also, the engineer has many desirable attributes. He has an expert technical knowledge, and he can appreciate the difficulties an industrialist must face in plant construction and operation. He can understand the economics of a process. He realizes that labor is only one of the many factors with which a manufacturer must contend. Briefly, the engineer is as impartial a judge as capital could hope for.

In view of these qualifications of the engineer, I believe that he would be an unexcelled arbitrator. I do not feel that he would be able to offer a remedy for all the world's ills, or even for the evils of industrial strife; but I do contend that his experience makes him eminently suitable for the role of conciliator. He is not a dreamer, an idealist, or a theorist; he is a practical man.

II Cooperation

By C. Vernon Olson, E.E., '39

"STATISTICS show that 21 years after graduation 63 per cent of engineers occupy executive positions," states Mr. G. R. Beach, a duPont personnel man. It is with the problems of this 63 per cent of engineers who act as foremen, department heads, and executives of various kinds that we are here principally concerned. They have the problem of keeping their relationship with the men directly under them coöperative and friendly. But this is not all. Theirs is the duty (often ignored) of keeping the relationship between their men and the central management harmonious by interpreting the just desires of the men to the central management and vice versa. It is in these two directions, by preventing the accumulation of grievances, that manager-engineers can be so mighty an influence for industrial peace.

Since much which can be said about the one problem is applicable, with modifications, to the other, no distinction will be made here. I shall use the expressions "management" and "men" as general terms to represent the employer, leader, or boss and the employee, follower, or laborer, respectively.

This writer subscribes to the idealistic theory that in any organization a state of industrial peace can be reached which is satisfactory to both management and men. The problem is one of understanding the men's point of view and of showing a sympathetic attitude toward their desires *before* they express themselves with a strike.

Let us look for a moment at the divergent outlooks of management and men.

A Manager's Attitude

Managers, being for the most part rugged individualists, have worked hard and long to attain their position. Theirs has been the constant worry of making ends meet. Having fought for what they have, they believe they have the right to treat employees as they please. Among employers there is, as Taft, former president and later chief justice, expressed it: ". . . the Bourbon, . . . the man who says: 'It is my legal right to manage my business as I choose, to pay such wages as I choose, to agree to such terms of agreement as I choose, to exclude from my employment union men because I don't approve of the tenets of the union, . . . I do fairly by my men; I pay them what I think is right, and they will not complain unless some outside union agent interferes. I run a closed non-union shop, and I am happy and propose to continue happy.' This man is far behind in the progress of our social civilization."

All the problems of scientific management and of the economic relationships between wages, cost, prices, volume of production, and so forth, are constantly before the manager; but the problems of men, with their increasingly real obstacles to opportunity and advancement, and lack of security, tend to be ignored, or else dismissed with a shrug of the shoulders.

A Laborer's Attitude

A laborer who works in less agreeable surroundings at jobs requiring little mental effort has plenty of time to compare his position with that of the "big shots." Those of us who have worked with labor know that there is in nearly every laborer's heart the conviction that he is being ruthlessly exploited by large, fat, hard-headed Bourbons who sit around smoking large cigars.

Having had little schooling, his comprehension of management's problems and of the differences in individual capacities is very limited. His reaction to all problems of scientific management or to the relationship between himself and management tends to be emotional rather than logical. He has no patience with economic theories; he wants higher wages and shorter hours, but where they will come from is no concern of his. He sees no reason why the executives of a business should get any more than he does. Men forget that with the possibility of great losses under the capitalistic system should, and must, go the possibility of profits.

Perhaps most important of all is his feeling that he is treated like an insignificant cog in a vast, cruel, economic-industrial machine, when he is human, and, to his notion, has just as much right to recognition and money as other luckier individuals.

Thus we see, as we view objectively the attitudes of management and men toward each other, that they each have much to resent in the other. A certain amount of sympathetic understanding on both sides would smooth their relationship. Who is better fitted than the engineer to interpret the desires of each to the other?

The importance of the psychological factors which affect industrial peace cannot be overemphasized. Whiting Williams, a man who for 20 years has worked with labor in a great many jobs for the purpose of understanding them, states that labor trouble is caused, not by "huge, fundamental, class-wide abuses, but by accumulated, simple grievances."

In this connection, if you will pardon a personal reference, I was once working as a laborer in a manufacturing plant during a time when the seasonal business of the firm was very good. Serious labor trouble threatened. In an honest effort to get the viewpoint of the men, the management, wisely suspecting that wages were not the only trouble-making factor, called the men into an informal conference. They then explained the economic position of the company, the losses incurred during the depression, and the company's policy of raising wages just as soon as they could do so. When the management asked the men to express their grievances, the main idea brought forth was their resentment to being treated as inhuman machines rather than as individual men. By merely changing their attitude from one of indifference to one of sympathetic understanding, the management averted really serious labor trouble.

Nothing causes as much labor trouble as management's high-handed attitude—"You take what you get, and do what you are told, or else get out." (It often happens that the men get this impression of the management from the actions of their foremen, or department heads, although the central management is sympathetic in its attitude.)

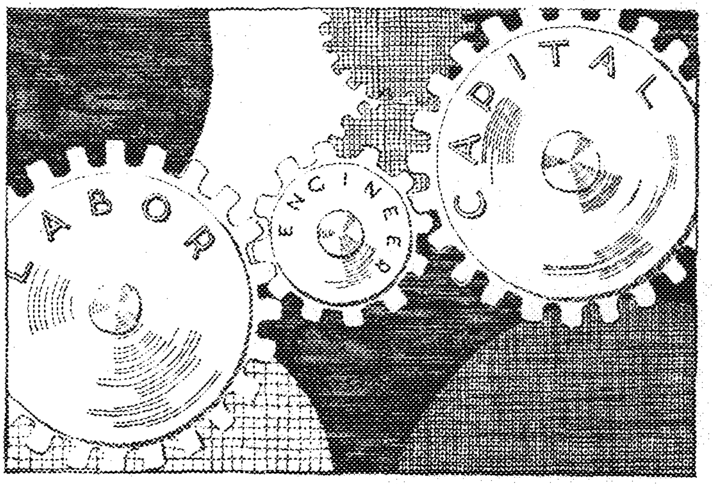
The engineer, as an introducer of efficient, labor-saving, machines and as a time-and-motion expert, often arouses suspicion and resentment on the part of the men. The workers usually believe the "lump of labor" theory—that there is just so much work to be done, and that any increase in efficiency decreases the number of man-hours available. This is a short-sighted point of view which is not easy to disprove convincingly. Patterson & Scholz in *Economic Problems of Modern Life* state that "neither a shorter working day nor a limitation of output will protect the worker, in the long run, against unemployment."

Laborers overlook the fact that if the demand curve has much elasticity, an increase in efficiency with a decrease in price may increase the plant's output. "The record of history shows that the introduction of machinery has not decreased the total demand for labor." (Garver & Hansen, *Principles of Economics*.)

When men force their employer to pay them more than they are economically worth (more than their marginal productivity) they overlook the fact that, though this may benefit some, there is the possibility of unemployment resulting for the less efficient, or, if there are seniority rights, for the younger workers.

Paternalistic schemes on the part of the employer, such as profit sharing and welfare work, have, in general, met with little encouragement from the men. All this seems to point to the fact that no matter how much an employer has his employee's welfare at heart, the employee will be suspicious of any change unless his confidence has been gained by getting his reactions to the proposed changes, by explaining in a general way the reasons for the changes, and convincing him that the changes are, in the long run, for the good of all. Before making changes which will influence men we can lay down the rule—explain first; act later.

So far the emphasis has been on the interpreting of the desires of the management to the men. Of no less importance, however, is the need to interpret the desires of the men to the management. When he believes that the men deserve and should get a wage increase, a system of job security, better working conditions, or shorter hours, the engineer should make every effort to get it for them. Only in this way can the men's confidence be gained. If the engineer is impartial, honest, and a square-shooter, the men



Through the engineer, capital and labor can work together smoothly.

will come to respect him, knowing that he will always treat them with consideration and fairness.

If open-mindedness and understanding are maintained between men and management, clashes will never occur. It is the attitude on the part of management that they are running the business and that the men have nothing to say about it, that causes war. The men *do* have something to say about their jobs. If they have no other way of expressing themselves, they will do so by means of a strike.

Who will doubt that engineers, by bridging the widening gap between men and management, can be a mighty influence in averting industrial strife?

ALUMNOTES

'05

Franklin R. McMillan, C.E., director of research for the Portland Cement Association of Chicago, and **Prof. George A. Maney,** C.E. '11, professor of structural engineering at Northwestern University, presented papers at a recent meeting of the American Concrete Institute held in Chicago.

'10

George Nason, C.E., recently regional landscape architect for the National Park Service, has returned to the professional practice of landscape architecture with Morell and Nichols, Inc., in Minneapolis.

'15

Warren Withee, C.E., assistant district engineer of the United States Geological Survey, died in Nashville, Tennessee, in February. He had been connected with the U.S.G.S. since 1920.

'24

Clarence J. Velz, C.E., who has been acting chief engineer for P.W.A. in New Jersey, has recently been appointed senior engineer of P.W.A. in the regional office at New York City.

Martin E. Nelson, C.E., is in Iowa City with the United States Engineer department and is in charge of hydraulic laboratory research. His work is with hydraulic model tests in connection with the development of navigation on the Mississippi river. Working with him are **Marvin Webster,** Arch.E. '31, and **Robert Kreiss,** C.E. '33, and **Roy Warner,** C.E. '32. Martin is married and has a four-year-old son.

'25

Norman R. Moore, C.E., is in the United States Engineer office of the War Department at Vicksburg, Miss. He says that **Harold Flatta,** is the only other Vicksburger from Minnesota that he knows. Harold is in the soil section and, according to Norman, is well known locally as an amateur photographer and as a flyer.

'26

Frank A. Daly, C.E., has been employed in the office of the United States Engineers in St. Paul for the past four years.

Richard W. Palmer, who graduated from California Tech and received a master's degree here in 1926, was recently appointed chief engineer of the Vultee Aircraft company. He was associated with Howard Hughes for whom he designed a world's record breaking speed plane.

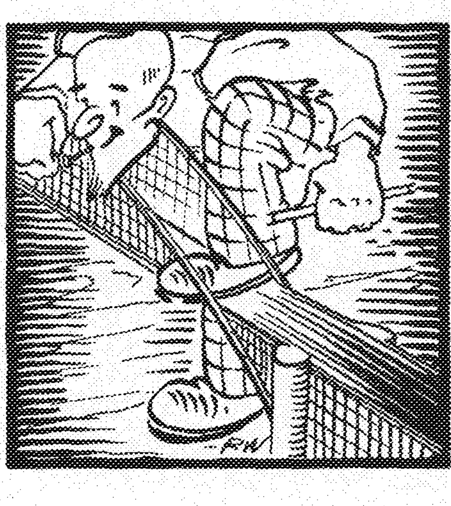
'31

Don Anderson, C.E., is construction superintendent for the W. P. Roscoe company in Billings, Montana. He is married and has a daughter, three years old.

Leonard J. Snell, C.E., has been in the employ of the National Park Service for the past four years as engineer or superintendent at various locations in Minnesota. He is now working on the resettlement project of 26,000 acres near Hinkley.

'33

Marcus Mattison, C.E., is a construction engineer for the Minneapolis Bridge company. He is now working in La Crosse, Wisconsin.



'34

William H. Tetrud, C.E., is working in Lewiston, Minnesota, as an engineer for the Soil Conservation Service. Also working as an engineer for the Soil Conservation Service is **Carroll Reese,** C.E. Carroll is working in Spring Valley, Minnesota, and is married, but so far there are no future engineers in his family.

William G. Campbell, M.E., is doing promotional work on commercial cooking, water heating, and refrigeration for the Minnesota Power and Light Company in Duluth.

Lucian G. Vorpahl, C.E., is living in Minneapolis and is sales engineer for the Sutherland Air Conditioning Corporation.

Bruce Wallace, C.E., is doing construction work with the Soil Conservation Service in Zumbrota. Bruce is married but as yet there is no Bruce Jr. in the family.

'35

Thomas Ruth, C.E., is working for the S. J. Reader company. He is doing paving work for the field office at Brainerd. He recently returned from a vacation at Miami, Florida, and says that he found "the southern sun (and women) every bit as kind and soothing to the nerves and body as they are generally rated."

'36

Edmond Klint, C.E., working for the Minneapolis Honeywell Regulator Company, has been transferred to the plant at Atlanta, Georgia.

'37

Don Aubrecht, Ch.E., is a chemical engineer with the Linde Air Products Company at Buffalo, New York. Don expects to return to Minnesota to do graduate work towards a Ph.D. degree.

Henry Carlson, Ch.E., is with the Koppers Coke and Tar Company in Folansbee, West Virginia. He is working in the caustic soda plant.

FACULTY SKETCH

By Robert C. Becker, Ch.E. '40

Prof. Elting H. Comstock

DR. COMSTOCK is the Professor of Mine Plant and Mining, and is Head of the Department of Mining and Petroleum Engineering. He was born in Milwaukee, Wisconsin, and, after completing his preliminary schooling there, went to the University of Wisconsin, where he received his Bachelor of Science degree in 1897. Professor Comstock received a fellowship the next year at Cornell University, and another fellowship the following year at the University of Chicago. Both of these were used for the study of mathematics. Mr. Comstock then had a year's teaching fellowship in mathematics at the University of Wisconsin. When this fellowship expired, he went to Superior, Wisconsin, to teach in the public schools, and then to Houghton, Michigan, where he was superintendent of schools. In 1906, Mr. Comstock came to the School of Mines and Metallurgy at the University of Minnesota as an instructor in mathematics, and he received his Master's Degree in mathematics in 1907 from Minnesota. Mr. Comstock has been in the School of Mines since he first came here, and, although he no longer teaches mathematics, he does have several classes in this school.

During past summer vacations, Mr. Comstock has worked for the State Auditor's Department in the Mines and Mineral division, and he has also done consulting work for some of the mining companies. Professor Comstock is a member of Acacia fraternity and of Theta Tau Engineering fraternity. He is on the TECHNO-LOG Board, the Book Store Board, and the Technical Commission. At present, Professor Comstock, together with Professor Brooke and the chairman, Professor Sneed, is very busy with the Freshman Students' Work Committee. This committee works with the problems of the 324 students in the Institute of Technology who should be upperclassmen but who are deficient in their freshman work.

Boy Scout work is Mr. Comstock's particular hobby. He is chairman of the Board of Review in Minneapolis and acts as one of the instructors of the leaders' training school held each summer at Itasca Park. A second hobby is the raising of a pedigreed German Shepherd dog, Patty's Blossom, *alias dictus* Pat or Patty. Although she has not been entered in any kennel shows as yet, some of her predecessors have, and one of them won a cup about three years ago in a Minneapolis show.

TECH NEWS

Stephens Resigns

Dr. H. N. Stephens, assistant professor of inorganic chemistry, has resigned his position here to head research at the Minnesota Mining and Manufacturing Company. The appointment of T. Ivan Taylor as an instructor of inorganic chemistry to replace Dr. Stephens has been approved by the president. Mr. Taylor will take his Ph.D. degree at Columbia University in June under Dr. Urey and will come here in September.

Aeros Back From Trip

Thirty-five senior aeronautical engineers returned to their classes March 31 after spending two weeks touring the east and visiting its leading aircraft plants. The group arrived in Detroit, Michigan, March 19, and from there proceeded to plants in Connecticut, New York, Maryland, Pennsylvania, Virginia, and Ohio. While the group was at Newport News, Virginia, they visited the Langley Field airport and the Newport News shipyard where some of the group took a short course in operating the "Yorktown," the navy's newest and largest aircraft carrier. On the way home the aeros stopped at Dayton, Ohio, to see the Wright Field airport.

A. M. A. Hears Speakers From Capital, Labor

The local student branch of the American Management Association, under the chairmanship of Don Raudenbush, has held two meetings recently. On March 16, Mr. Ivan C. Lawrence, of the Minnesota Mining and Manufacturing Company, addressed the group on the subject, "Incentive Wage Plans." He discussed comparative advantages of individual and group bonus systems. On April 6, the Honorable George W. Lawson, regent of the University and secretary-treasurer of the Minnesota branch of the A. F. of L., discussed before the group some labor phases of management.

Delegates Attend Society Conventions

Fifty seniors will attend the A.S.M.E. student branch district convention at Milwaukee, April 18 and 19. The group will continue to Elgin and Chicago after the convention, making inspection trips at many of the important plants, and will return on April 24. Arrangements are in charge of Asst. Prof. James J. Ryan and Wilfred Cadwell.

Allan Paine, president of the Minnesota branch of the A.S.M.E., will preside at one of the two official convention meetings. Election of officers, discussions, and presentations of student papers will occupy the meetings. Prizes of $50, $25, and $15 will be given to the authors of the best technical papers. Papers to be submitted by the Minnesota branch have been picked from a number of papers recently written by students.

Michigan, Illinois, Wisconsin, Indiana, Iowa, and Minnesota branches will send members to the convention. Most of their stay in Milwaukee has been planned by the national committee.

Tuesday afternoon, April 19, the Minnesota engineers will tour the Elgin National Watch Works in Elgin. From there they will proceed to Chicago for the remaining four days. They will see many of the largest industrial plants in the city and also the Field Museum and the Museum of Science and Industry.

Delegates will attend the A.I.E.E. convention at Illinois on April 21-22. Since the incoming branch chairman was requested to be a delegate, the local chapter held its election April 6. The University of Illinois will hold its electrical show during the convention, and delegates are invited to attend.

Chemists Hear Speaker, Will Attend Meetings

Dr. E. Rabinowitch, refugee from Germany, spoke before a chemistry colloquium last week on his way to Stanford University.

Dr. Victor LaMer, of Columbia University, will speak on April 14 before the local section of the A.C.S. on the subject, "Kinetics of Ionic Reactions."

The spring meeting of the A.C.S. will be held in Dallas, Texas, April 18-21. Among those who will attend are Drs. I. M. Kolthoff, G. B. Heisig, J. L. Maynard, and C. A. Mann.

At the meeting Dr. Kolthoff will lead a symposium on "The Use of the

Dropping Mercury Electrode in Pure and Applied Chemistry." He will present an introductory paper, which will be followed by papers describing the general aspects and specific applications of the subject.

Ag E's To Hold Spring Meetings

Two interesting activities of the local section of the American Society of Agricultural Engineers this quarter will be a talk by Mr. Lu Tsing Woo, graduate student of the University of Shanghai, and a trip to southern Minnesota with Mr. H. B. Roe, head of the agricultural engineering division's land reclamation section.

A.S.A.E. member Charles G. Snyder taught last quarter at the Northwest School of Agriculture in Crookston.

Funds earned by the Ag. Society information booth during Farm and Home Week were used last quarter to finance the very successful Ag. Engineers' Party. Eugene C. Hesli was chairman of the committee in charge.

Job Pamphlets Available

The Engineers' Bookstore has on hand a supply of Howard Lee Davis' pamphlet, "How to Apply for a Job." Many other pamphlets, describing employment opportunities in various industries are available in the Placement Office, Main Engineering Building.

Societies Banquet

The second annual banquet of the A.I.Ch.E. was held Tuesday, April 5, in the Union. All faculty and student chemists and chemical engineers were invited. Dean Lind addressed the group on the subject, "The History of Radium." Dr. C. A. Mann was toastmaster of the banquet.

The A.I.E.E. plans to hold its annual spring banquet the last week in April. The results of the local prize paper contest will be known at this time and will be discussed at the meeting. Reports of the national convention of the society will also be given.

Remember to Vote

Don't forget the All-University elections coming up Thursday, April 14. This year council-members will be elected by proportional representation from the student body at large. This means that if the technical students don't turn out and vote they may have no representation on the All-University council. We feel that the candidates from engineering deserve our support. Bring your fee statement, cast your vote, and guarantee the Institute a voice in student government.

Prof. and Mrs. C. A. Koepke recently returned from a four month trailer trip through the eastern and southern states and Mexico. Prof. Koepke, on sabbatical leave, studied the small-scale hand production methods of the Mexicans.

A. S. M. E. Sponsors Trips and Picnic

The A.S.M.E. is arranging several functions for the spring quarter. Wednesday, April 6, the group toured the Ford Plant in St. Paul. This week they are making an inspection trip through the Russell Miller Milling Company in Minneapolis. Plans are being made, also, for a picnic to be held later on in the quarter.

ECMA NEWS

ECMA stands for Engineering College Magazines Associated, an organization comprised of the publications of the country's leading engineering schools. This month we have assembled from these magazines items describing recent happenings on the various engineering campuses. We would appreciate your criticism of this column.

The Ohio State Radio Club (W8LT) is designing and making plans for the construction of a 1,000 watt CC transmitter.

* * *

The custom of celebrating St. Patrick's birthday as Engineers' Day originated at the University of Missouri. Most of the engineering colleges in the U. S. now celebrate St. Pat's Day.

* * *

The University of Pennsylvania placement service has placed over 5,200 students in full-time or part-time jobs.

* * *

At New York University, the student chapter of the A.S.C.E. recently held a joint meeting with chapters of 10 other metropolitan schools.

* * *

At Michigan they are rebuilding their cyclotron type atom smasher to increase the power from 7 million to 11 million volts.

* * *

A student chapter of the A.I.Ch.E. was recently formed at Marquette.

* * *

At the University of Iowa the engineers' annual celebration takes the form of a Mecca Week. During this week there are held all the various activities associated with Engineers' Day in other colleges. The word Mecca is formed from the first letters of the names of the various engineering courses.

* * *

A chapter of the Eta Kappa Nu was recently installed at N.Y.U.

* * *

Exhibits at the open house held March 18 and 19 at Kansas State included hamburger being cooked on a cake of ice, a working model of the cable spinner used on the San Francisco-Oakland Bay Bridge, and a complete replica of a soap factory.

LINDQUISITION

By Bertil H. T. Lindquist, Aero. E. '38

The good old Engineering Library is the finest place on the campus for honest studying—and orchids to Miss Gertrude Veblen for making it so. . . . By the way, Miss Veblen has a brother who is test pilot for Douglas Aircraft and another brother who is the dean of the graduate school at Harvard.

The one man who has done more than anyone else on this campus to promote fine feeling between the Army and the rest of the University is likeable, southern-drawling, Col. Adam E. Potts. A true gentleman of the old South, Suh!

Bob Aslesen, Senior Civil, has got himself inextricably ensnared by looker Betty Beach. Wonder if that pert wink of hers had anything to do with it?

E. Lawson McGee, erstwhile T-Log Bus. Mgr., and crooked campus politician, went to see the big money-making baby film at the Lyceum with our incumbent business mangler, Warren Waloon. The picture so unnerved the usually equanimical McGoo that he felt the need of liquid reinforcement.

Wallon let McGoogle pay for the brew and when Mac boarded a streetcar to go home he found he didn't even have car fare. He pleaded earnestly but the flint-hearted conductor bounced him into the middle of a cold night. Resourceful McGee found a pal in another bar and borrowed the necessary shilling.

And here are a few notes on the Aero trip:

You often hear a rabid dissertation from some misguided soul on the savory qualities of raw oysters. Such a soul is our Prof. Barlow. He convinced your weak-willed raconteur that raw oysters are an epicurean event, in fact, he convinced us to try them. Even if it were possible to look the slimy things in the puss and still entertain ideas of eating them, the resulting gastronomic volcano that occurs when you allow one of them to caress the old oral cavity is enough to keep you on bread and water for a week.

And the next aeronaut that plaintively inquires, "Who'll carry the mail across Death Valley?" will get one—a big one—hung on his chin.

The night ride from Scranton through the mountains was a nightmare. The relief driver was one of the original mountaineers of the section and he never found out what the brake pedal was for. That stretch was a continuous succession of hills and curves and they were all taken at the same speed—wide open. There were times when it was hard to believe that the front and back seats were both on the same bus—particularly that time when the driver took it down off the Bear Mountain ski jump. . . .

"Jail-Bait" Wagner very carefully shot pictures all one forenoon—with no film in his camera.

"Tug" Wilson, world's finest bus pilot, brought his wife aboard for a portion of the trip, and the boys immediately agreed that she's the prettiest they had seen since they left home. Guess Tug isn't worried by "Slow"—dangerous curves ahead."

The gal I'd relegate
To far-off Foo
Is the dame who chortles,
"Well, anyhoooo . . ."

Mental gem of the month:
You can't beat fun—for amusement

PICK AND PAN

By M. A. Troxell, M. '39, and H. A. Larson, M. '39

In the Springtime a young engineer's fancy lightly turns to thoughts of—among other things—Engineers' Day. The colorful parade, the pagentry of the knighting, the gala field day festival, the gayety of the dansant and the brawl; not to mention elaborate open houses featuring souvenirs, refreshments, faculty, and other delightful elements—all of these give the 1938 Engineer a glimpse of the most successful Engineers' Day ever planned.

Here's a little inside dope:

Wilson Brown, our general arrangements chairman, is doing a splendid job in proportioning committeemen equally from the major departments in the Institute. He and his assistants have already laid the foundation for the festive occasion and are actively engaged in the preparations.

Faculty recommendations are to play an important part in the administration of Engineers' Day for the first time.

* * *

The parade will be as clean as a boarding house icebox. Aero Frankel appeared dejected when advised to discontinue plans for a streamlined depository.

* * *

Bob Wolfe, the Baron of the Brawl, whispered confidentially into our ears that the engineers need not worry too much over lack of dates for the Brawl. This will be arranged by the Brawl dating bureau. Dame Rumor has it that the Engineers will bring beverage and pretzels to their festival on the river flats.

* * *

Problem: To find a feminine Technology senior who can fulfill the duties of St. Pat's Queen. None of the fair damsels considered by the Tech Commission can ride a horse! Shall we ignobly stuff our Queen into a car, or shall we put her on a steed and risk the loss of both steed and Queen? The person tendering the best suggestion will receive a fur-lined bathtub at no extra charge—just the usual parking fee.

* * *

We think the Northern States Power Company would make a good dating bureau because of their meter service.

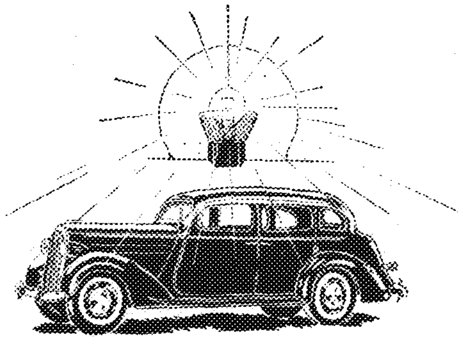
* * *

Those who suspect our sources of information for this column insist, "We're working our way through colleagues."

* * *

Frank St. Vincent received a shock the other day when he came into Mine Mapping Class and found a large ink blot and tipped bottle on top of his map. With appropriate language he carefully removed the bottle and succeeded in pushing the dried blot completely across two feet of the paper with a knife. The class almost died of strangulated laughter until Frank found the ink was only a "joke" blot that one of the professors had carefully arranged upon the map to inspire merriment.

G-E Campus News



18 INCHES OF SUNLIGHT

A 30,000-WATT General Electric MAZDA lamp, a foot and a half in diameter, was recently installed in the Styling Section of the General Motors Corporation at Detroit. This lamp, the first of its size to be used commercially, is utilized to simulate sunlight on automobiles on display. Previous lighting not only was inadequate, but produced distracting reflections on the car bodies.

By means of a G-E thyratron reactor control similar to devices used to dim lights in many large theaters, the light from the lamp can be varied from full brilliance to a black-out.

Many such practical applications as this are the culmination of group effort. That is why General Electric Test men of today and yesterday are always to be found contributing their part to General Electric's progress.

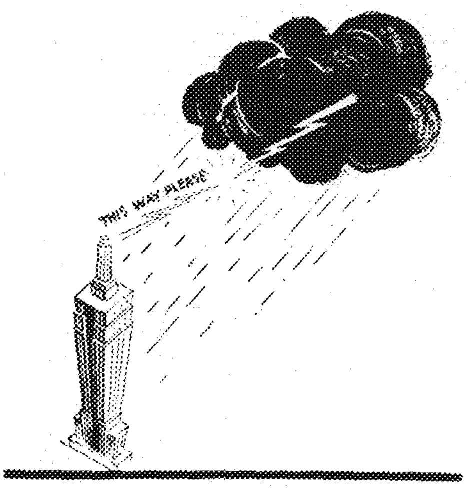
FOR OUTSTANDING ACHIEVEMENT

EACH year General Electric honors those employees who have done outstanding work in their fields as provided in the Charles A. Coffin Foundation. This year 40 men were chosen—15 of them college graduates:

Adelbert Alexay, Polytechnic Institute of Budapest, '11; *Alexander Babillis, Rose Polytechnic Institute, '28; *T. M. Berry, Kansas State College, '27; Michael Broverman, Tri-State College, '22; F. E. Carlson, University of Michigan, '25; *S. B. Crary, Michigan State College, '27; R. E. Farnham, Case School of Applied Science, '17; J. W. Gilchrest, Cooper Union, '08; *A. H. Lauder, University of Wyoming, '22; *Domenico Martignone, Central Technical College of London, '01; *F. N. Neal, University of Utah, '31; *D. R. Shoults, University of Idaho, '25; F. C. Smith, Drexel Institute, '06; *L. A. Umansky, Polytechnical Institute of Petrograd, '15; R. E. Worstell, Purdue University, '25.

If any one generalization could be made to cover the qualifications for this award, it would probably hinge upon the extent to which an employee took advantage of his opportunities, beyond the ordinary routine of his work to achieve an outstandingly worth-while result.

Former G-E Test man



LIGHTNING GUIDER

AFTER three years of photographing natural lightning striking the Empire State Building in New York City, it was determined that many lightning strokes which appear to crash from the clouds to the ground actually are met part way by a small flash, originating from the earth, which guides the stroke to its destination.

In addition, laboratory tests, under the direction of Karl B. McEachron, graduate of Purdue University and former G-E Test man, indicate that discharges between points and planes always begin at the point. The Empire State represents to the cloud a tremendous needle on the earth's surface. Thus the guiding flash will originate from the tower and shoot upward.

Destruction occurs when a lightning bolt contacts a high-resistance area. Lightning conductors prevent this by grounding the discharge in an area of low ground resistance, and the lightning control on the Empire State affords a protective area within a radius of approximately one mile.

GENERAL ELECTRIC

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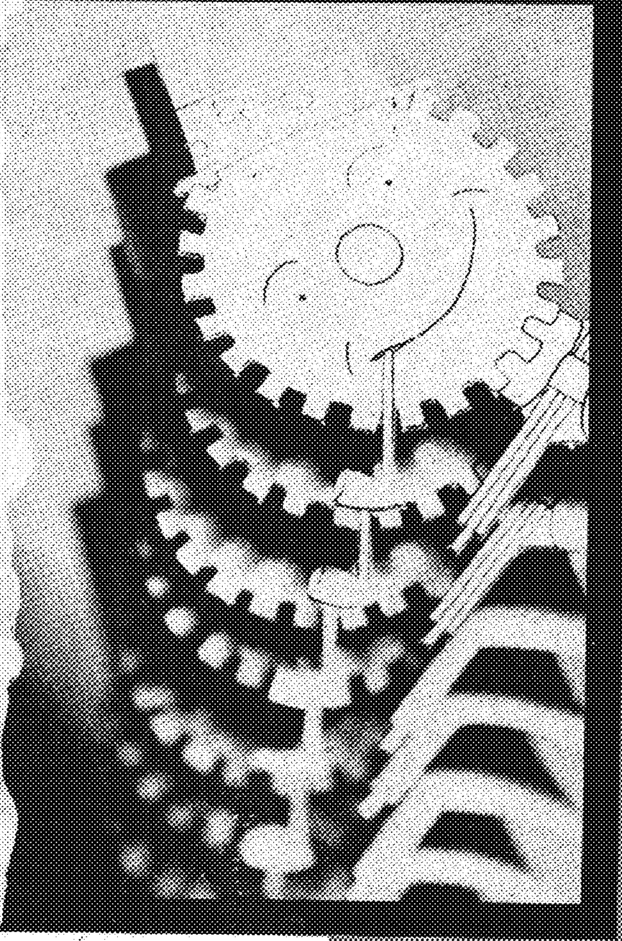

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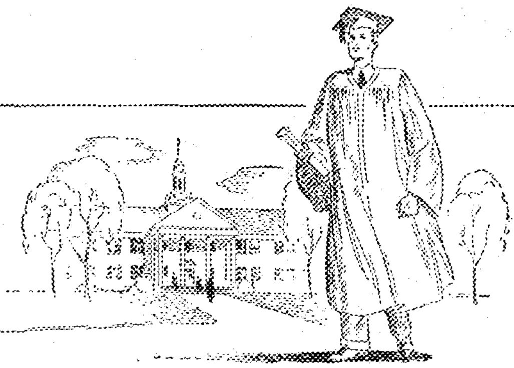
MINNESOTA TECHNO-LOG

After Graduation . . .



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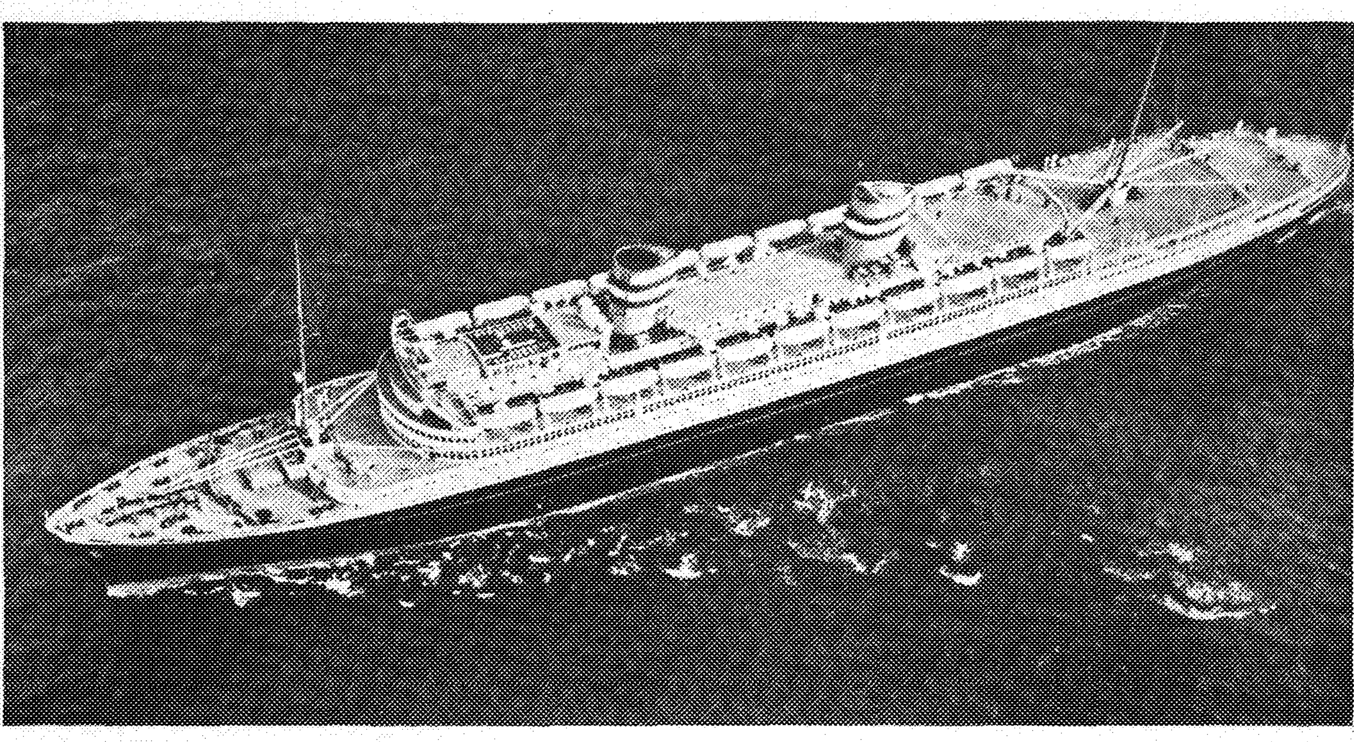

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AN ORGANIZATION OF ENGINEERS

Minnesota Techno-Log

Volume XVIII — 37 Electrical Engineering Building, University of Minnesota, Minneapolis — Number 8

ERLING HELLAND, Managing Editor — WARREN WALEEN, Business Manager

Published Monthly
from October to May

☆ ☆ ☆

This Month

Our cover picture is the product of e efforts of Al Arneson, Arch., '39, rancis Meisch, Arch., '38, and Bertil indquist, Aero., '38. We think the cture is quite distinctive. Bert also ok most of the group pictures in is issue.

Our first article was written by hn F. Ripken, C.E., '34, graduate udent and instructor in hydraulics. nce he graduated he has done grad- ate work in hydraulics under Dr. raub. He also had a part in de- gning the new hydraulic laboratory which he writes.

Alvin Isaacs, C.E., '41, who tells us out his "Shanghai Adventure" this onth, has really been around, around e world in fact. During his two ars of experience as a seaman he s circumnavigated the globe and ited many of its odd corners.

Walter Smoleroff, Chem. E. '38, kes his second contribution to the gazine this month. Walter gives us report on the Chem. E.'s trip. If u've wondered what those Chem. s actually do on their trips, now the time to find out.

Ward Simmons, Mines '39, gives a new angle on the future of the industry in Minnesota. Ward is nember of Sigma Rho, Alpha Tau nia and the Mines Society. He says pet peeve is Minnesota's ore tax- policy.

And finally, on the last page, we it a letter received by Harley ghes, M.E., '38, from William ison, M.E., '37, who is at present king in Africa. We think that gives an excellent picture of the of the engineer in the tropics. the way, Bill was a member of TECHNO-LOG Board last year.

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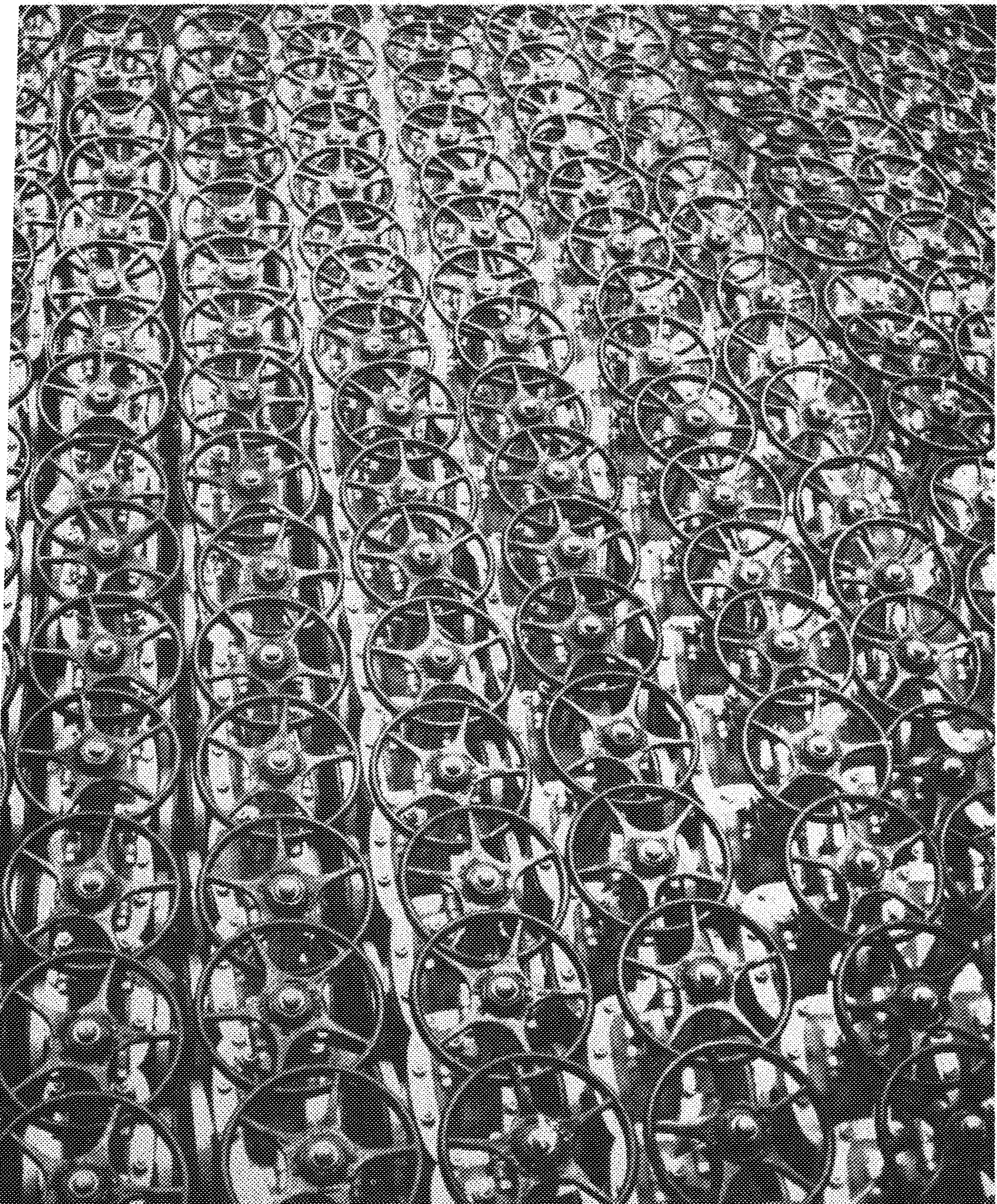


VALVE WORLD

Wheels of Progress

The Why and Wherefore Of the New Hydraulic Lab

One of the finest hydraulic laboratories in the country nears completion at Minnesota. Here is a description of the work that it will house.

By John F. Ripken
Instructor in Hydraulics

TODAY the half million dollar St. Anthony Falls Hydraulic Laboratory of the University is virtually complete. Located on historic St. Anthony Falls in the heart of Minneapolis, it stands today as one of the country's foremost research laboratories. Situated on the brink of the falls, with a water drop of 50 feet directly through the building and with a capacity of 300 cubic feet of water per second, it offers natural facilities unequalled anywhere. After two years of laborious work the structure finally stands ready to serve its many purposes. What these purposes are have long been a question to many persons, so herein will be attempted a résumé of the why and wherefore.

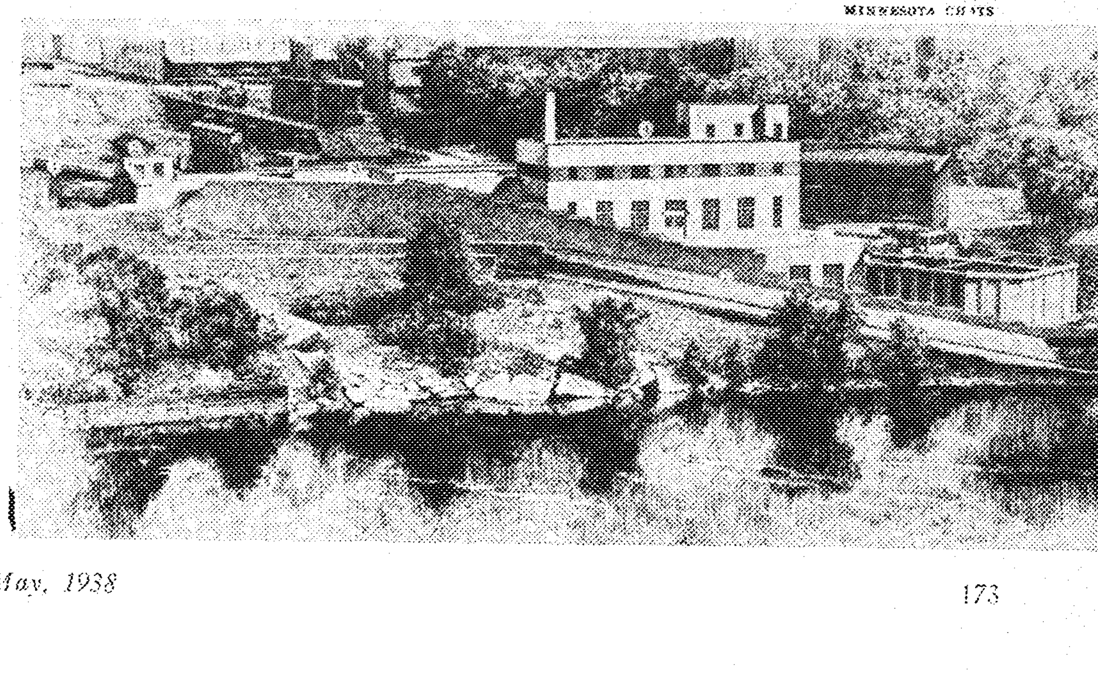
To the lay mind the study of hydraulics may present no apparent difficulties, yet any person having dealt with its many phases will appreciate the intricacies involved in a rational analysis of its problems. While most engineering work can be quite readily and accurately solved by purely theoretical applications of the laws of mechanics, such cannot be said of the study of hydraulics; for in most instances the basic laws must be materially altered to compensate for the innumerable secondary effects involved. By past experience it has been found that the most ready solutions to these intricacies are the experimental methods made possible by the laboratory, and it was for this reason that the hydraulic laboratory originally came into being and has progressed until today many of the hydraulic problems can be readily solved by reference to a standard hydraulic textbook, particularly for those problems dealing with the flow through orifices, weirs, pipes, and artificial open channels. However, it is very frequently desirable to attain greater precision than is offered by the standard data where such precision will permit important construction economies, and it also frequently occurs that the standard data apply only to relatively small or standard construction and cannot safely be construed to be true for the larger constructions. Where such problems occur, we must necessarily depart from the limited work of our predecessors and resort to the only reliable method of determining the desired data, that is by actual studies of the occurrence in nature. Obviously in most cases no exact duplicate of the problem in question can be found in nature and generally for economic reasons cannot be artificially imitated except on a much smaller scale, and it is for this so-called model study that a portion of the new laboratory is intended.

Many persons think of such methods of attack as being unnecessarily tedious and expensive, yet it has been amply proved that on problems involving any considerable sum of money the expense of a suitable model study is more than justified if an increase in efficiency or economy of only a fraction of a per cent can be attained. This has been so adequately proved that at the present time the government engineers try to subject all questionable hydraulic structures to thorough model tests and have done so as far back as the construction of the Panama Canal.

In fact, one of the first works to be initiated in the

A composite sketch and photograph of the St. Anthony Falls hydraulic laboratory, which is now nearly completed.

MINNESOTA CUTS



new laboratory will be a complete model study of the proposed eight million dollar upper harbor project for the city of Minneapolis. This project involves the construction of two locks through the Falls of St. Anthony, together with extensive dredging which will give river barges access to the excellent harbor above the falls. The model, as proposed at present, will consist of two parts—the first being a complete scale model of the falls together with that portion of the river immediately above and below. This will be constructed at a scale which is one-fiftieth of natural size. The second model will consist of the locks proper and will be built at a considerably larger scale to permit more precise studies. These studies are expected to lead not only to increased economic and hydraulic efficiencies but will probably disclose unpredictable hazards in the construction and operation that may be remedied or eliminated by cut and try corrections on the model.

An area of 36 x 155 feet has already been allotted to this project, and work is expected to begin at once. Construction and operation of the model will be by personnel of the Army Engineers.

Concurrently with the above described specialized model study, extensive longtime fundamental research will be pursued in the other portions of the river laboratory. These studies will be primarily concerned with the very important problems of the water erosion of soil and the attendant study of the transportation and deposition of sediments in waterways. The purpose of this research will be to fill in the many gaps in our present knowledge of the subject and to develop and extend our present theories to new limits and into new spheres.

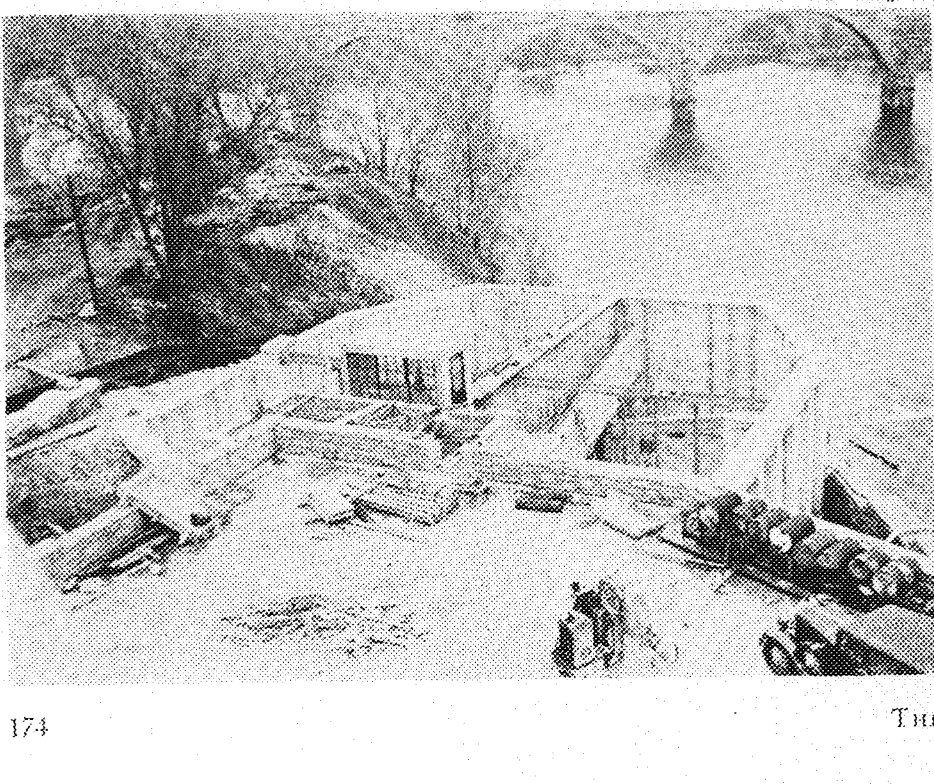
Another unit included in the river laboratory, and a potential mine of research data, is the large testing channel which measures 9 feet wide by 6 feet deep and 250 feet long. This channel is so arranged that water velocities in it may be fixed anywhere up to 25 miles per hour and a finely controlled flow ranging from a mere trickle to 300 cubic feet per second may be handled. (During the drought period of 1934 the entire flow of the Mississippi at Minneapolis dropped to 310 cubic feet per second.) A 20 foot length of this channel is arranged for the addition of a glass side and a glass bottom to permit unobstructed observations and photographic records to be made of complex flow problems. Such studies involve not only river and harbor problems but also those allied fields of ship, barge, and submarine design. By anchoring the model under study in the water flowing over the glass section, conditions comparable to towing the model through still water may be attained, yet detailed observations and photographs may readily be made from all angles. An interesting phase of this work is anticipated in the development of a similar technique for streamline studies of automobile and aircraft models. This method has obvious advantages in that the laws of similitude permit slow moving water currents to be substituted for the extremely fast air currents commonly used in wind tunnels. The greater simplicity and ease of operation will make this a fruitful field of research.

An interesting feature of the new building is the four story vertical shaft located at the east end. This shaft will permit extensive tests of sanitary fixtures and plumbing on a set-up corresponding to a full-size office building. Work of this nature will be carried on in conjunction with the State Board of Health. The shaft also offers excellent facilities for tests of various types of vertical lift pumps.

Still another valuable portion of the building is constituted by the large hydraulic machinery laboratory and the spacious low level turbine testing laboratory. The facilities of the latter will permit the testing of pumps and turbines under a pressure head of 45 feet of water, with an available flow capable of generating 225 horsepower.

The measuring tanks as seen from the roof of the laboratory. The building is now open and may be reached from the main campus by driving west on University avenue to Third avenue S.E., then south for two blocks, and thence across the wood bridge.

BERTIL LINDQUIST



One of the most valuable assets of the new laboratory is the extreme flexibility which permits experimental water from any portion of the plant to be diverted into either the small weighing tanks or the large exterior volumetric measuring tanks. Together these units will be capable of catching any quantity of water up to 300 cubic feet per second and accurately measuring it to within a fraction of one per cent before discharging it back into the river.

While the principal purpose of the above described features is the pursuit of fundamental research and its correlation with actual practice, it may be said in closing that the facilities of the laboratory will always be available to interested parties both public and private where such work will lead to the conservation of our natural resources, the improvement of our mode of living, or the more general use of our abundant and valuable natural water facilities.

Education Prepares You for Luck

An engineer works with materials which will always fit into mathematical equations. Not so with the engineer himself. He is always a variable and must depend on Luck, Judgment, and Education to solve his person problems.

By Roderick W. Siler
Assistant Professor of Mathematics

COMMENCEMENT Day, 1938, is at hand. This is the anniversary of an occasion always celebrated throughout the land in song and story, caps and gowns, advice and assurances by the elders, and a certain amount of doubt among the graduates as to whether or not they are going to get jobs. I am inclined to think that, in all this jollification and back slapping, doubt is the most reasonable feeling a man can have. There really isn't much doubt but that everyone who gets a diploma will eventually get a job. The real question is—what will the job lead to?

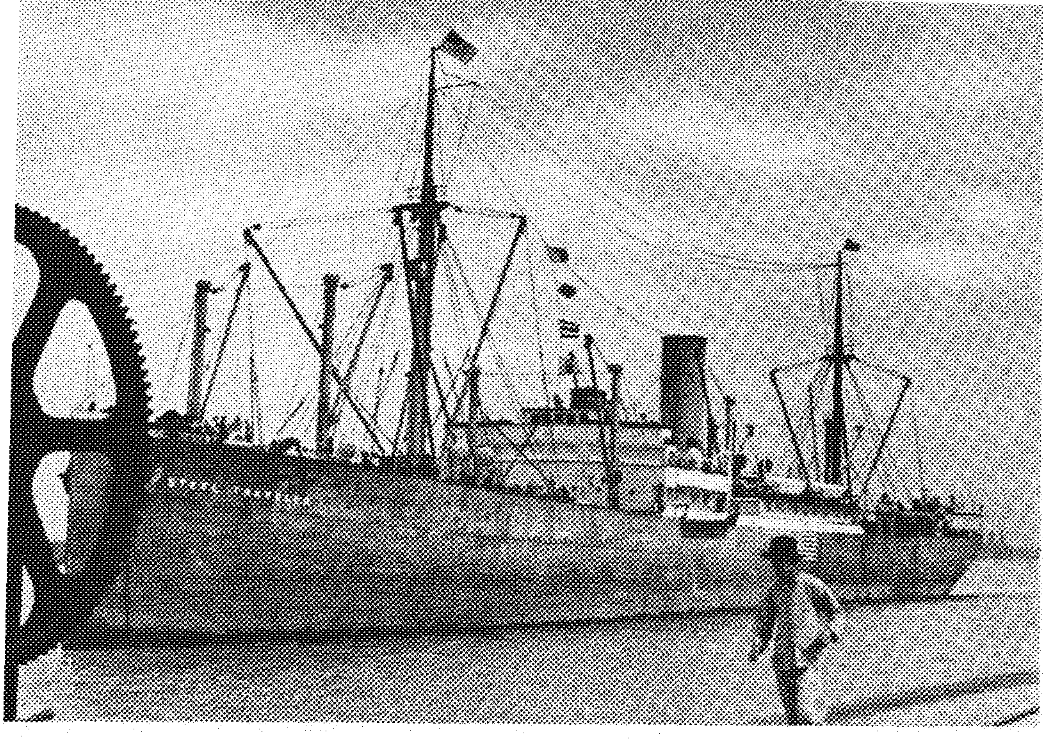
One thing seldom appreciated by the average young man, panting to step out and split the world wide open in his search for gold and glory, is how much the splitting process is going to be affected by that which is usually referred to as "luck." For instance, statistics show that of all the men who graduate from technical schools a large proportion end as business men, farmers, teachers, G-men, actors, writers, dog breeders, etc. No doubt most of these deserters from purely technical lines would have been considerably depressed at graduation had the finger of Fate appeared at the time and shown them the course they were ultimately doomed to take. Now, 20 years or more afterwards, they probably take a more philosophic view of the situation. They look around and see all the old crowd, Class of 1918 or before, in much the same fix as themselves, still showing the old college fighting spirit, you understand, but a bit dizzy, nevertheless, under the jolts of the unexpected. Some are married. Some are divorced. Some—not very many—have made money. Some, sad to tell, are bald. I am not saying that these things are bad or good or sufficient to keep a good man down. I simply state that they are developments which the great majority of old timers, in June of their graduation year, never thought of and never imagined would so affect and complicate life later as they have. In one thing is the class, 20 years or more out of school, agreed on. It is that luck has a lot to do with this life, and that if they had it to live again, and knew what they do today, they would make greater effort to prepare for the uncertainty of all things.

Not being an authority on horse racing I cannot say with assurance just what it is that is most responsible for its uncertainty, but I suppose such facts as whether a horse gets the rail or not, whether or not he slept well the night before, have something to do with it. Anyway, we do know that horses hoofing it around a track have their problems, and that the deciding factor as to where they place at the finish must be how well they are ridden. In other words, stamina and training are not sufficient to win races. Someone, either the horse or the man aboard him, must know how to circumvent or take advantage of the turns of luck that come his way. And that is exactly the luck that every older person knows is part of life, and that most young men never trouble their heads about.

Men go to professional schools for two reasons: to get professional training and to get an education. The two things are not one and the same. As far as technical training is concerned, it can be pretty well defined by the list of required subjects in a course curriculum. It will be noted that these subjects deal almost entirely with material, or its treatment in a theoretical way. Every profession has its own medium in which it works, and the medium of the technical man is matter. There is this to be said of this medium: the laws governing its conduct are pretty well known, theoretical treatment of it based upon experimental data may be applied with considerable assurance, and that which is called luck or chance is reduced to a minimum. This is all very nice, and if only the technical man were himself a machine, working with other human machines, his life from beginning to end could be prophesied with as great a certainty as the career of a concrete mixer.

But, unfortunately, the engineer is not entirely mechanical, and therefore never so logical in his conduct as the machine he invents or runs. What he and his fellowmen will do is always more or less doubtful. Luck and the unexpected come into play. Purely technical training is all very well as long as life's problems are confined to matter, but of very little use when the matter is animated, as in the case of most human beings. The processes of the average man are far from being as simple as they would be if he were a cylinder rolling through life down an inclined plane. Therefore, mathematical calculations, so valuable in deciding upon the conduct of material, are not much use here. Judgment rather than exact knowledge is now called for. And that peculiar judgment results, not from technical training, but from education.

What is education? Having heard it defined so often and in so many ways by educational experts, I have about concluded it cannot be defined. Broadly speaking, and of education especially as it relates to technical students, perhaps it may be said to be composed of a knowledge and consideration of everything outside of pure matter. Particularly, it includes a knowledge of men. Perhaps it is largely instinctive, something dependent upon the individual's capacity and background. But whatever it is it remains the only thing with which to face the luck of the world. If anything can, it makes a man adaptable and capable of meeting the unexpected. Purely technical training will not do so. The man who has only training is a specialist, and he fits into the social system as nicely as a brick into a wall—as long as walls are being built or are left standing. If he has education with his training he is not confined to the life of a brick. Luck, chance, is inescapable in this world. Education is the one thing which can prevent a man being a victim of it. Training is preparation for a sure thing. Education is preparation for what is not sure. And if anything is sure in these times it is that nothing is sure.



The Isthmian Steamer Steel Traveler as she entered Shanghai.

Ship Runs Gauntlet

Shanghai, Oct. 31.—(U.P.)—Seamen of the Isthmian Line freighter Steel Traveler—first American ship to run the gauntlet into Shanghai since the President Hoover was bombed—landed here today and learned they were heroes.
(St. Paul Dispatch)

SHANGHAI ADVENTURE

By Alvin Isaacs, C. E. '41

"ALL hands 'midships! Skipper's orders." The bos'n's call, echoing down the companion-way to our foc's'les, brought us excitedly on deck. The red-glowing October sunset over the China Sea sent an ominous feeling through me as I joined the rest of the crew gathering at number-four hatch. The captain drew in the last few puffs on his pipe, and we all waited in dead silence as he prepared to speak.

Here we were, aboard the freighter S. S. *Steel Traveler*, running sou'sou'west from Tsushima Strait, bound for Hongkong, after five days of pleasant rollicking in the Japanese Land of the Rising Sun. We had unloaded a cargo of submarine plate and were free to continue the voyage around the globe, picking up the products of the East for the markets of America as we went along. Still in our hold were several thousand tons of barbed wire which we expected to deliver at Hongkong.

The captain spoke, "The admiral of the United States Asiatic fleet just radioed he's sending a warship to convoy us. They will meet us in 36 hours. We're putting into Shanghai!"

The dawn came up chilly, and the watch stood shivering as they waited for the first sight of land. I had come off lookout at four a.m. after four hours of vigil in which I sighted only one lone patrol vessel. Now at six a.m. all hands were called to stand by as the Japanese blockade fleet was coming in sight and the mouth of the Yangtse lay dead ahead. Like a distant thunderstorm, the rumbling of heavy guns was audible to our ears. A destroyer left the line and started toward us. Just then, under full steam with the "Stars and Stripes" whipping at her gaff halyard, the U.S.S. *Bulmer* hove in sight on our port bow. We cheered as the Nipponese destroyer bore off when our escort came up. A few minutes later, with a party of fully armed, steel-helmeted, Yankee gobs aboard us, we followed in the *Bulmer's* wake, up the blockaded river into ten days inferno of shrapnel fire, bombs, and air-raids.

The Yangtse was crowded with Japanese troop transports and supply vessels, and the Imperial Navy's third fleet was anchored at regular intervals all the way from Woosung to Shanghai, in the Whangpoo River. We previously had boarded up the side windows of the wheelhouse, chartroom, and radio shack with four-inch planks and mattresses, as a precaution against stray machine gun bullets, and this preparation proved its value almost immediately, for as we turned at Woosung into the Whangpoo we found ourselves in a crossfire of artillery, and the beginning of No Man's Land. Woosung, which had been the huge Chinese fortress guarding this strategic junction of the waterway into Shanghai, had been leveled off by the invaders. Deep shell holes were everywhere along the sea-wall and the buildings were in ruins. Now the Japanese were busy repairing the damage and were establishing this as their field headquarters and base of operation.

The entire area from Woosung to Soochow Creek, Shanghai, was occupied by Japanese, but the left bank of the Whangpoo, the sector known as Pootung, was still held by the Chinese troops. The latter were bravely facing the huge naval guns that sent shell after shell crashing into them at point-blank range. Their reply was usually with spasmodic rifle and machine-gun fire, and occasional light field artillery.

It was to these front line Chinese trenches in Pootung that we were steaming, to unload the barbed wire, and the Japs protested our audacity while the Chinese welcomed our arrival. But we didn't reach moorings without danger. As we neared the berth, the entire Imperial fleet, aided by land batteries, laid a heavy barrage into Pootung to cover the movement of a naval transport. The Chinese all about us immediately opened reply with their light armament. For a few minutes we almost lost headway in the terrific storm of shrapnel and shell that swept across our decks, but all hands stuck to their posts and we finally succeeded in warping alongside into our berth. Squadron after squadron of light bombing planes zoomed over the area, strafing the waterfront with machine-gun fire and bombs. At this moment a detachment of U. S. Marines came by launch from the International Settlement, to relieve the naval guard and to take charge of our defense. With fixed bayonets, quick-fire rifles, and sub-machine guns, they established an oasis for us. Just after this baptism of fire, the chief of staff and an aide from the American cruiser *Augusta* came aboard for an official visit, bringing Admiral Yarnell's compliments and congratulations for having "upheld the best traditions of the sea." We learned we were the only merchant vessel to have entered Shanghai in more than three months.

There was little that we could do in preparation for discharging cargo that first day. The singularity of our unexampled position, amid the fitful gunfire of two armies, was beyond the most delirious dream of any seaman, and it took us quite some hours to comprehend. Seafaring brings great adventure, and here we got it in plenty.

Over the boat deck we stretched a hatch tarpaulin on which the bos'n had painted a huge American flag. This was our only precaution against air bombing. At the foremast truck and on the ensign staff over the stern the national colors were also displayed. Over the sides, on the hull, flags were painted, too. As night fell, orders came around to keep the ship in total darkness, blankets were spread over skylights, and battle-ports were battened. No one was allowed to cross deck with even so much light as that of a cigarette in hand. The danger of being hit by snipers was too great to ignore.

Well after sunrise next morning, in boats flying neutral flags, a batch of coolies came aboard to start swinging the barbed wire out of the holds. Now we got our first evidence of the poverty and starvation that the war was inflicting on millions of homeless people. The poor beggars fought for the garbage from our breakfast, and not until the cooks could scramble up some chow for them were they of any use to us. They were rather slow unloading, and each day found them wandering off into the trenches to join their countrymen. We later learned that the replacement stevedores were soldiers who were anxious to earn some coins and get a little extra to eat.

The International Settlement, a mile farther up the river, was the goal of every member of the crew, and twice each day the foreign commercial interests in Shanghai would send out a launch, flying either the British or American flag, to carry any of us that had leave up to the city. This brought us through the line of Japanese men-o'-war, and we had opportunity to observe their gunnery at close range.

The Settlement streets were jammed with refugees, homeless and hungry and diseased. Practically all white people had left, and the place was under martial law. Side by side, British and American troops manned the entire perimeter, while native soldiers from Indo-China guarded the French Concession. Policing of the city was done by Sikhs from India and the Shanghai Volunteer Corps, which is composed largely of White Russians. Every street corner had a sandbag parapet and barbed wire barricade, ready for times when shells would land in the town. The mobs of refugees were easily panic stricken, and these precautions were in readiness.

Night life in the Settlement offered little diversion, for the exodus of the white population had slackened patronage, but one or two theatres were presenting old films, and a few cabarets on Bubbling Well Road seemed to be still prospering. At the luxurious Cathay Hotel it was possible to dine in real style, and finances were never a problem with one's pockets full of bonus money exchanged into Chinese currency.

A jaunt through the far-famed "Bloody Alley" proved to a shipmate and me that Shanghai's reputation as a sailor's port was exceedingly true. With the four international cruisers with their large crews enlivening the town, there were more police patrolling outside of the dives than patrons drinking within. After five minutes in one saloon we were quite satisfied that shrapnel offered less danger, and we retreated to the Bund to watch the Japanese flagship *Idzumo* firing at Chinese advances. When the international troops cleared the Settlement's streets at the curfew hour of 11:30 p. m., we took up night lodgings at the Navy Y.M.C.A..

The work of unloading went on very slowly, and with the constant air raids and artillery battles stopping our activities, it took us almost ten days to discharge. We couldn't compliment either army on its gunnery, for whenever they attempted to get the range with their guns, the sickening whine of the shells and the bursting shrapnel would send us to shelter. Although I never saw a Chinese airplane, the unopposed Jap fliers were none too good, and one afternoon we watched from our rigging while they spent two hours bombing a field-headquarters shack.

One of the greatest thrills I enjoyed during my ten days on the Whangpoo occurred when I crawled with the boatswain and quartermaster through some shell holes to a Chinese dugout and snipers' nest. We managed to fill our pockets with shell fragments before the Japanese observers spotted us. They were armed with rifles, and we didn't exactly care to be shot in a case of "mistaken identity, very sorry." Consequently with great apprehension and assumed coolness we retreated to the *Steel Traveler* where we could breathe a bit easier.

Black buzzards winged sinisterly over the ruins along the waterfront and fed on human flesh. A cold rain fell slowly during our last day, and we looked forward to sailing on the morning tide. We were all seamen, and we wanted to fill our lungs with the pure lusty air of the sea again.

A northerly gale furnished us protection as we left Shanghai under escort of an American destroyer. And I remember dipping our colors to them in appreciation and farewell when we reached the open sea. Clear! Clear, at last, for Java ports, for Singapore in Malaya, and more adventures beyond westward horizons around the world.

We Saw Plants, Too

During spring vacation the senior Chemical Engineers went on an inspection trip to midwestern industrial plants. They did a few things besides inspect plants. One of the seniors tells us what some of these other things were.

By Walter J. Smoleroff, Chem. E. '38

PERHAPS the one course looked forward to with more interest than any other one on the chemical engineering curricula is the inspection trip taken by the seniors during the spring vacation. This trip presents the best and last opportunity for the graduating students to learn more about each other and the several faculty members who accompany them. This year the fortunate members were Dr. C. A. Mann, Dr. M. C. Rogers, and C. S. Grove, Jr. The trip lasted ten days, starting on the Wednesday of final week and ending on the Friday of vacation week. So much for formalities. I shall not attempt to state the purpose of the trip for I am sure that my fellow students had their own definite ideas on the subject. These ideas didn't necessarily coincide with those of the faculty.

So, full of anticipation as to what lay ahead of us, we straggled, singly and in groups, to the back of the Chemistry building on Wednesday morning, and gradually filled our two chartered busses. Because we were told to keep the same bus in order to avoid confusion in taking attendance, a little rivalry naturally developed between the two. We called our bus the "good" bus and the other one the "slug" bus. What they called us we never found out. The first time they realized that such a rivalry existed was on the second day, when Merman, Cromer, and Shapiro happened to climb in with us. "Out with the foreigners!", we bellowed, led by the doughty Holahan. He could always bellow the loudest. Have you ever heard him sing (?) an operatic aria? You haven't? Boy, are you lucky! Well, we cured the "foreigners" and had trouble only once more when Uhlrich entered and sat down by mistake. "Wait until one of you guys gets in our bus," he threatened as he hurriedly left. We didn't even appreciate it when one of the boys invited Jones from the other bus to be our guest artist.

If any of us thought that riding would be tedious, the idea was certainly dispelled as soon as we had started. In no time at all card games, crap games, quartettes, et cetera, sprang up all over. One of the memories of the trip I shall always have is of jogging along with the country-side speeding backward at the rate of a mile a minute, a misty sky overhead, damp air around us, but nothing but high spirits in the busses. One could always kibitz in a bridge game, join in a song, have a bull session, or even engage in a little rough-housing. Perhaps many of us, for the rest of our lives, shall never be as free again. For a brief ten days we hadn't a care in the world; school was behind us, nothing but good times ahead, and we were our own masters. We had known each other for almost four years and were, for the most part, good friends. What more could one ask?

Our first stop was at Wausau, Wisconsin, where we visited the Quarzite branch of the Minnesota Mining and Manufacturing Company. Trutna thought they jiggled the screens to prevent him from seeing how they worked. From here we proceeded to Appleton to spend the night. Although we saw plenty of girls the next day, they certainly hid themselves that night. Were they warned that Schmidt was coming to town? The next day we had the unique experience of seeing how Kleenex and Kotex were manufactured and, with our faces red (heh, heh) and samples in our pockets, we dashed off for Milwaukee. That night some of us who were feeling in a particularly aesthetic mood wandered down to the shores of Lake Michigan to take in the moonlight view. Here we saw the impressive statue of Lincoln, a gift to Milwaukee by its citizens, who stubbornly refused to turn around and see the glistening ice between the break-water and the shore surge gently to the motion of the waves. On our way back we picked up Lunde, MacDougall, and Trutna at a beer joint and marched up the street, six abreast, shouting, "Hip, hip, etc.," and feeling silly.

Friday was our masterpiece; we visited four plants. In one plant our guide had apparently forgotten that they had such things as elevators there, and he also must have been imbued with an infinite amount of energy. We would literally run up five stories, look at stuff on the way down, go to another building, run up five more stories, etc., ad infinitum. When we reached the top of each building our tongues would be dragging and our breathing sounded like Niagara Falls on a quiet night. By the time we were in a condition to appreciate what was going on we would be dashing like mad up another building. We crawled into our busses like beaten dogs. Such a life! And I never saw such a close-mouthed bunch of seniors as I did when we went through that tannery. To think that we used to gripe at the foul odors (so we thought then) coming from the organic laboratory.

Our departure for Chicago was accompanied by dreary weather. Evidently Dame Nature tried to counter-balance our high spirits with a damp atmosphere, but for once she was on the losing side. As we approached the great city everyone ceased his activities and sat silently, staring out of the windows as if he were afraid of missing something. We who had never been there before were thrilled at the massiveness and height of the buildings, the huge crowds of people surging to the silent calls of the green lights at the street crossings, the rumble of the elevated and the roar of the traffic, over which one could always hear the shriek of a police whistle. It was an orderly confusion that one would think could not possibly exist so close to the brink of chaos and still not drift into it.

We quickly checked our baggage at the Atlantic Hotel and dispersed to eat lunch. We had the Saturday noon off and wanted to have a lot of time for exploring. One can certainly find people in odd places while strolling around in a strange city. Who would imagine that Mr. Grove and Dr. Rogers would be found browsing around in the second-hand book section at Marshall Fields, or that Berger, like the proverbial postman on his day off, would be ambling about the University of Chicago. Colby dropped into my room late that afternoon and was dog-tired after a several hour's tramp around the loop. "Boy, is this town crazy!" he exclaimed. "More things happen around here. A guy tries to make a left-hand turn and gets stuck half way around the corner. You should have heard the other drivers honk. A mounted policeman came up to straighten out the mess and got in front of a car that wanted to pass. Did the driver wait? The dang fellow drives up and bumps the horse right in the fanny. Another time a street car was crossing over a drawbridge and when it got to the middle, the jolt it received in going across the open ends of the tracks broke the trolley pole right in the middle." Poor Colby had never been in a big city before, but then neither had I. That night Kitty Davis and her hostesses did a rip-roaring business. In fact traffic was so heavy on the floor that Plant had to direct it. I imagine it must have seemed twice as heavy to him.

By this time some of the boys were becoming a little tired at a few who persisted in shoving away anybody who stood between them and the guide. These few, poor fellows, were in constant dread of missing a few words of explanation, and wouldn't hesitate to clip somebody in order to advance themselves in a more desirable position. Thus it came to be that the F.O.C. (Freeze Out Committee) was organized. We would plant several men on each side and behind the guide. His stopping to explain a particular piece of equipment was an automatic signal for a quick closing in on the flanks and forming a solid ring of apparently super-interested students with the guide as a nucleus. Our ideal students, left on the outside, would frantically skirt the edges, in hopes of finding an opening. However, we did our work well. In one plant in particular we were so efficient that the guide noticed something was unusual. No matter how fast he walked there were a few of us who managed to stay ahead of him. As a consequence, instead of his leading us through, we carried him along at quite a good clip. Mr. Grove explained the situation to him when we had finished and he, an understanding soul, accepted it in good spirit. Although we were too busy to take notes, we certainly had fun.

Our stay in Chicago lasted four days and finally terminated, much to our regret. Such names as State Street, the Field Museum, the Ghetto, Atlantic Hotel, Gold Coast, China Town, etc., serve as mental landmarks to the good times we had. One must not forget the One Cow restaurant where Trutna ate a steak dinner and a plate of chow mein but refused to help Wookey with his meal, claiming that he, Trutna, had a heavy breakfast that morning and wasn't up to his usual gustatory par. No wonder North Dakota is so barren. No doubt Kitty Davis will have a cherished spot in the hearts of quite a few engineers, including one member of the faculty.

We left, via several plants, for Joliet. That night poker games came to the fore as the principal form of entertainment. Student Dobratz surprised everybody at his willingness to participate, but when he left the game with several dollars on the profit side they realized that his logical mind was applicable to more important things in life than studies. Halvorsen managed to come out sufficiently ahead to buy his girl friend a nice present. I wonder what he would have done if he had lost. Jones and Dr. Mann were two men to be feared in any man's game.

Our piece-de-resistance, our crowning achievement, was a visit to the Hiram Walker and Sons Distillery at Peoria. Our enthusiasm in visiting plants quickly regained, nay, even surpassed, its original level. Every landmark that we passed that indicated we were a little closer to our goal was greeted with shouts of approval. Some hinted darkly about samples we might be given at the conclusion of our visit. Finally we arrived at one of the few plants in the United States that hadn't even heard of the 1938 recession. Perhaps the main reason for this is the large numbers of people who chose to drown their sorrows in more or less potent beverages. Upon conclusion of our inspection we were led to a nicely decorated bar and were told to call for our favorite "pizen." MacDougall called five times (or was he stuttering?), and was a regular hell-on-wheels the rest of the day. We left reluctantly but with gleaming eyes and a friendly feeling.

Friday finally arrived and our trip was almost over. We visited one plant this last day, the Western Clock Company, where, as "N-B" Thompson so clevahly put it, all the help were clock watchers. We settled back in our busses for the last time and prepared for a 400-mile drive back home. Podas sprawled all over the back seat preparatory to a long siege of magazine reading. Carlson, Hoffman, Helleckson, and Grove started a game of bridge that lasted for 400 miles. The boys in the back of the bus filled the air with nice, clean original songs that bothered the bridge players a little. Meyers wanted to know if Conklin bought his dental technician girl friend a set of false teeth as a present.

Since 400 miles is a very finite distance we finally reached St. Paul, where some of the boys, who lived in the suburbs of a famous city noted for its flour, left us. Art, the driver, gave a little speech and told us what fun he had and what a fine bunch of boys we were. Swell fellow, Art. This officially ended our trip. There was nothing left for us to do but go home and catch up on some much needed sleep. We had a feeling that the trip had accomplished everything that it was meant to. I am sure, if we had the chance, that we would most willingly go again.

Hundreds of Years of Iron Ore

Minnesota has an almost unlimited supply of low grade iron ore which cannot be economically reduced in a blast furnace in its present state. A magnetic process of concentrating this ore developed by the Mines Experiment Station is described in this article.

By Ward Simmons, Met. E. '39

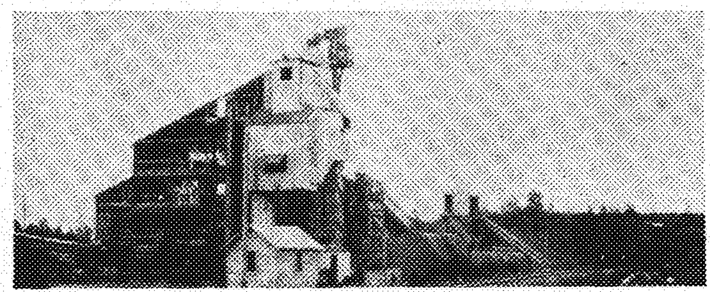
THE life of the Superior iron ore district has been estimated at between 30 and 40 years. This estimate, however, was based on the reserves of direct shipping ore and the rate at which this ore is being mined at the present time. What then should a traveler in 1988 expect to find on the iron range when Minnesota's red gold is gone? Desolate ruins and ghost towns tied together by rusting steel rails? Hardly! It is more than likely that he will find hustling communities and busy concentrating plants from which train loads of bluish black sinter roll steadily toward upper lake ports. Concentration of the almost limitless supply of low grade ore and taconite is the elixir that can prolong the life of the iron country.

Outcrops of the Biwabik iron formation can be found stretched across Itasca and St. Louis counties for a hundred miles. This formation varies in thickness from 400 to 750 feet and slopes gently toward the southeast. The iron formation is principally a hard silicious iron-bearing rock called taconite. It contains an average of 30 per cent iron; and is covered only by glacial drift of varying thickness. This enormous amount of iron-bearing rock is not an ore, but can be called a potential ore. The iron ore being mined today has been formed in the Biwabik formation by the leaching and removal of the silica, which makes up 60 to 70 per cent of the original taconite. The Mesabi range contains 95 per cent of all the known ore in Minnesota. I am referring to this range.

There are many methods for concentrating iron ore. Between 20 and 25 per cent of the ore shipped from Minnesota in the last few years has been produced by the concentration of lean ores. Concentration methods include screening to remove coarse rock, washing to remove partially leached silica still in the ore, classifying, tabling, and jigging. Most of the lean ore, however, cannot be satisfactorily concentrated by any of these processes. Flotation of iron ore is still in the laboratory stage.

J. N. Searles, assistant professor of ore dressing at the School of Mines and Metallurgy, has been able to secure a concentrate of 63 per cent iron, and tailings of 2.5 per cent iron, from fine (100 mesh) wash ore tailings which average 22 per cent iron. A recent development in beneficiation of low grade iron ore is magnetic roasting and concentrating, a process developed at the Mines Experiment Station. In this process the non-magnetic oxides, hematite and limonite, are converted into the magnetic oxide, magnetite, by roasting. This product may then be concentrated by methods already in use for the concentration of natural magnetites.

Magnetic roasting is not a new idea. In the laboratory the conversion from hematite to magnetite is simple and rapid; but attempts to commercialize the process have usually resulted in failure. In Minnesota, while direct shipping ore is available, this process must meet the competition of ore that can be produced for about $2.75 per ton. The process, however, has been proved to be metallurgically and economically sound.



The plant at Cooley. Does it inaugurate a new era for the Minnesota range?

Two commercial magnetic roasting plants are in operation at the present time. One, owned by the Showa Steel Works in South Manchuria, is operated on low grade ore which can be made merchantable only by magnetic roasting and concentration. The other plant is located at Cooley, Minnesota, on the west end of the Mesabi range. This plant was built by the Mines Experiment Station of the University of Minnesota with the aid of Butler Brothers Mining Company. At Cooley, the process is operated in competition with natural high grade ores; but the ore being treated is a coarse tailing product rejected from two near-by jigging plants. The cost of mining and crushing of this material has already been paid. The plant was operated by the Minnesota Experiment Station during the 1934 and 1935 ore-shipping seasons, and 15,795 tons of merchantable ore were produced. The University then sold its interest in the plant to Butler Brothers, who put the plant into commercial operation in the spring of 1936. Last year 25,000 tons of concentrate were produced during the shipping season.

The first problem in connection with the roasting of iron ore is that of heating the ore to the required temperature. In commercial practice a temperature of between 700 and 1100 degrees F. is usually used. It is possible to convert hematite to magnetite at much lower temperatures if sufficient time is allowed for the reaction. Heating of the ore can be carried on most efficiently by some application of the principle of countercurrent flow. The hot gases and products of combustion are passed through or over the ore, in the direction opposite to the movement of the ore. In this way the hottest gases come in contact with the hottest part of the ore; and the waste gases are discharged at as low a temperature as possible.

Reduction is accomplished by bringing the hot iron oxide into contact with a reducing agent. Because intimate contact between the reducing agent and the iron oxide is necessary, the reducing agent must be a gas. Hydrogen and carbon monoxide are used either singly or as a mixture, such as water gas. The time required for the chemical reactions that change hematite to magnetite depends almost entirely upon the time required to bring the oxide and reducing gas into intimate contact. The time required therefore depends upon the porosity of the ore and the size to which it has been crushed.

The change from hematite, Fe_2O_3, to magnetite, Fe_3O_4, can be expressed as $3\ Fe_2O_3 + CO = 2\ Fe_3O_4 + CO_2$.

or $3\ Fe_2O_3 + H_2 = 2\ Fe_3O_4 + H_2O$. In the first case, carbon monoxide reacts with hematite to produce magnetite and carbon dioxide. In the second case, hydrogen reacts with hematite to produce magnetite and water. These reactions are both exothermic, and sufficient heat is produced so that cold reducing gas may be used without causing a reduction in the temperature of the ore.

Under certain conditions it is possible that the ore may be overroasted—that is, the desired magnetite, Fe_3O_4, may be further reduced to ferrous oxide, FeO. This reaction is desirable in the blast furnace when metallic iron is being produced, but ferrous oxide is practically nonmagnetic and therefore is no better for magnetic concentration than was the original hematite. Overroasting is controlled by steam or CO_2, which either is introduced with the reducing gas or passes over the roasted ore. The FeO is converted back to magnetite.

Although water gas is the most efficient reducing agent that is commonly available, it is not a cheap gas to manufacture. Other reducing agents are frequently used, but they are broken down to hydrogen or carbon monoxide before they react with the iron oxide. The Showa Steel Works in Manchuria use coke oven gas as the reducing agent, while the plant at Cooley, Minnesota, has used oil both for reducing and heating. Butler Brothers and the Mines Experiment Station are now installing equipment at Cooley for the production and use of water gas as a reducing agent and for the use of pulverized coal for heating. Capacity is expected to be increased by 50 per cent by these improvements, which will be placed in operation about the first of June.

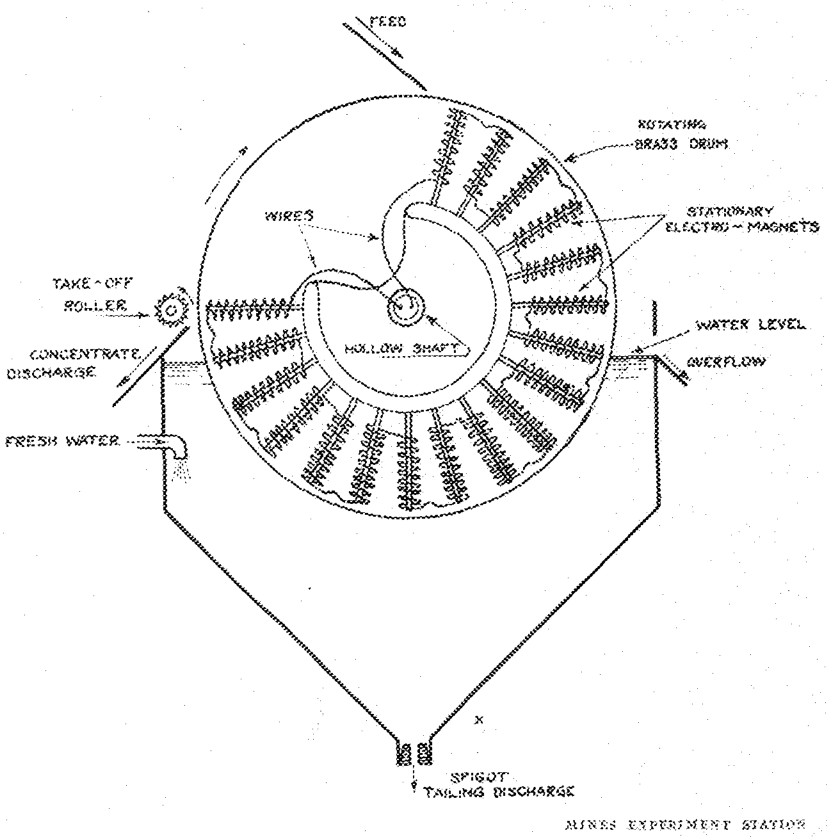


Diagram of wet magnetic cobber, used for separating the magnetite from gangue.

At the end of the reducing operation, the iron present is in the form of magnetite and its temperature is several hundred degrees. If the ore in this condition is exposed to the air, it will oxidize to hematite according to the equation $4\ Fe_3O_4 + O_2 = 6\ Fe_2O_3$. Artificial magnetite has been found to be relatively stable below 212 degrees F.; therefore it must be cooled in the absence of air to below this temperature. Steam and water accomplish this cooling.

The Cooley plant concentrates the roasted ore with a magnetic cobber. In this machine a brass drum rotates about a series of stationary electromagnets. The lower one-third of the drum is submerged in a tank of water. The ore is fed onto the top of the drum and at once enters the magnetic field. No separation is made above the water level, but the strength of the magnetic field below the surface of the water is regulated by means of a rheostat so that weakly magnetic particles drop away from the drum. This weakly magnetic material settles at the bottom of the tank and is drawn out through a spigot discharge as tailing. The revolving drum carries the magnetic portion of the ore up above the surface of the water to a position between the last magnet and a small take-off roller. This take-off roller is made of steel shafting in which slots have been cut. Due to its small diameter and its closeness to the strong magnet within the drum, the take-off roller becomes a strong induced magnet, with the result that the particles of magnetite leave the drum and attach themselves to the roller. The take-off roller revolves at a high rate of speed, and centrifugal force causes the magnetic particles to be thrown off into the concentrate discharge.

The Mines Experiment Station and others interested in Minnesota's future are trying to develop iron ore beneficiation to the point where in normal years all of the ore shipped can be produced from the low grade ores by concentration. The remaining high grade ore would then be kept in reserve as a sort of balance wheel for the industry, to be drawn upon when demand exceeds the capacity of the concentrating plants. There is one thing which at present stands in the way of rapid progress toward this goal. It is the ad valorem tax which is assessed against practically all real property in the state. This tax is based on the value of the property. Every time a ton of ore is removed from a mine the mine becomes less valuable and less tax is paid. It is obvious, then, that the mining companies are forced to mine their valuable high grade ore as rapidly as possible; they cannot afford to let it stay in the ground and pay taxes on it year after year. The ad valorem tax is the principal tax paid by the mining companies. Now just suppose that the ad valorem tax were made very small and that some other tax, for example a profits tax, were made the principal tax; the mining companies would no longer be penalized for keeping their ore in the state. The rush to mine the high grade ore would be over. Millions of dollars of capital would come into Minnesota to build concentrating plants because the steel plants want to keep their ore supply near at hand, and in the United States.

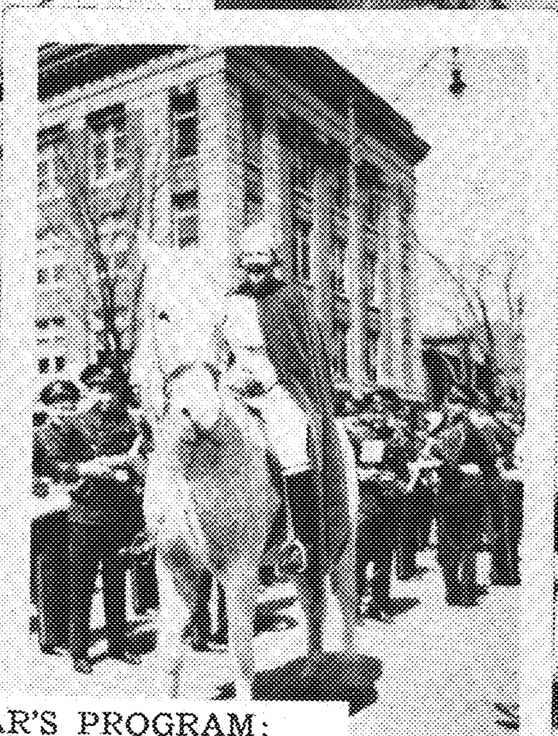
SAINT PAT AND HIS QUEEN

BERTIL LINDQUIST

Mary Elizabeth Emmel   Mark Olson





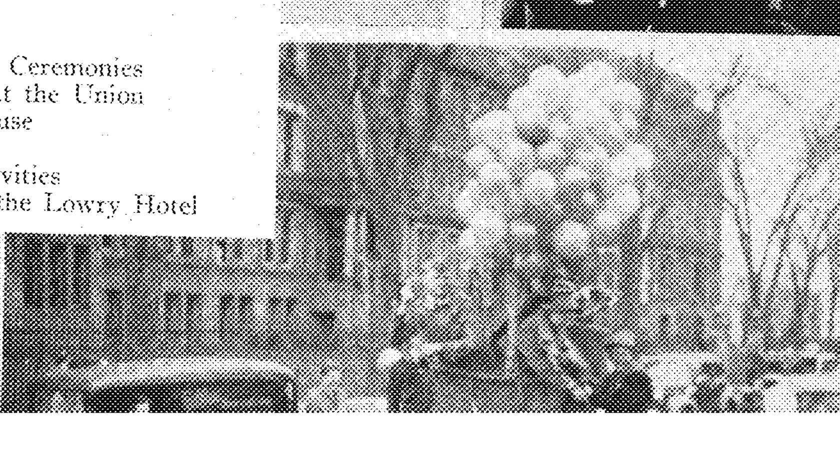

THIS YEAR'S PROGRAM:

Friday:

10:30-11:30	Parade
11:30-12:30	Knighting Ceremonies
3:30- 5:30	Dansant at the Union
2:00-10:00	Open House

Saturday:

9:30- 3:30	Field Activities
9:30 P.M.	Brawl at the Lowry Hotel

ENGINEERS' DAY PLANNERS

Wilson Brown talks to his executive committee. Left to right: Ken O'Brien, Treasurer; Brown, General Chairman; Paul Feyereisen, Field Day; Bob Wolfe, Brawl; Millard Troxell, Open House; Don Lampland, Parade; Frank Larson, Buttons; Herb Gaustad, Publicity.

Field and Track Events

Juniors vs. Seniors
- Jim Kemper, chmn.
- John Lorentzen
- George McDougall
- Lloyd Fredrickson
- Kera Miller
- Bill Guppy
- Franklyn Downton
- Bob Hanson
- Irvin L. Anderson

Freshmen vs. Sophomores
- Chuck Levitt, chmn.
- Linus Schramsky
- Charles Stanford
- Bill Mitchell
- Erick Schoenstedt
- Sam McIver
- John Kabrud
- Carl Halverson

Diamondball
- Bill Durrenberger, chmn.
- Louis McDermott
- Dick Weires
- Leonard Cohn
- William Bowman
- Woodrow Ersted
- George McBride

Picnic Arrangements
- Al Raudenbush, chmn.
- John Erhart
- Vincent Walker
- Howard Nelson
- Ed Heinch
- Lloyd Bergren
- Saul Fitelman
- Gunnar Carlson

Senior Contact
- Robert Asleson, chmn.
- Ed Pierson
- Don Scott
- Charles Berger
- John Wenzel
- Stanley Balik
- Robert Moore
- Parry Morris

Knighting Ceremony
- Ed Seder, chmn.
- Bill Snyder
- Wilson Davis
- Louis Quast

Route
- John Pitblade, Chmn.
- Robert Moulton
- Reuben Olson
- Ken Anderson

Float Ideas
- Curtis H. Johnson, Chmn.
- Con Moorhead
- Marvin Warner
- Carl Magnuson

Float Construction
- Earl Nyquist, chmn.
- Ken Sorenson
- Dan Yri
- Clayton Johnson

Society Float Organization
- Don Frankel, chmn.
- Bill Coons

Truck Committee
- Fred Rule, chmn.
- Clem Sculley
- James Webster
- George Mowry
- Don Garrison
- Dick McGee

Sign
- Merle Wiltrout, chmn.
- Don Brewer

General Sales
- Fred Anderly, chmn.

Aeronautical
- Allen Bjerke, chmn.
- Bob Peters
- Norvin Erickson
- Bob Moore

Agriculture
- Quentin Erlandson, chmn.

Architecture
- Jean Nemic, chmn.
- Doris Eckman

Chemistry
- Dan Lundy, chmn.
- Philip Nolan
- Joe Morrow
- Henry Peterson

Civil
- Don Basgen, chmn.
- Harold Hansen
- Herb Brown

Electrical
- Burton Wyman, chmn.
- John Dahlberg
- Hugo Hesse
- Russ Powers

Mechanical
- Archie Peterson, chmn.
- John Krietinger
- Harold Ostdahl
- Gordon Rood

Mines
- Irvin Bachelder, chmn.
- Roy Johnson
- Gordon Pfaff
- Kenny Bickford
- John Hope

Sales Girls
- Mary Jean Lindsay, chmn.
- Leora Thompson
- Loraine Simpkins
- Ernice Trapskin
- Jerry Breese
- Ruby Lewen
- Ethyl Mae Lindsay
- Fannie Hall

Brawl Arrangements
- Wallace Wilcox, chmn.
- Tom Jackson
- Earle Barker
- C. R. Morse
- Ralph Brittigan
- Eldrid Nelson

Brawl Sales
- Ed De Werff, chmn.

Aero
- Bob Jahnke, chmn.
- Bob Sexton
- John Seaman
- Joe Tucker

Agriculture
- George Ridings, chmn.
- Howard Lindlow

Architecture
- John Wenzel, chmn.
- Clinton Hegg
- Wallace Holm
- Myron Keeney
- Jack Lindsay

Chemistry
- Phil Claybourne, chmn.
- Bill Kronmiller
- Curtiss Thompson
- Gabriel Jaffe

Civil
- Francis Jacobs, chmn.
- Joe Kennedy
- Wade Larkin
- Don Hook

Electrical
- John Liggett, chmn.
- Joe Kinegel
- De Witt Stark
- Chuck Zoubeck
- Pete Culbertson

Mechanical
- Ernest Kluegel, chmn.
- Howard Bushnell
- Fred Carlson
- Ken Pierson
- Dick Jerome

Mines
- Ross McCorquodale, chmn.
- Bud Boyum
- Al Tweelings
- Howard Nordquist

Tech Fraternities
- Richard Coulston, chmn.
- Lewis Larson
- Don Callahan
- Gordon Nygren

Dansant
- Don R. Johnson, chmn.
- Byron Ertsgaard
- Priscilla Wrenn
- Don Duncanson
- Orville Lundstrom
- Robert Felt
- Wesley Larson

Green Tea
- Martha Burr Bates, chmn.
- Amygene Kilpatrick
- Ruth Heritage
- Mary Jane Lorimer
- Venette McManus
- Mary Emmel

Office
- Milton Smithman

Campus Publicity
- Don Reed, chmn.
- Frank Powers
- Bob E. McDonald
- Eben Finger

Off-Campus Publicity
- Vern Hoden, chmn.
- Bruce Corlett
- Arne Chilstrom
- John Shannon

Radio
- Bob Anderson, chmn.
- John Lambert
- Leslie Anderson
- Bertil H. T. Lindquist

Posters
- Charles Wiley, chmn.
- George Levin
- Elaine Hanson
- Fritz Roth

WHAT TO SEE AT OPEN HOUSE

General Arrangements

Harry Larson, chmn. — Sid Clark
Steve Purcell — Victor Krause
Ray Hopper — C. W. Mott

Aeronautical Exhibits

John McCarthy, chmn.
Elmer Hollar — Sheldon Stillwell
Stan Church — Wayne Kircher

Armory

Piccard's Exhibit of flight equipment.................Main floor
Meteorological Exhibit of instruments and methods of predictions.................Room 105A
Aerial Navigation Exhibit.................Room 105A
Airplane Structure Exhibits.................Main floor

The Oak Street Laboratory will be open for inspection but no exhibits will be shown.

Ag. Engineering Exhibits

Eugene Hesli, chmn.
Robert Thornburg — Niels B. Anderson
Lloyd Peterson — Louis Evans

Main Engineering Building

Model Farmstead.................1st floor
Model Farm Machinery Display.................1st floor
Electric Fence.................1st floor
Land Reclamation.................1st floor

Architecture Exhibits

Albert Arneson, chmn.
Gerald Buetow — John Wylie
Grover Dimond — Idell Hillman

Main Engineering Building

Library.................Room 318
Grade II Draughting.................Room 302
Grade III Draughting.................Room 316
Interior Architecture.................Room 309
Water Color Exhibit.................Room 417
Modeling.................Room 405

There is an architect's curricula presented in a colorful graphic way on a series of posters, also prize winning drawings, senior thesis, and interesting models.

Chemical Exhibits

Bob Lundborg, chmn.
Bob Marvin — Bob Moulton

Chemistry Building

Chemistry Show.................Main Auditorium
Chemical Engineering Laboratory.................Room 90
Exhibit of Chemistry School.................1st Floor Hall
Organic Chemistry.................Room 110
Inorganic Chemistry.................Room 110
Physical Chemistry.................Room 190
Industrial Exhibit.................Main Floor
Radioactivity and Liquid Air Demonstrations

Electrical Exhibits

Wilbur Coffin, chmn.
John D. Kling — Henry R. Rehmann
Edward A. Brickman — Joshua Premack

Electrical Engineering

Commercial Exhibits
Western Union's Teletyper.................Museum
Jacobs Wind Generating Company.................Main Lab.
Curtis Lighting Company.................Room 138
Minneapolis Honeywell-acatherm in operation.................Museum
Bell Telephone Company.................Museum
Northern Photo Supply Co.................Room 237

Student Exhibits
Automatic Doorman.................Main Lab.
Personality Meter.................Main Lab.
Arc Welding.................Main Lab.
Tin Can Motor.................Main Lab.
Whiskey Bottle Set-Up.................Main Lab.
Oscilloscope.................Main Lab.
Stroboscope.................Room 238
Revolving Coin.................Main Lab.
Floating Bar of Metal.................Main Lab.

Civil Exhibits

Harold Maiers, chmn. — Charles Van Nest
Ken Person — Gene Dixon

Main Engineering

Blueprinting.................Room 23
Maps, Aerial Photography.................Room 135
Instruments.................Room 136

Experimental Engineering

State Highway Department Laboratory.................Room 113
Concrete Laboratory.................Rooms 8 and 10
Bridge Models.................Room 8
Testing Machines and Hydraulic Experiments.................Main Floor

Mechanical Exhibits

Roland Meyer, chmn.
Edwin Hage — James Parsons
Robert Callaway — Don Flinn
Ed Tupper — Ed Cornwall

Mechanical Building

Pattern Making.................Shop, Main Floor
Machine Shop.................Shop, Main Floor
Foundry.................Shop, Main Floor
Forging and Welding.................Forge Shop
Power Plant.................Forge Shop
Design Exhibits.................Room 151
Heating and Ventilating
Internal Combustion
Machine Design
Time and Motion Study.................Machine Shop

Experimental Building

Operating Machines.................Main Floor

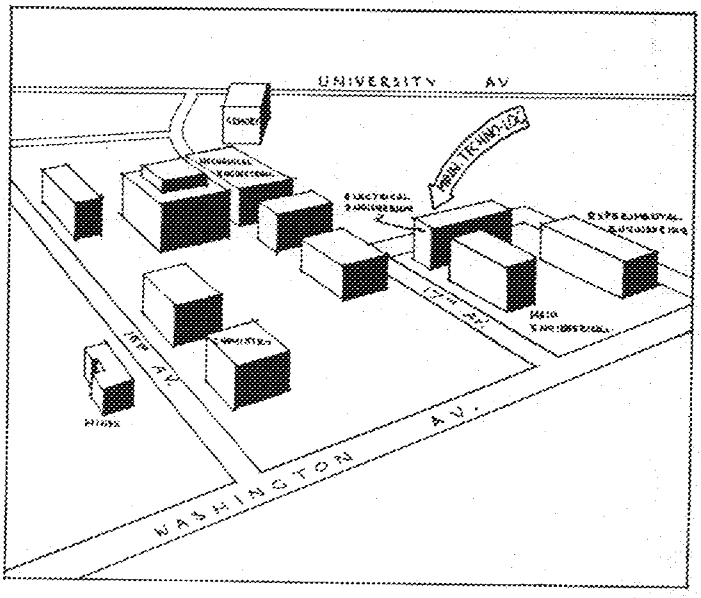
Mining Exhibits

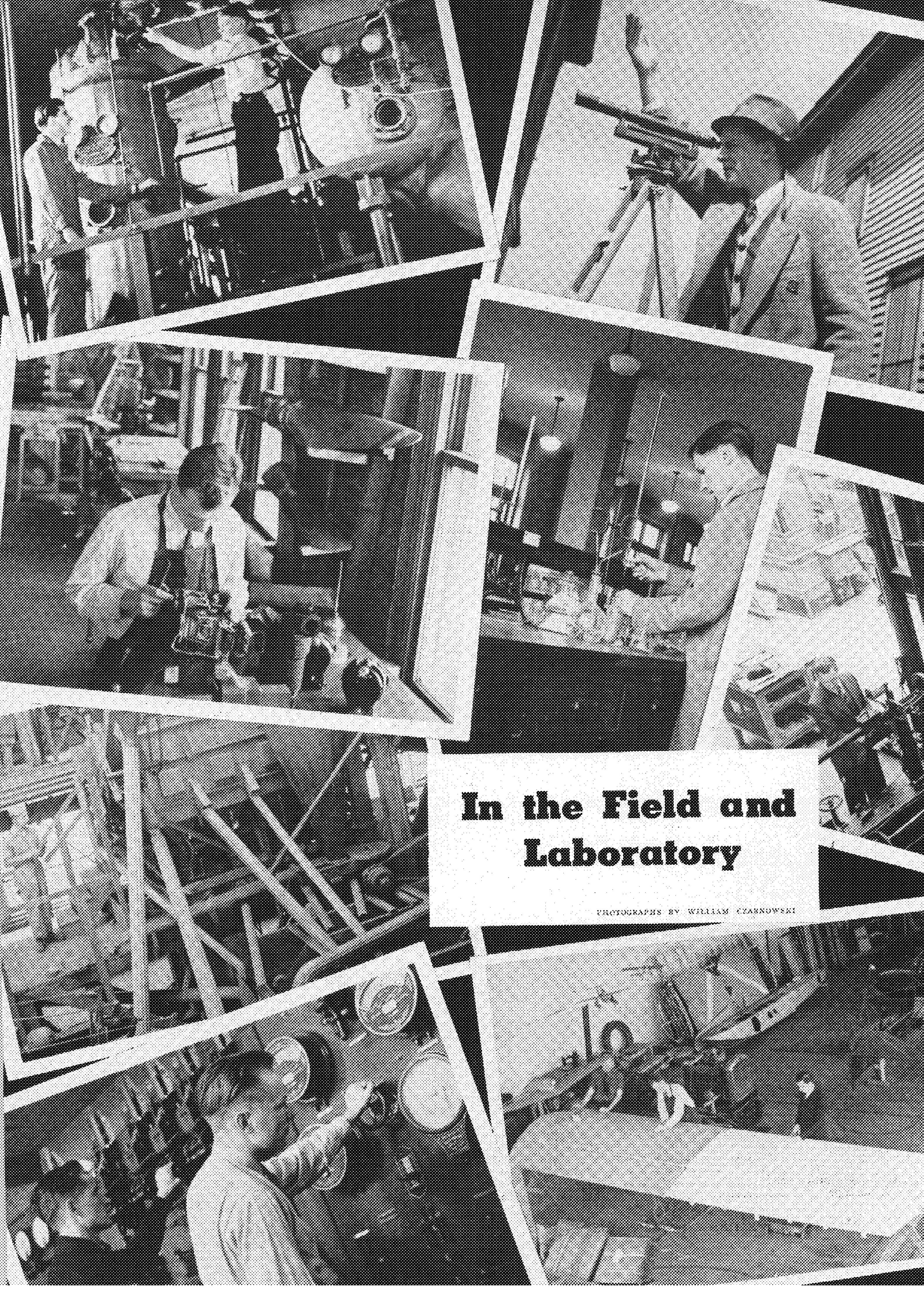
Hugh Leach, chmn. — Ray Helgeson
Homer S. Anderson — Vernon Robinson
Dick Mollison — Charles Walton

Mines Building

Mine Models.................Room 208
Movies.................Room 107
Mine Rescue Exhibition.................Room 208
Timbering.................Main Hall
Petroleum Display.................Main Hall
Assaying Experiments.................Basement
Metallography Display.................3rd Floor

AL ARNESON





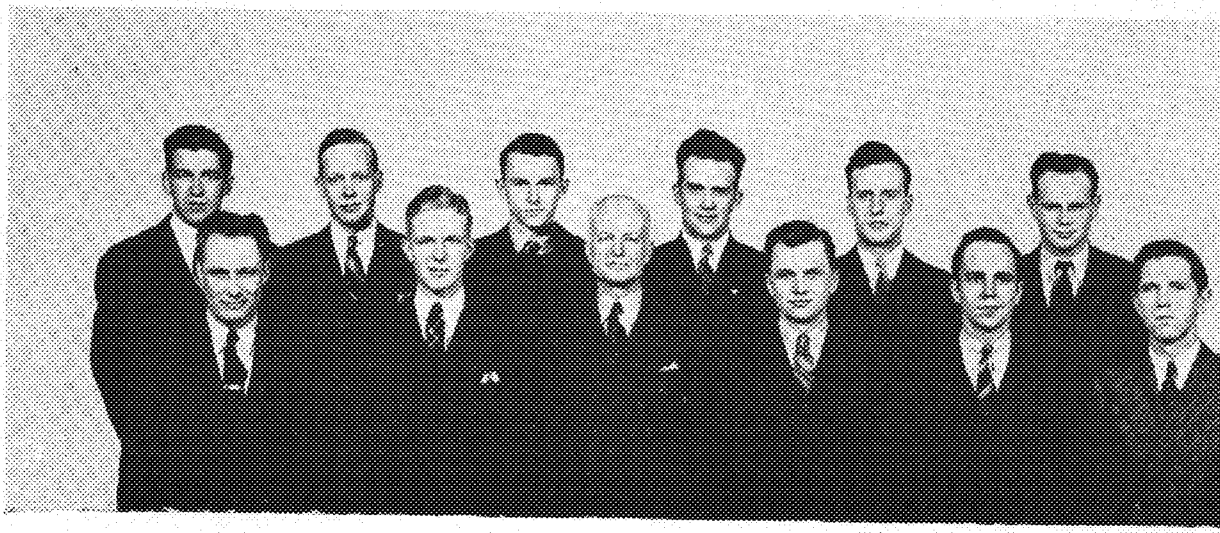
In the Field and Laboratory

PHOTOGRAPHS BY WILLIAM CZARNOWSKI

Technical Commission

Front Row—Hamilton, Funke, Lindquist, Erickson, Larson.
Second—McVeety, Wenzel, Person, Neuberg.

Plumb Bob

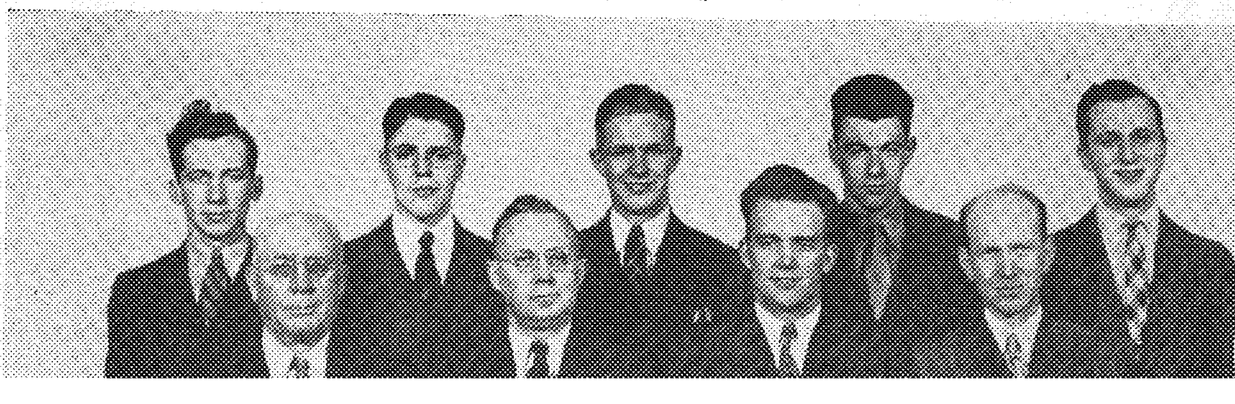


Honorary Senior Fraternity

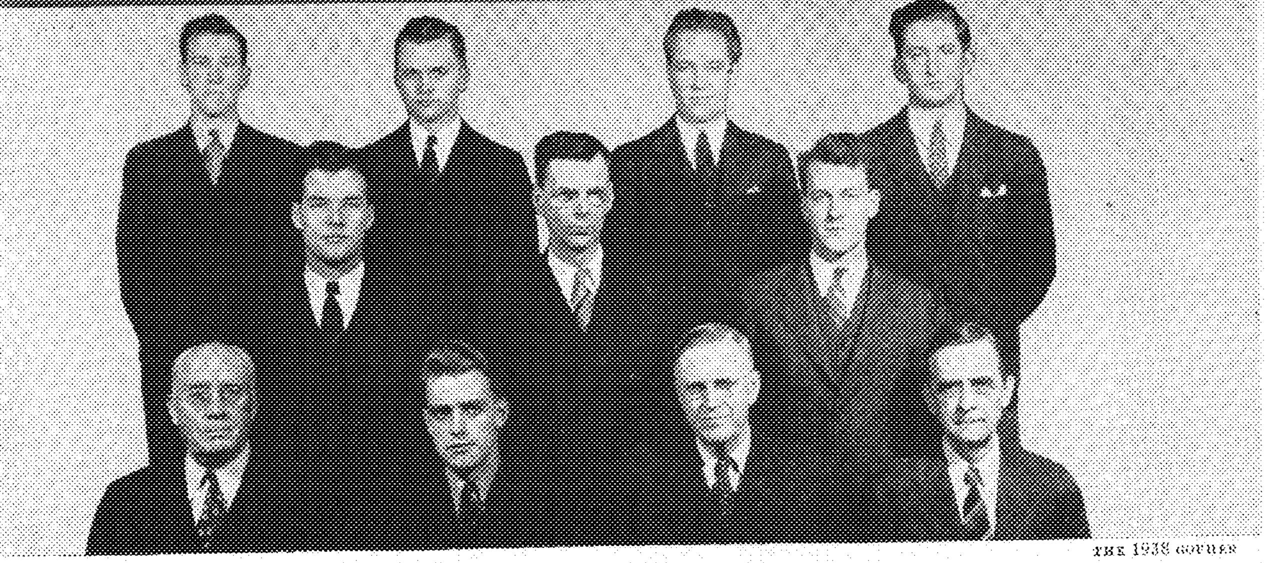
Front Row—Onstad, Helland, Richardson, Piercy, Raudenbush, Meisch.
Second—Hughes, M. Olson, Erickson, Lindquist, Berger, S. Finger.

Front Row—Professor Comstock, Professor Reyerson, Lindquist, Professor Straub.
Second—Waleen, Kellum, Helland, Dunning, C. Arnold.

Techno-Log Board



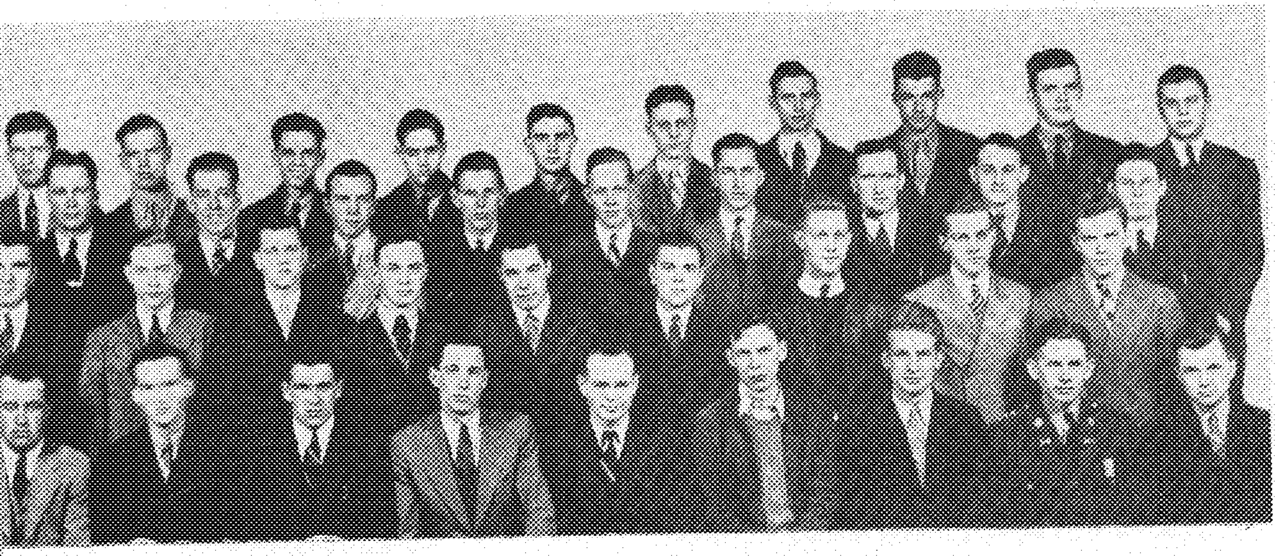
ALL GROUP PHOTOGRAPHS BY BERTIL LINDQUIST



THE 1938 GOPHER

Front Row—Comstock, Moore, Zeiner, Brooke.
Second—Serigstad, Smith, H. Brown.
Third—McMullen, Piercy, Onstad, Moskovitz.

Bookstore Board



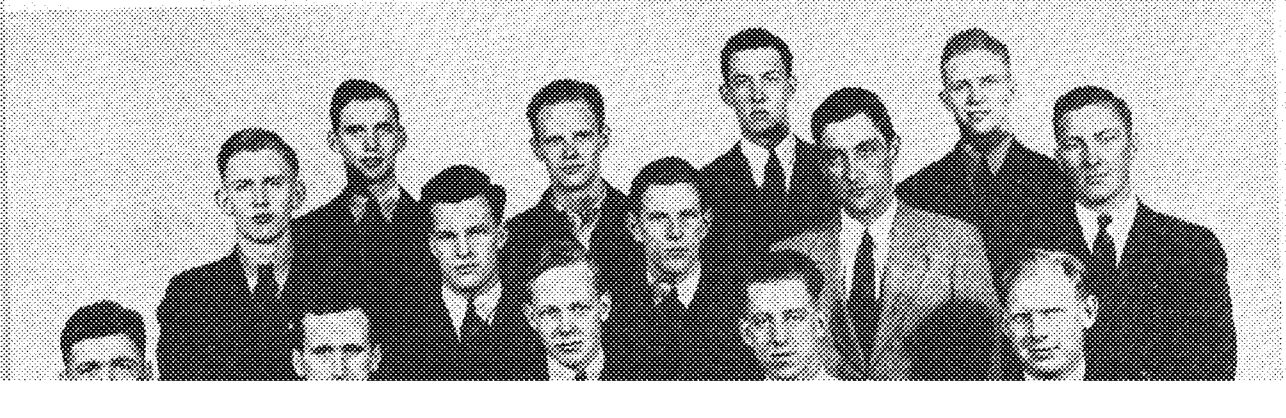
Tau Beta Pi

Honorary Engineering Fraternity

Front Row—Swan, Trutna, Hughes, Hook, Finger, Lee, A. Anderson, Hage, Piercy.
Second—Hall, Wookey, English, H. Anderson, Lewis, L. Johnson, Schmidt, Stillwell, R. Olson.
Third—Onstad, Gaustad, Lowe, Person, M. Olson, Meyer, Maiers, Luck, MacDonald.
Fourth—Wilcox, Wagner, Daniels, Turner, Brierly, Hagen, L. Anderson, Dunning, Tollefsrud, W. Johnson.

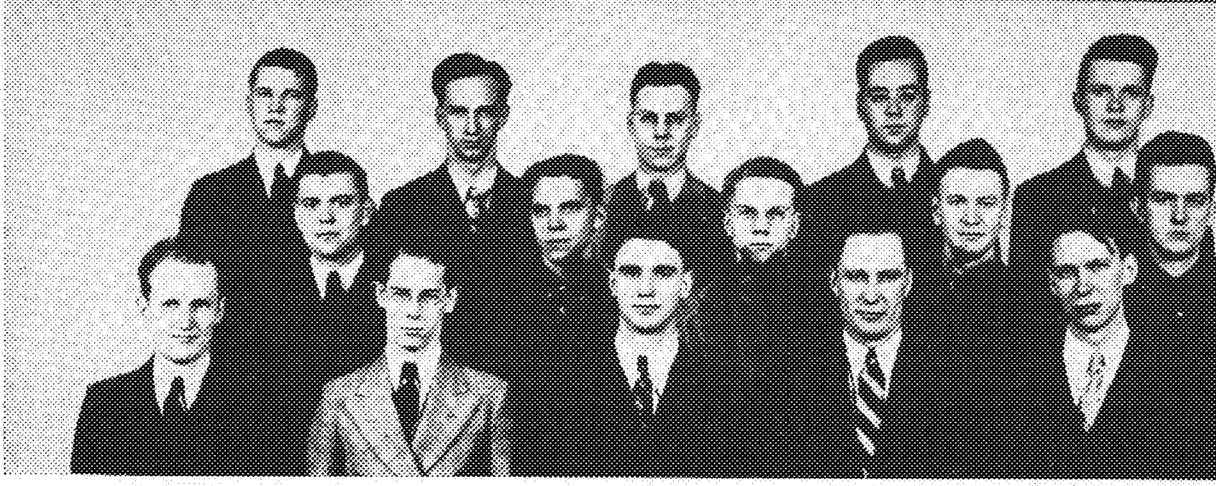
Honorary Civil Engineering Fraternity

Front Row—McGee, Maiers, M. Olson, Gaustad, MacKenzie.
Second—Sorenson, Jacobs, Person, Hillman, W. Olson.
Third—L. Anderson, W. Brown, Hook, Helland.



Chi Epsilon

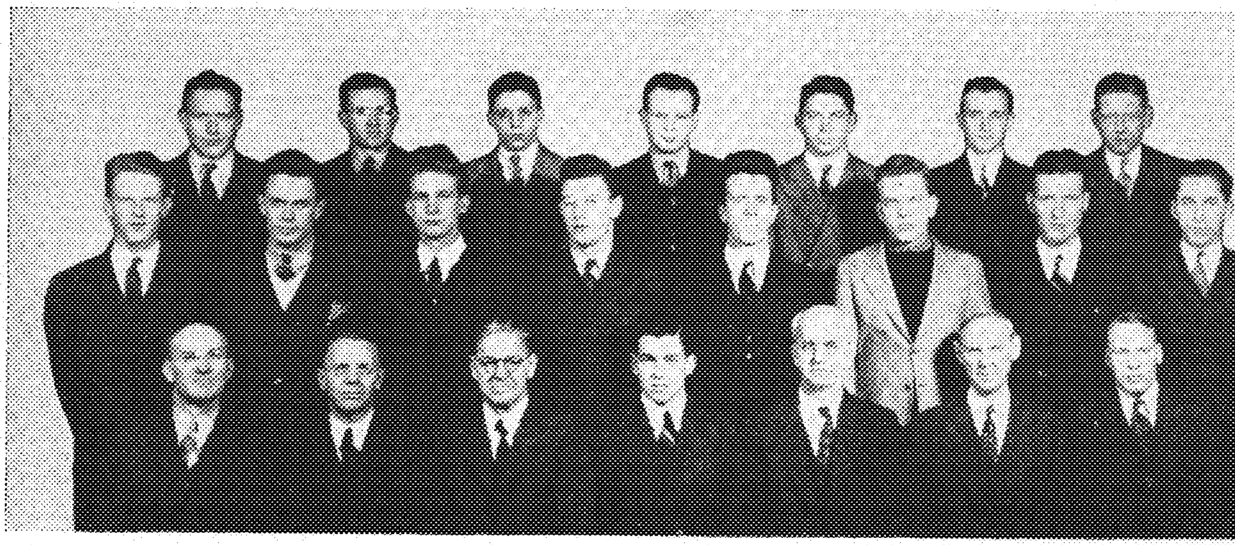
Eta Kappa Nu



Honorary Electrical Engineering Fraternity

Front Row—Morris, Patterson, Brierley, Onstad, Lee.
Second—Johnson, Downey, Prestholdt, Hanson, Couillard.
Third—English, Sabine, Hagen, Prenack, Tollefsrud.

Pi Tau Sigma



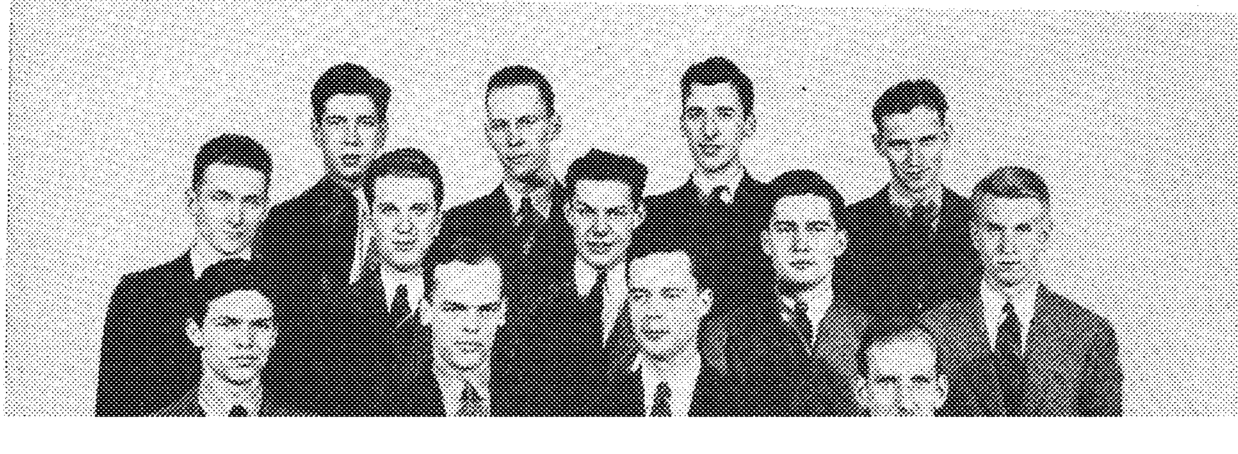
Honorary Mechanical Engineering Fraternity

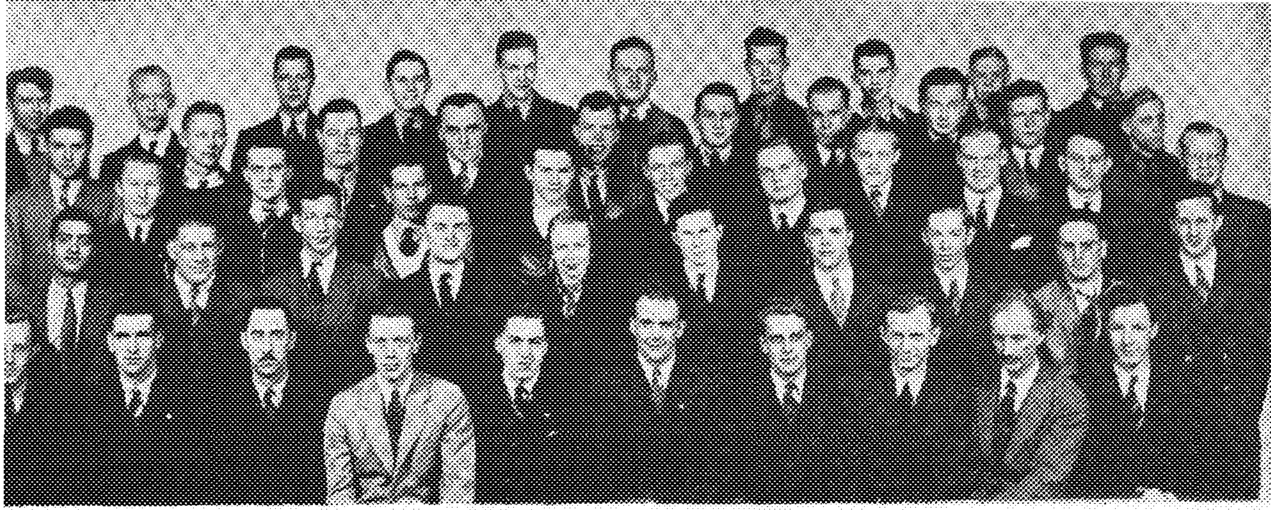
Front Row—Professors Robinson, Algren, Schoop, Hughes, Martenis, DuPriest, Ryan.
Second—Manly, Pierson, A. A. Anderson, Ostdal, Retrum, Olson, Lein, Meyer.
Third—Cadwell, Shotwell, Davies, Finger, Andres, Hoagberg, Kordish.

Scarab

Honorary Architectural Fraternity

First Row—Rafferty, Frahm, Waters, V. Johnson.
Second Row—West, Wenzel, Lindsay, Petri, Griswold.
Third Row—BeVier, Dimond, Fritch, Abbott.

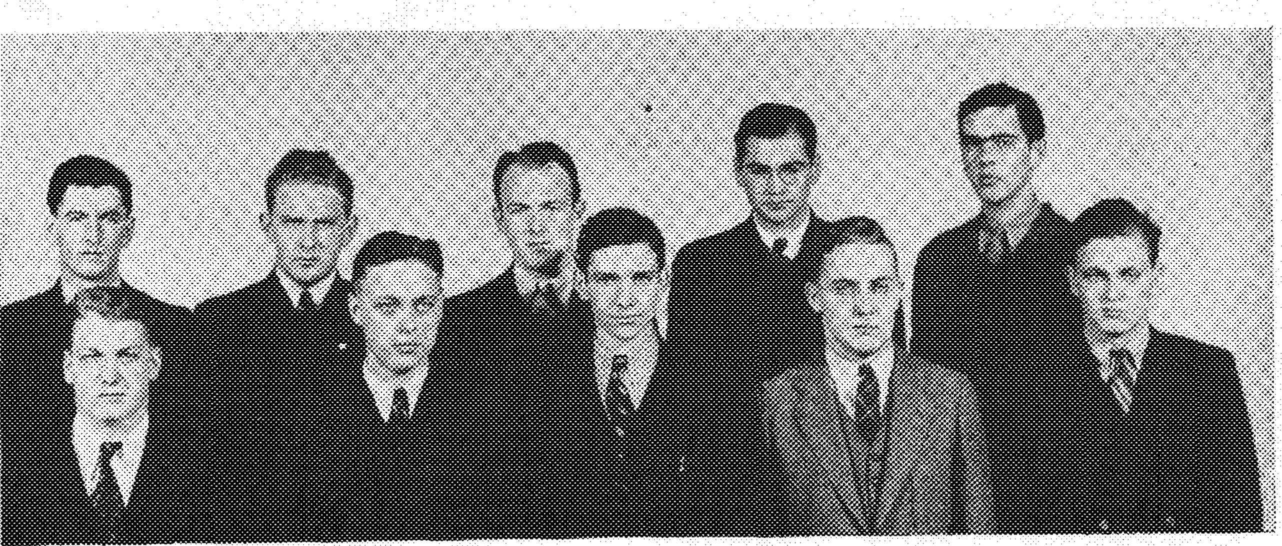




I. Ae. S.

Institute of Aeronautical Sciences

Front Row—Carlson, Magner, Barlow, Brush, Schoonmaker, Lindquist, Moore, Professor Akerman, Professor Piccard, Hoffman.
Second—Flushman, Micka, Winker, LaClare, Wrenn, Lundy, Lockerby, Swanson, Kreidler, Heid.
Third—LeVine, Towle, Hickman, Clarkson, Hollar, Jones, Brattret, Crowley, Luck, Sandgren.
Fourth—Kerker, H. Schmidt, Stowe, Richter, Hall, Huseby, Cameron, Waring, Tunis, Travis.
Fifth—D. Benson, Dean, Brissman, Beamer, A. N. Anderson, Bertholf, Slifer, Flynn, L. Nelson, Widman.



A. S. A. E.

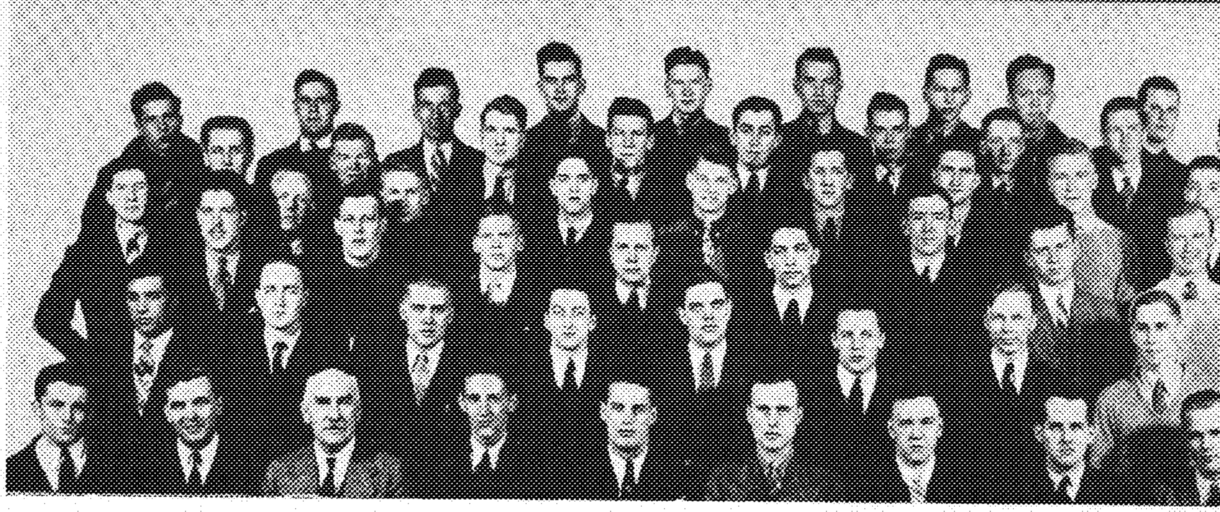
American Society of Agricultural Engineers

Front Row—Peterson, Erlandson, McVeety, Ridings, Lindow.
Second—Hostager, Thornberg, McGhie, Hesli, Dingle.

Front Row—Bollum, Mitchell, Waters, Wenzel, Hillman, Folsom, Lorimer, Epstine.
Second—Haugen, Kirkpatrick, Hansen, McManus, Bossen, Ekman, Wilder, Nemic, Arneson, V. Johnson, Lenz.
Third—Marshall, Rafferty, Ludwig, Breeze, Thompson, Kilpatric, Meisch, Kutzick, Hamm.
Fourth—Roth, Frahm, Frederickson, Rogness, Lindsay, Petre, B. Johnson, Griswold.
Fifth—S. Johnson, Abbott, Bergman, Flynn, McGronn, Hohn, Lindstrom, West, Kromhout.
Sixth—BeVier, Lie, Fritch, Buetow, Wiley, Dimond, Bouman, Shimea, Siegerstrom.
Seventh—Hegg, Kremer.

Architectu[re]
Society

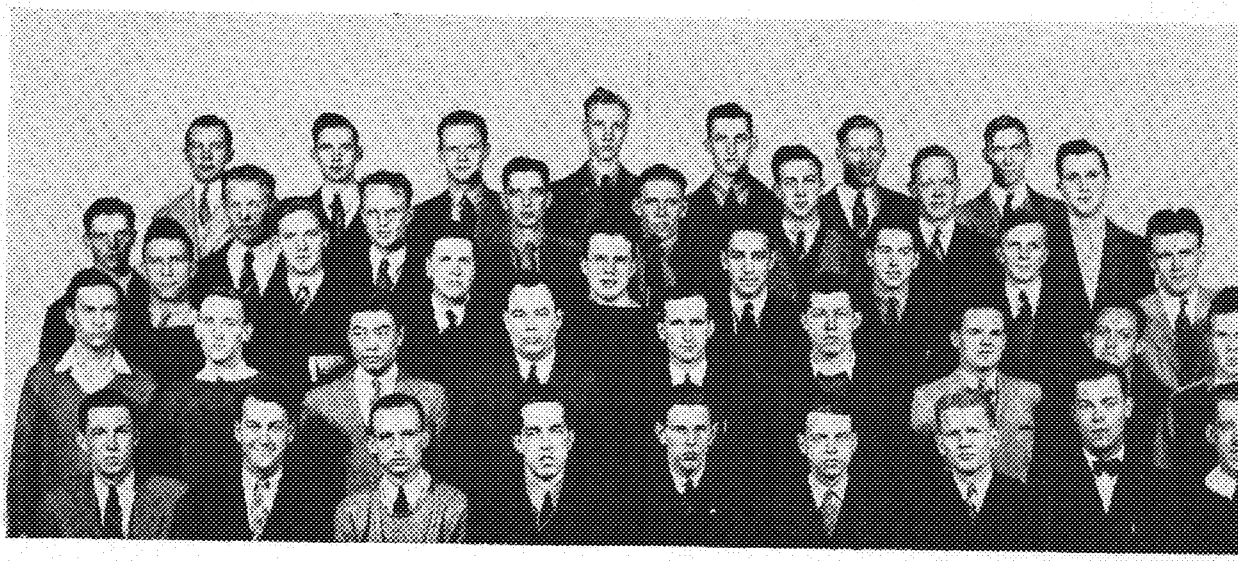
A. I. Ch. E.



American Institute of Chemical Engineers

Front Row—P. Johnson, Dr. Piret, Dr. Mann, Van Hoven, MacDonald, Berger, Kemp, Dr. Rogers, Wahlroos
Second—West, Oen, Berglund, Cromer, Carlson, Wallentine, Taipale, Schilberg.
Third—Lunde, Griffith, Stoltz, McKusick, Rashka, Fattu, Clinard, Motl, Colby.
Fourth—MacDougal, Merman, Turner, Hafslund, Peyer, Sherwood, Lundborg, Dobratz.
Fifth—Lund, Bergvall, Hoaglund, Pratt, Baumgartner, Syverson, Ehlers, Becker, Rowland.
Sixth—Holohan, Conklin, Earle, Schmidt, Wright, Enderson, Smith, Logan, Ballard.

A. S. C. E.



American Society of Civil Engineers

Front Row—Hook, H. Brown, Kellum, Huebscher, Person, D. Hook, Hanson, Halvorson, Gaustad.
Second—Kelsey, Furdy, Wu, Aske, Maiers, Martin, Sculley, Reina, O'Brien.
Third—Dixon, Warner, Sigs, J. Arnold, Segal, Bennetts, Axelson, Lischeid.
Fourth—L. J. Larson, Hage, Bataiden, Nichols, K. Anderson, G. Anderson, M. Olson, C. Arnold.
Fifth—Lowe, Anderson, W. Brown, J. Lindsey, Postels, Monson, Nyquist.

American Institute of Electrical Engineers

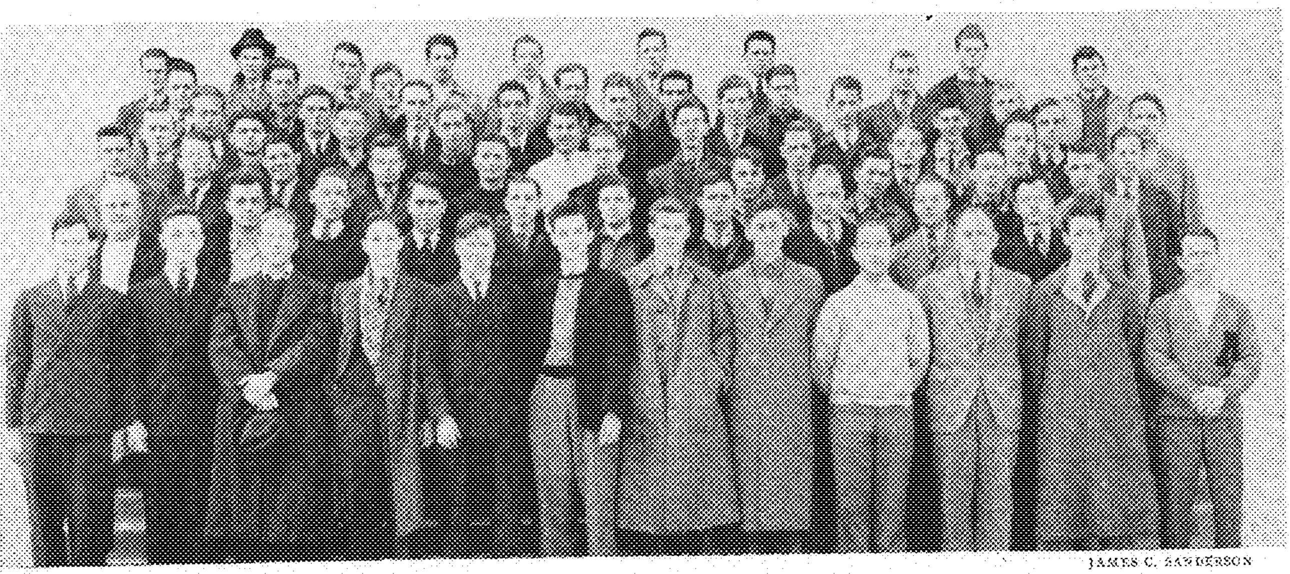
Front Row—Rundle, Skoog, Downey, Onstad, Erickson, Prof. Kuhlmann, Hagen, Kirievsky, Rebmann.
Second—Waleen, Biggam, W. G. Johnson, Brickman, Kling, Morris, Kaiser, Swoffer, Patterson, J. Murray.
Third—Osmundson, Thompson, Held, Korhone, Hopper, Prestholdt, Kelsey, L. Johnson, Burns.
Fourth—Couillard, Brinda, Spethmann, Yokich, Lund, English, Haines, Daniels, Hendry.
Fifth—Hanson, White, G. Anderson, Sabine, Brierley, Saunders, Lee, Premack, Coffin.

A. I. E. E.

A.S.M.E.

American Society of Mechanical Engineers

Front Row—Christianson, Filbert, Bennett, Professor Ryan, Dye, Paine, Pierson, Lien, Wolfe, Haggerty, Bergsland
Second—Walstrom, Kuphal, Gustafson, Bredeson, Buckley, Swenson, Calloway, Davies, H. Hanson, Schonstedt.
Third—Brewer, Funke, Gerstemaier, Putts, Meyer, Kordich, Snyder, Shotwell, Cadwell, Prosser, Ellis.
Fourth—Davis, Henning, Ostdahl, Graham, Anderson, Reed, Caple, Hughes, Stone, Jernberg, A. Peterson.
Fifth—Ersted, Baer, Larson, Rasmussen, Freberg, Anderson, Larson, Kreitinger, Manly, Pflieder.

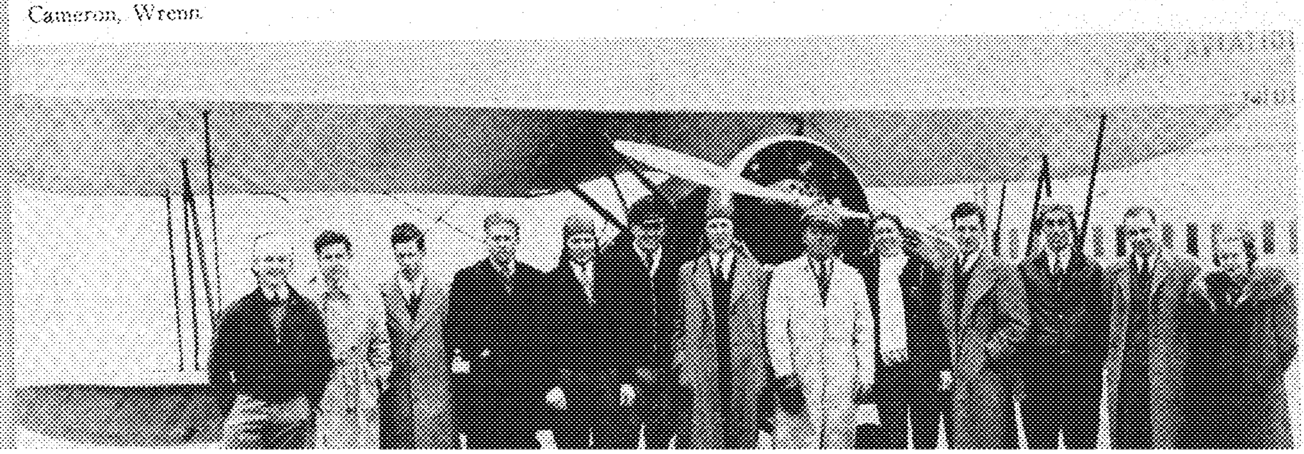


JAMES C. SANDERSON

Mines Society

Front Row—Stock, Anderson, Felt, Michie, J. Nelson, Tarkin, Pfaff, Lilligren, Koshuba, R. Olson, Parker, McCorquodale.
Second—Hovde, Bickford, Callaway, Zuppann, McMullen, Moss, Purcell, Gustafson, Tweelings, Rasmussen.
Third—Wiltrout, McMillen, Scott, Larson, Ward, Wood, Ronicker, Novak, Tyler, Turner.
Fourth—Daley, Woodard, Simmons, Holbrook, Balchelder, Flynn, J. Johnson, Troxell, Mollison, Ranta.
Fifth—Edwins, Nesse, Berkner, Leach, Brown, Geldman, Helgeson, Fine, T. Olson, D. Johnson.
Sixth—Ross, Sinclair, Boyum, McHugh, Hastings, Holton, Dervey, Schramski.
Seventh—Sundquist, Hope, Robinson, Neuberg, Nordquist, Walton, Krause, Malmgren.

Front Row—Lundgren, Lundy, Rawley, Westerlund, Knowlton, Lindquist, Lampland, Hinke, Onsgaard, Hoffman, Nessa, Cameron, Wrenn.



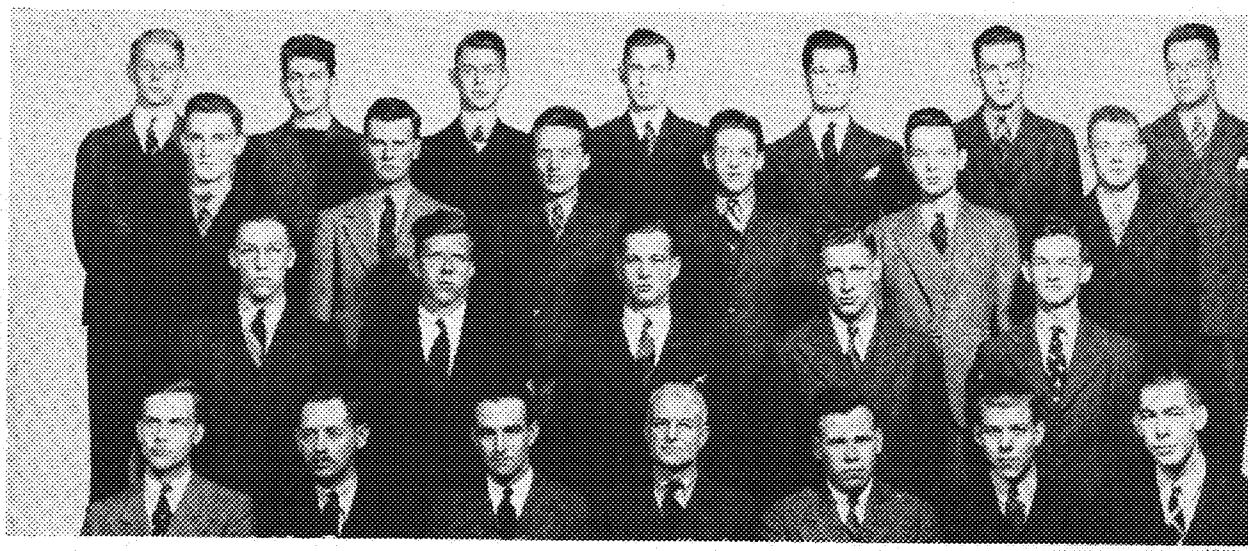
Flying Clu

Alpha Chi Sigma

Professional Chemical Fraternity

Front Row—Husen, Joesting, Rowland, Griffith, MacDonald, McKusick, Motl.
Second—Turner, Schilling, H. V. Anderson, Stammen, Meile, Sanders.
Third—Janssen, Miller, Bordwell, Tuomy, Stoltz, H. W. Anderson.
Fourth—Ballard, Sherwood, Merman, Patton, Lynch, Sheeks, Logan.

Alpha Rho Chi



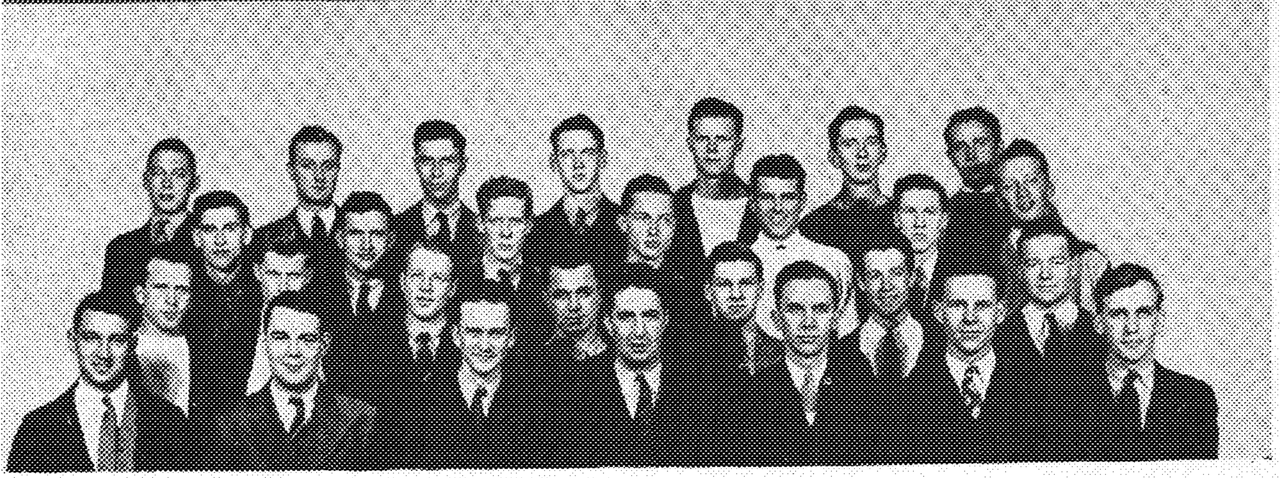
Professional Architectural Fraternity

Front Row—M. Johnson, Prof. R. Cerny, McGrann, Prof. H. C. Richardson, W. Johnson, Bergman, Krammer
Second—Buetow, Lie, Hegg, S. Johnson, Wiley.
Third—Schimer, Flynn, Seegerstrom, Roth, Calrow, Holm.
Fourth—Kief, Hamm, Krombout, Rogness, Arneson, Coffman, Folsom.

Professional Electrical Engineering Fraternity

Front Row—Morris, Stenderson, Williams, Sabine, Haswell
Second—Molenaar, Busse, Erickson, Janousek, Chalmers, Tillemans
Third—Strand, Odden, Donnelly, Wagner, Wilcox

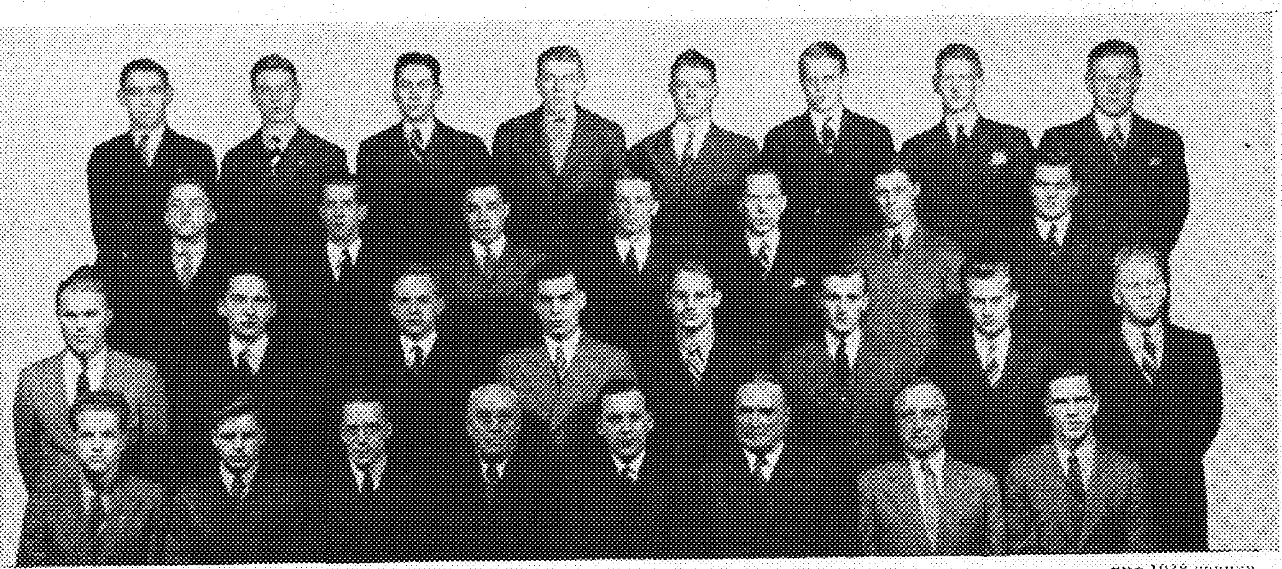
Kappa Eta Kappa



Sigma Rho

Professional Mines Fraternity

Front Row—Turner, Robinson, Sundquist, Neuberg, Nordquist, Krause, Olson.
Second—McCorquodale, Erickson, Feit, Bickford, Pfaff, Parker, Tweelings.
Third—Lilligren, Purcell, Becker, Larson, Batchelder, McMullen, Magnuson.
Fourth—Callaway, Dervey, Simmons, McNelly, Malmgren, Flynn, Konicker.



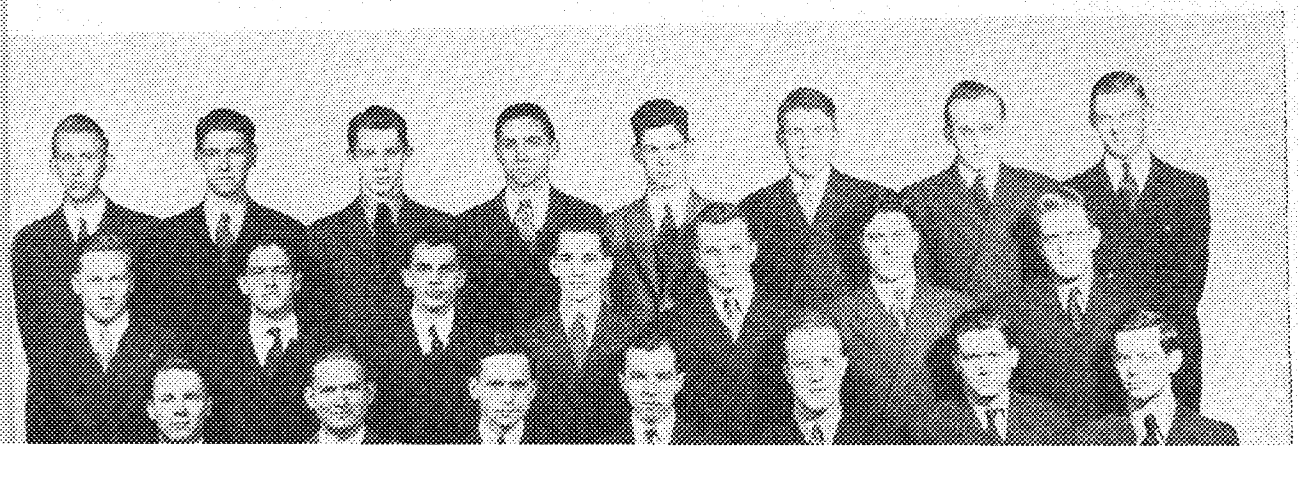
Theta Tau

Professional Engineering Fraternity

Front Row—Nygren, Larson, Scott, Comstock, Aslesen, Emmons, Parker, O'Keeffe.
Second—Starlof, D. R. Johnson, Duncanson, Ohman, Troxell, Stegmeir, Kojola, Lundstrom.
Third—V. Peterson, Coulston, Lewis, McMillan, Rauta, Britzins, L. Anderson.
Fourth—Erhart, Boyum, Bass, Pratt, St. Vincent, Gimse, Hodgman, Ronbeck.

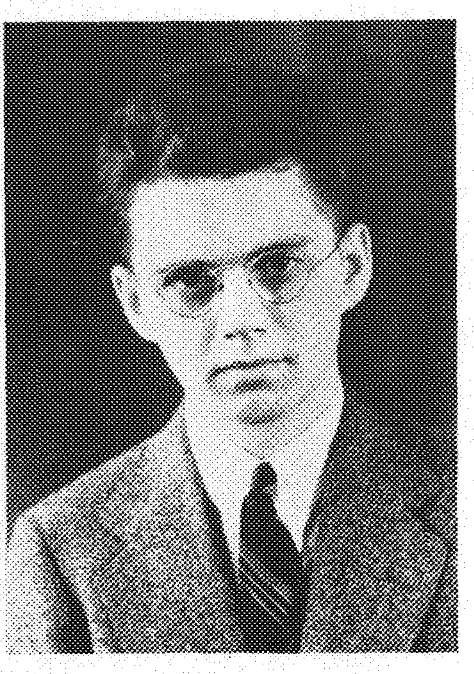
Professional Engineering Fraternity

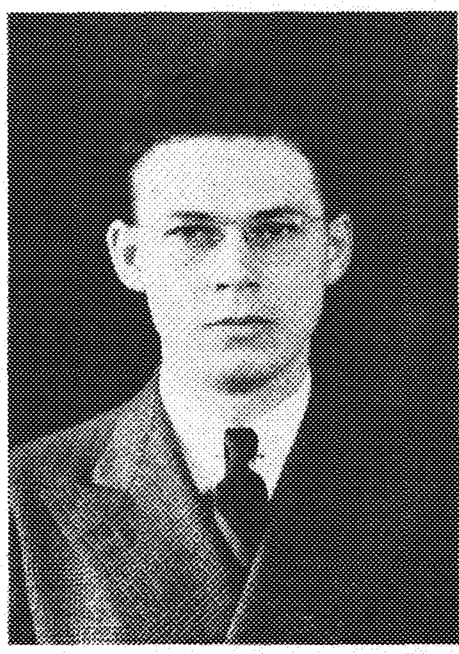
Front Row—Brewer, Barber, Funke, Lowe, Hesse, Wiltrout, Ulrich.
Second—C. Johnson, Powers, F. Larson, Nolan, Yri, Wilcox, Moore.
Third Row—Belsaas, Pfleiderer, Sexton, Pugh, Nimlos, Ryan, L. Larson, Gustafson.



Triangle

These Men Will Guide Next Year's Techno-Log





Piloting next year's Techno-Log will be Woolsey Motl, this year's feature editor and editorial writer. Woolsey, who is a junior in chemical engineering, came to Minnesota two years ago from St. Thomas College. He is a member of Alpha Chi Sigma, professional chemical fraternity (this year he edited its Beta Ray), and the American Institute of Chemical Engineers. You can recognize him by his bushy, uncombable hair and his easy, unhurried manner.

Acting as co-pilot and navigator of the financial course of next year's magazine will be Robert McDonald, a junior in the five-year combined course of Business Administration and Electrical Engineering. Bob has worked on The Techno-Log for the past two years, this last year as advertising representative. Bob is also a member of Tau Beta Pi and Eta Kappa Nu, Honorary engineering fraternities. Not confining his activities to the Technology campus, Bob is the representative of the College of Engineering on the Student Board of Publications.

Techno-Log Staff

Front Row—Arneson, Motl, Waleen, Richardson, Helland, Kennedy, Wilcox.
Second—Moore, Reilly, Wrenn, Montillon, Troxell, McGee, Meisch, Lindquist
Third—Segal, Kreitinger, Dingle, Miller, Gaustad, H. A. Larson, Hyde.
Fourth—Hoden, L. A. Anderson, Kendall, Templeton, Stone, Hopper, Strom, Becker.

The Minnesota Techno-Log

MAY, 1938

For A Better Techno-Log

This is the customary time for the retiring editor to take his feet down from the roll-top desk and write his reminiscences of the year just past.

I will not do that.

Rather, I want to ask you all—graduating seniors, undergraduates, alumni, faculty, and other readers of the magazine—to do your very best to promote the growth and improve the quality of the Institute's most important unifying influence, the TECHNO-LOG.

Why should you do so? Because by your efforts the TECHNO-LOG can become an increasingly useful supplement to the curricular activities of the Institute and help you further your education in directions not attempted by the formal educational plan of the University.

The two most important ways in which the TECHNO-LOG accomplishes these purposes are the giving of practical experience in the work of publication and the presentation of information and argumentation for educational, cultural, and entertainment purposes.

What can you do to further your interests and those of the Institute and University through the furtherance of the TECHNO-LOG?

You who are alumni or graduating seniors can do three things: First, you can subscribe to and read the magazine; this will keep you informed of its progress and of the progress of the Institute. Second, you can write your comments, favorable or adverse, to the editor, who will thank you even if his ears are burning. Third, you can submit to the editor manuscripts that you feel will benefit the general readers of the magazine.

It is upon you who are students, however, that the main responsibility for the progress of the TECHNO-LOG falls. Here are a few of the things you can do. First, you can thoroughly read the magazine as it is published and comment on it critically and in writing, telling the editor what you like and what you dislike. Second, you can carefully consider candidates for the TECHNO-LOG board, and then vote. Third, you can join the staff.

This year I have been fortunate in having the cheerful coöperation of many members of the faculty, particularly in the engineering English office. I am very grateful to them and to all others, in and out of the University, who have helped us during the past year.

—*Erling Helland.*

WHY & HOW

We were quite pleased by the response to the questionnaires we sent out last month. Although the results from the criticism blanks have not yet been completely tabulated and analyzed, the general impression received from those checked so far is that the students like the TECHNO-LOG as it is. From the number of students who took the time and the effort to fill in these blanks conscientiously we could conclude that the student body is interested in its magazine. To those of you who made this effort, our heartiest thanks. We can assure you that information we obtained from this survey will play an important part in governing the editorial content of the magazine next year.

As for the application blanks, a large number of them were also turned in. On the basis of the number of applicants, plans have been laid for a larger editorial staff next year. There will be five assistant editors; namely, a copy editor, a feature editor, a makeup editor, a news editor, and a departmental editor. Each of these editors will have under him a number of men who, with his supervision and help, will perform the work assigned to that department of the magazine. We will attempt to maintain as large a staff as is feasible throughout the year, so as to lessen the work required of any one individual and to make TECHNO-LOG experience available to all who desire it.

We would like to have those of you who are considering working on the TECHNO-LOG next year drop in at the office, Room 37 in the Electrical Engineering Building, some time before the end of the school year. Tuesday or Thursday morning would be the best time. The editor-elect will be glad to discuss next year's plans with you and to help you find a place in the TECHNO-LOG organization. The only qualifications you need are a willingness to learn and a desire to work. Previous experience on other publications, while desirable, is not necessary, and the time and effort you put into this work will be profitably spent, we can assure you.

NOW HERE'S A BOOK

By C. I. Haga, Instructor in English

WHAT would you say of the directors of a corporation who, with their stockholders, foresaw in its principal competitor an increasing effectiveness which could be met only by a moderate enlargement of plant and personnel—yet who refused to expand because the new foremen and plant managers available were not all members of the better college fraternities? What would you say of an industrial management which refused to install modern labor-saving machines because of the boresome labor required to understand the new appliances, to train the workmen in their use, and to readjust production schedules to the new techniques? What would you say of a forestry patrol service that recognized the constant danger of forest fires, but in planning against outbreaks ignored an important area because the chief rangers did not like the lay of the land?

At first we would be aghast at such frivolity and incompetence, but it would not take us long to find our voices. If these parables were translated back into the context from which I drew them, we would shout with one voice—Militarism! If you believe I have been idly romancing when I invented these four scandals, turn to *The History of Militarism* by Alfred Vagts and you will find each one named and documented as evidence of the militarist in action. The first fable refers to the rejection by the German General Staff of three additional army corps just before the World War because the aristocratic officers were afraid of the cost (in privilege, not in money): ". . . that the military strength . . . must no longer be identified with the exclusive need of officer families for jobs; that everything should be dropped which served only to meet the flair of the officers for parading and luxury; that the Prussian class electoral law . . . ought to be abolished; . . . that officers must be drawn from wider classes of the people; that the ranks must be given a chance to produce officers; and finally that the costs . . . should be furnished by taxing high incomes, great fortunes, and large inheritances." My second fable pictures the English dislike of the machine-gun whose superior numbers in German hands had held the English at bay for two years. Haig called them a "much overrated weapon," and Kitchener conceded merely that four per battalion might be an advantage. Lloyd George interfered and proposed sixty-four to the battalion. The third fable is from the French: "Foch admitted during the war that every part of France had been studied by the French staff and himself as a theatre of war—except French Flanders. 'They never thought a French army would have to fight there.'"

What then is militarism and what are its origins? And, most important, how can we control it? The definition given is quite clear and reasonable and involves a sharp distinction between the militaristic man and the military man, one though the two may seem when viewed uncritically. The difference is one we know of in other institutions and vocations quite unlike the martial. The militaristic man, says Dr. Vagts, is that officer or statesman who makes the army serve him and his more selfish purposes, even to the weakening of the only utility an army can have: protection of the state. The military man is he who serves the army faithfully by yielding his will to that of the state, being directed by it that the army may be what the state will have it. Defining the army's function so tamely, we find it no different in importance or dignity or grandeur than the postal service, let us say, or the weather bureau, except that we hope we may never need it.

But idleness cannot long be condoned; we would soon disband an army whose only tradition was inaction and whose only ambition was unbridled sloth. Nor do we allow our armies to ripen into such perfect utility. Every generation or so we give them work to do, and in the intervals—who finds what for what kind of hands to do? "Militarism," says Dr. Vagts, "flourishes more in peace time than in war." Officers become militaristic for the same reason that other people blow their own horns—to be what one is, is never as appealing as to seem to be more. Politicians become militaristic because it takes less wit and courage to win votes with imported spooks smuggled in under specious labels ("Place in the Sun," "Protect Our Foreign Investments," "Greedy Neighbors") than to be busy with necessary home work by whose utility even the plain citizen can judge the politician's worth.

Now that we know them, we would like to learn how to check and correct these swashbucklers who get us by the ears and are a drag on our milksop civilian ideals of compromise and conciliation in affairs between states, these confident men of force always wanting us to be ready for war but themselves unready, these bravos who retail the glory of death on the battlefield but who "never touch it themselves" (on this last delicate point Dr. Vagts uses the indecent statistical method). In war time there is only one way out, the terrible way of the Allies in 1917— ". . . soldiers mutinied and civilians and non-professionals reclaimed direction of the war." In peace time there is only one way—keep the military forces subordinate to the state and keep the state subordinate to the welfare and will of the people. That is a large dose and a bitter one, not only to militaristic officers and politicians but also to many other respectable citizens. Yet it is not as fatal as the cancer it has to cure.

Finally there remains the question of an American yielding to militarism. The danger is not great, Dr. Vagts leads us to believe. We have no aristocracy and we have much water between us and "greedy neighbors." In addition to being democratic, we are also industrialized (between recessions) and making money is the great American religion. Men do not get rich in the United States army. They work on a straight salary basis and generally they serve it for the sake of serving it well. Comforting though the local implications of *The History of Militarism* may be, there is still no harm in knowing the facts and being ready for the worst. "In time of peace, prepare for war," is a dictum common to all armies. Perhaps they would be wise citizens who borrowed this watchword and put it to their own cryptic use, making of it a genial kind of secret whose sharing among our millions would help to reduce misunderstanding and, let us say, friction. By all means get the book and read it.

ALUMNOTES

'14

Arthur P. Anderson, E.M., reports that he is still with the Anderson Well Shooting Co., in the "biggest little city in the world," Taft, California.

'21

Herman Davies, E.M. (Geol.), is now acting geologist for the Rocky Mountain Division of the Standard Oil Company of California.

'22

Mayer G. Hansen, E.M., recently wrote a very newsy letter to the School of Mines from the Philippines, where he is employed by the H. A. Wendt & Co., Ltd., as chief engineer. He states that **George Hezzlewood,** E.M., 1923, who until recently was his assistant, is now on a temporary consulting job in Australia but expects to return to the Philippines with the H. A. Wendt & Co. as soon as his consulting job is completed.

'24

Ta Heng Huang, E. M., is mining engineer with the Kailan Mining Administration, Hopei, China.

'27

Lee C. Armstrong, E.M. (Geol.), is now a geologist with the Socony Vacuum Co. in Caracas, Venezuela, South America.

'29

Thebian Redmond, Arch., is now setting up his office in Milwaukee, Wisconsin.

Willis J. MacLean, E.M., is also in the Philippine Islands, according to word received from him recently, with Developments, Inc., Paracale, Camarines Norte, P. I.

'30

Hugo Kojola, M.E., is working for the Prestolite Company in Indianapolis, Indiana. He is married but has no junior assistants.

John Skidmore, C.E., has recently been transferred to Long Island Office of the Carrier Corporation at Long Island, N. Y. John is married and has a son three years old.

Rudolph C. Gebhardt, E.M. (Geol.), engineer and geologist with the E. J. Longyear Co., Minneapolis, is at present located in Alaska.

'32

Robert O. Haxby, E.E., is one of five winners of fellowships awarded by the Research Laboratories of the Westinghouse Electric and Manufacturing Co. He will work a year on "atom-smashing" in the nuclear physics department of the Company at East Pittsburgh, Pa.

'33

Loren Abbott, Arch., is being employed as an architect in Des Moines, Iowa.

Marvin G. Sedam, Met.E., writes that he is working in the research laboratory of the Republic Steel's new 98-in. strip mill—the largest strip mill in the world. He writes, "The work is very interesting and I am enjoying my work and life in general."

'34

Ralph E. Monson, Techno-Log editor, '33-'34, took notes at the reunion of the '34 Civils on March 4, 1938, in a downtown Minneapolis restaurant. Of the 26 men attending, 14 are married and 12 more are on the verge of the fatal step. Census showed five young engineers on the scene.

The following are from Ralph's notes: **Wesley Johnson,** married and living in Minneapolis, now is employed by the Soo Line R. R. **Glenn Brokke,** single, is with the Bureau of Public Roads in Minneapolis. **Sidney Mitchel** is another married civil working for a railroad, the MN&S. He is in charge of the Minneapolis Main Office. The U. S. Engineers have a full representation with **Merlin Berg** in the St. Paul office, **Roy Karlen** in Louisville, **Harold Flaata** reputedly in Vicksburg, **Wallace Gruenhagen** in Rock Island, and **Marx Anderson** in Chicago. **Victor Bock** and **Waldo Solstad** are also with the "Engineers" at Prairie du Chien, Wisconsin. When last heard from, **Fred Haverland** was down in Nebraska with the U. S. Indian Service.

John Ripken and **Miles Kersten** are teaching and continuing studies at the University. **Arthur Solum** is connected with St. Olaf's College in Northfield. **William Rindsland** has recently accepted a position with the Appraisal Service Co. of Minneapolis. The Minnesota State Highway Dept. claims **Marvin Hermanson, C. F. Olson, Floyd Campbell, William Anderson,** and **Oswald Helseth.** Some are located in St. Paul and others throughout the state. **F. V. Olsen** was last known to be with the Interior department, located at Thief River Falls.

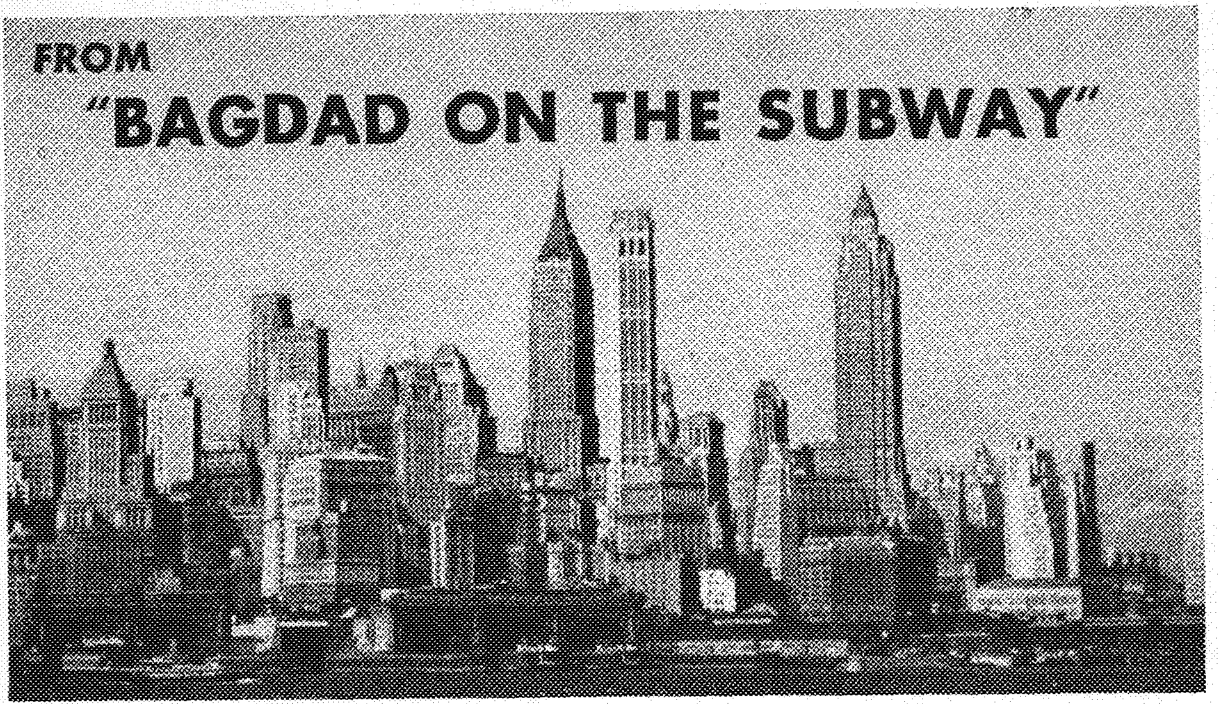
Harry Mayeron (red hair and all) is with the G. M. Orr Co. of Minneapolis. Although we know his job is no pipe, **Sewall Gross** is up at Thief River Falls representing the Lyle Pipe and Culvert Co. Among those employed by the Soil Conservation Service are: **William Tetrud,** at Lewiston; **Hugo Shogren,** at Hay Creek; and **Carroll Reese,** at Spring Valley. **"Lou" Vorpal** is employed in the Air Conditioning Division of the General Electric Co.

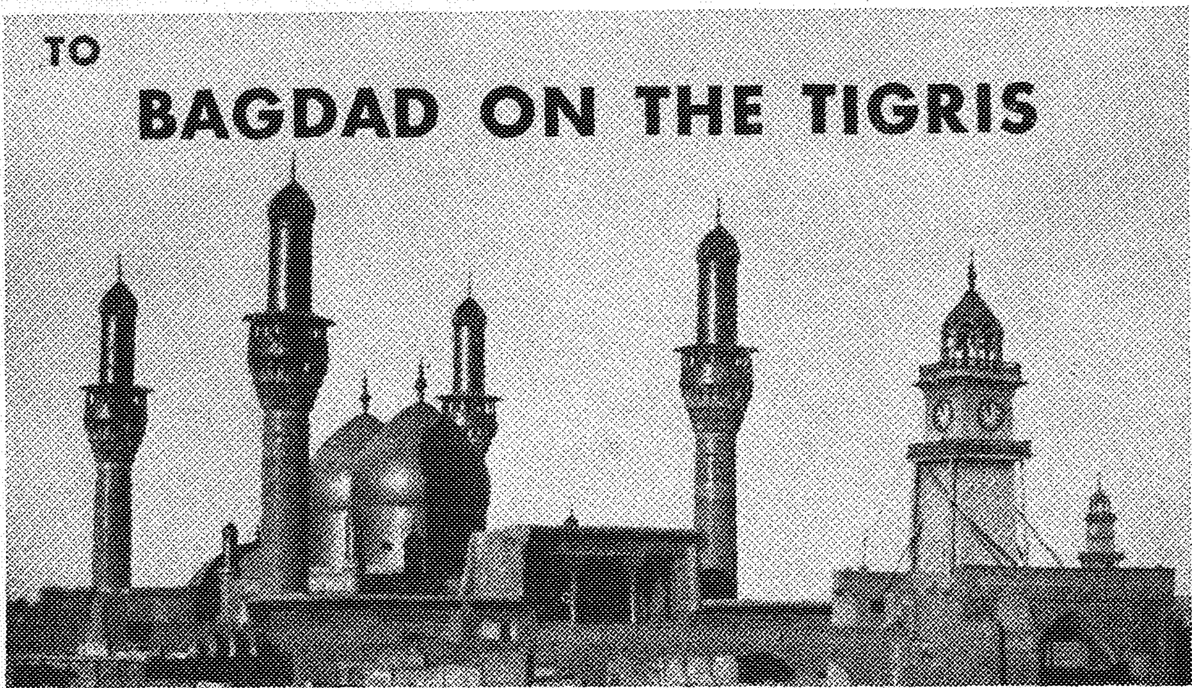
Robert Fefferman is with the Minneapolis Park Board on the river boulevard extension across the river from the campus. **Ralph Manson** is located with the Department of Public Works in St. Paul. **Lewis Martin** recently took a position with the Paper Calmenson Steel Co. of St. Paul. Only two of the class have digressed from engineering. **Jack Armstrong** is in the automobile parts business in Minneapolis. **Harry Ryan** is in business with his brothers at the St. Paul Milk Co.

'35

Reginald R. Isaacs, Arch., now in the employ of a Twin City architect, has just been awarded his second Harvard scholarship and will complete his graduate studies beginning next September. Isaacs was mar

(Continued on Next Page)





BY TELEPHONE

"Bagdad on the Subway" (as O. Henry called New York City) is now able to telephone to Bagdad on the Tigris.

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BELL TELEPHONE SYSTEM

Why not call Mother or Dad tonight? Rates to most points are lowest after 7 P. M. and all day Sunday.

ried last year and spent three months studying in Europe.

'36

Nicholas Knickerbocker, E.M., is also with the Developments, Inc. His address is P. O. 3230, Manila, P. I.

'37

Charles M. Sampson, E.M., writes that he has found his work as field engineer with the Freeport Sulphur Company at Freeport, Texas, very interesting.

Herman Pusin, Aero., M.S., '37, has recently joined the Glenn L. Martin Company in Baltimore, Md.

Robert R. Gilruth, Aero. E., and **E. Jean Barnhill,** Aero. E., who were married soon after graduation, are establishing their home at Hampton Roads, Virginia. They announce "a new '38 model, very streamlined, equipped with a three-lung power engine."

Boyd Stephens, Aero. E., M.S., '37, is now stationed in Brownsville, Texas, with the Pan-American Airways.

Ronald Robertson, E.M., has been working the past six months as construction engineer for the Aramayo Mining Company in Bolivia.

Earl Bennetsen, Aero. E., is now employed in the Chicago Municipal Airport ticket office.

TECH NEWS

A.C.S. Affiliate, A.I.Ch.E. Meet

At a meeting of the Minnesota Student Affiliate of the A.C.S. on April 19, William Horwitz addressed the group on the subject "Electrokinetic Potentials."

On May 3, members of the group presented book reviews. Included in the program were reviews by Gordon Johnson on *Chemicals in War*, Robert Evans on *Prelude to Chemistry*, and Torsti Salo on *Selected Topics on Colloid Chemistry.*

Dr. B. J. Oakes, of the Minnesota Mining and Manufacturing Company, addressed the A.I.Ch.E. on April 12 on the subject "The Technical Man in Industry."

A.S.A.E. Banquets, Meets, Makes Trips

Agriculture Education Club members were the guests of the A.S.A.E. at its first spring quarter meeting. The speaker for the evening, Mr. Lu Tsing Woo, discussed the history and methods of education in China. The lag of scientific development in China, he pointed out, was due chiefly to the fact that too much emphasis in education was placed on literature, art, and music, and not enough on the sciences.

On April 29 was held the annual Agriculture Engineering student-faculty banquet, at which the faculty were hosts. Messrs. C. H. Christopherson, A. Hustrulid, and J. H. Neal were in charge of the arrangements.

Mr. Roe's Land Reclamation class made field trips to Spring Valley, Chatfield, and Caledonia on May 6, 7, and 8. The principal purpose of the trips was to see and study the application of soil conservation methods in the field.

I.Ae.S. Offers Sophomore Award

The University of Minnesota student branch of the Institute of the Aeronautical Sciences is offering this year, for the first time, a sophomore scholastic award. The award will consist of five dollars credit at the Engineers' Bookstore and a two year membership in the Student Branch of the I. Ae. S.

This award will be presented to the sophomore with the highest scholastic standing on the basis of his first five quarters work.

Colloquium Hears Belgian Scientist

On Monday, April 25, Professor M. de Hemptinne, of the Institute of Physics, University of Louvain, Belgium, addressed the chemistry colloquium on "Recent Researches in Chemical Physics at Louvain." Professor Hemptinne, who is visiting physics and chemistry laboratories of this country, stopped here several days on his way to a scientific meeting in Washington, D. C.

A.I.E.E. Hears Papers, Attends Convention

Mr. S. T. Kroon of the Northern States Power Company addressed the A.I.E.E. April 27 on "First Aid for Engineers." Following the talk, the delegates to the A.I.E.E. convention presented a report on the convention. Plans for the annual electrical open house on Engineers' Day were also discussed at the meeting.

The A.I.E.E. student competition for the local prize paper contest was held on April 19, when the local branch met at a dinner meeting with the Minnesota section. Papers were presented after the dinner, and the Minnesota members voted for the placement of the papers. The first prize went to Robert Saunders' paper, "The Operating Characteristics of Fractional Horse-Power Motors"; second to Gordon Lee's "High Tension Surge Apparatus"; third to Don Erickson's "Aurora Polorias"; and fourth to Robert Olson's "The Worth of a College Education."

Following the presention of the papers, the Minnesota section presented a film on the manufacture of rubber insulated cables and transmission lines. A talk on the practices of producing and using rubber insulated cable in industry concluded the meeting.

Members visited the Minneapolis Tribune April 13.

Minnesota delegates to the A.I.E.E. district convention at the University of Illinois returned to their classes Monday, April 25, after attending the convention and electrical show. They were accompanied on the trip by several junior electricals, who made the trip to get some ideas for the biennial electrical show next year.

The official A.I.E.E. delegates from Minnesota were Erling Hagen, incoming chairman, and Professor Kuhlmann, Minnesota branch faculty councilor. Other Minnesotans that made the trip were Don Erickson, student chairman, Bob MacDonald, Ray Hopper, Henry Rebmann, Perry Morris, Nordahl Onstad, Jack Hyde, Dale Haswell, Lyle Hanson, Luther Coullard, Jim Thompson, and France Anderson.

Erling Hagen was elected chairman of the A.I.E.E. student branch for the next year at an election held early in April.

At the same election Henry Rebmann was elected secretary-treasurer, and Elmer Brickman, vice-president.

Straub to Supervise Hydraulic Lab Work

Dr. Lorenz G. Straub, professor of hydraulics, has resigned his position as administrative assistant for the College of Engineering and Architecture so that he can devote more time to his work in the nearly completed Saint Anthony Falls hydraulics laboratory, which he designed. His resignation becomes effective July 1, 1938, when he will be succeeded by Mr. C. A. Koepke, professor of industrial engineering.

Dr. Straub has held the position of administrative assistant since the Institute of Technology was organized in November, 1935. In this capacity he has taken care of such administrative duties as the classification and registration of advance standing students, the handling of miscellaneous correspondence, and the solution of problems related specifically to the College of Engineering and Architecture.

The new hydraulics laboratory will be managed by a small office personnel and a research staff under the general supervision of Dr. Straub. Some research projects are being started in the laboratory, some already in progress in the Experimental Engineering building will be transferred to the new location, and others will be transferred later.

Mines Society Elects Officers

The School of Mines society held its spring election Thursday, April 21. New officers of the society are Hugh Leach, president; Leland Batchelder, vice president; and Dick Mollison, secretary-treasurer.

The Junior Miners' spring trip was postponed until now so that they could participate in Engineers' Day.

A.I.C.E. Inspects New Sewage Disposal Plant

Civil engineering students made their first inspection trip of the year to Pig's Eye Island in St. Paul on Wednesday, April 27. The trip, sponsored by the student branch of the A.S.C.E., was open to all C.E.'s.

Students were shown all the equipment used in the new Twin City Sewage Disposal Plant for the treatment of sewage from its entrance into the plant to its harmless exit into the river. All the sewage from the Twin Cities will reach this plant through a new system of interceptor sewers.

At an earlier A.S.C.E. meeting the plant was described and the machinery explained by George Schroepfer, assistant chief engineer of the plant.

A.S.M.E. Hears Pierson's Paper

Of the 30 mechanical engineering students who attended the A.S.M.E. student branch meeting at Marquette University, Milwaukee, Wisconsin, Edward Pierson was the only one whose technical paper was read at one of the discussion meetings. The title of the paper was, "Study of Stresses in Curve Beams by the Photoelastic Method." Pierson is a senior in mechanical engineering, and is taking the combined engineering and business five-year course.

The group returned from the trip Saturday, April 23.

Arch. Professors Attend Convention

Four delegates from the department of architecture attended the seventieth annual convention of the American Institute of Architects held this year in New Orleans. They were Messrs. Roy C. Jones, Robert T. Jones, Leon Arnal, and Rhodes Robertson.

On April 18, before the formal opening of the A.I.A. convention, the Association of Collegiate Schools, of which Minnesota is a member, held its meeting. A discussion on the methods of teaching architecture to beginning students was the principal concern of this meeting.

The A.I.A. convention opened the next day with an address of welcome by Gaston L. Porterie, the attorney general of Louisiana, and the address by the president, Charles D. Maginnis, of Boston.

One morning of the convention was spent on the reports of the Committee on Housing of which Mr. Robert T. Jones of Minnesota is a member. During the convention Mr. Jones was elected to fellowship. At last year's convention Mr. Roy C. Jones was elected to fellowship, and a few years before that Mr. Fredrick Mann, former head of the School of Architecture, was thus honored.

Of special interest to the Minnesota delegate this year was the presentation of the Gold Medal of the Institute to Paul Philippe Cret, an eminent teacher and architect. Mr. Cret was a former teacher of Mr. Roy C. Jones, and was instrumental in bringing Mr. Leon Arnal here.

Lind, Reyerson Talk On I. of T. Research

Dr. S. C. Lind spoke Monday, April 18, before two groups, the Master Plumbers' Association and the Minneapolis Engineers' Club, about current research work in the Institute of Technology.

At the annual "Duluth Day" celebration on April 26, Dr. L. H. Reyerson described the research program of the Northwest Research Institute.

Livingston Receives Research Fellowship

Dr. Robert S. Livingston, associate professor of physical chemistry, has received a fellowship grant from the Lalor foundation for chemical research. He will spend his sabbatical leave next year at Johns Hopkins University in the physics department, and will study photochemical reactions.

FACULTY SKETCH

By Robert C. Becker, Ch.E. '40

Dr. Lee I. Smith

MINNESOTA CHATS

Dr. Smith

DR. SMITH has been with the University of Minnesota since the fall of 1920, when he came here as an instructor in organic chemistry. He was born in Indianapolis, but obtained his public school education in Columbus, and was graduated with a bachelor of arts degree from Ohio State University in 1913. After receiving his masters degree from Ohio State in 1915, Dr. Smith went to Harvard as an Austin teaching fellow, where he received another master's degree and then took his doctorate in 1920 under Professor Kohler.

Dr. Smith served as an assistant in chemistry at Ohio State while working on his master's degree, and, upon the expiration of his two-year fellowship, worked as an instructor at Harvard until he transferred to Minnesota. Professor Smith was made head of our organic chemistry department in 1930, and last year was the administrative assistant for the School of Chemistry.

Besides the duties of handling 400 to 500 students in beginning organic courses and about 100 graduates, including 50 who are majoring in organic chemistry, Professor Smith has his own field of research, polyalkylbenzenes and polyalkylquinones. According to Dr. Smith, "These compounds were only of academic interest when investigation was first started, but now they appear to be of interest both commercially and biologically." In 1918, he also did research work in the Chemical Warfare service on mustard gas and on lewisite.

Professor Smith is a member of the American Association for the Advancement of Science, and of the American, London, German, French, and Swiss chemical societies. He is also a member of Alpha Chi Sigma, Phi Beta Kappa, Sigma Xi, and of Phi Lambda Upsilon fraternities.

Dr. Smith goes off to the mountains every summer to pursue his two hobbies. He has done extensive mountain climbing in Colorado and in the Canadian Rockies, and in his own words, "Wherever I go, my camera goes."

APOLOGIA PRO ENGINEERIA

Ye denizens of the lab,
Ye peepers through transits,
Ye muttering, perspiring, worrying,
Scorchers of slide rules,

Deign to look kind upon
Insults of us lesser beings—
Perish omnibus! Perish artibus!
But long live technibus!

Muriel E. Stowe

LINDQUISITION

This, fellows, is what you've been waiting for—my last column—my swan song, if I may call it that. It might seem a trifle incongruous to some of you, that the lad whose forte seems to have been ribaldry and cynicism should clamber to the heights of honest sincerity, but it's happened—here's how I feel about it. . . .

When you boys march under the sword of St. Pat today, you experience commencement in your own unique way. You enter the portals of the engineering profession a knight, sworn to uphold the glory, honor, and ideals of your chosen field, and to abide by the ethics set forth therein. May this first flush of triumph and enthusiasm never dim, but deepen into the lasting glow of a full and successful life. . . .

My heartfelt thanks to—

—Andy, Eddy, Chris, Ted, and all the lads in our splendid fixer-upper crew for the swell help they have given to your old chronicler. There isn't a thing around this school they won't give you if you have a good reason for wanting it. . . .

—The engineering secretaries—they've been plenty sweet. . . .

—My editor and pal, Erling Helland, for saving my worthless columnar skin by pulling certain items from my column. . . .

—The good old Technical Commission, the finest group of men I've ever met . . . . and all secretly idealists at heart . . . . may the sunset never touch them. . . .

—Bob Moore, dependable and fine as a 21-jewel watch. He knows what I am and is my friend in spite of that knowledge. . . .

—My professors; you've given me infinitely more than an engineering education. . . .

—Frances, who often worked into the wee hours typing my reports; and kept the fires roaring in the old boilers long after I thought there were only ashes left. . . .

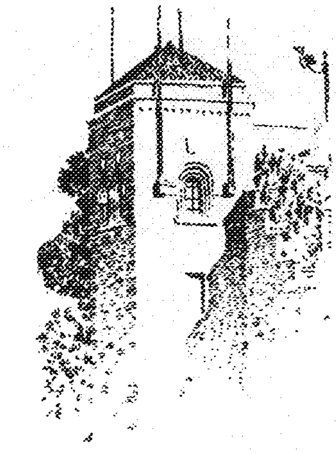
—The Techno-Log staff, past and present; they have included me into a camaraderie that will live forever . . . . true brotherhood. . . .

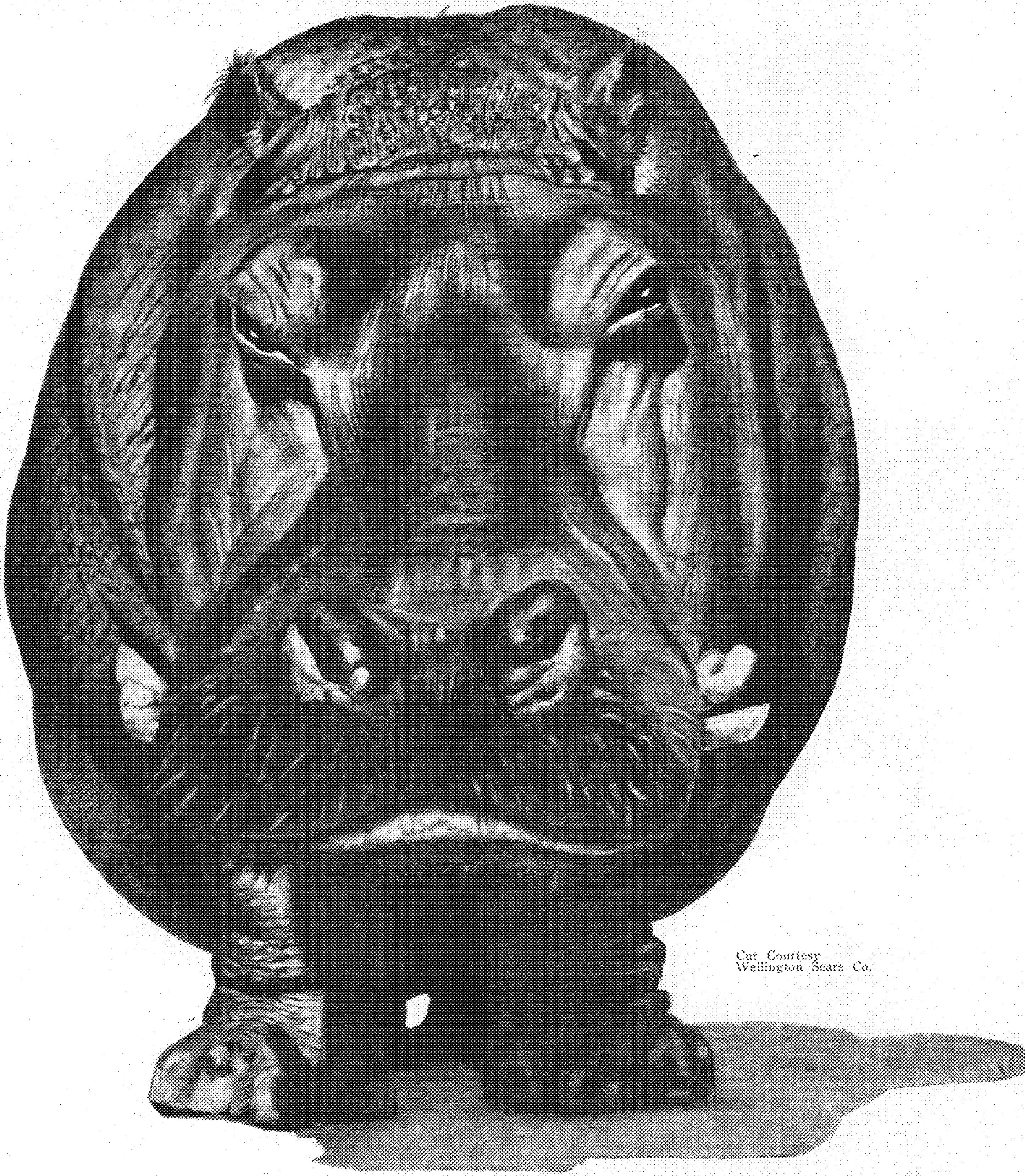
Now that we are about to leave, we suddenly appreciate the dusky beauty of the campus at twilight . . . . when rectangles of feeble light challenge the approaching night and only the outlines of these citadels of knowledge remain discernible against the darkening sky. . . .

And now, after our last warm handclasp, we turn to follow the winding lane of our own choosing, our eyes straining to pierce the mist that lies ahead, our ears tuned to hear, as from a great distance, the closing bars of "Hail to Thee"; the setting sun throws crimson rays of approval on your last day as a student, promising to smile just as benevolently on your future days as an engineer. . . .

Yours truly,

Bertil Herbert Thorsten Lindquist




Cut Courtesy
Wellington Sears Co.

PICK AND PAN

By M. A. Troxell, M. '39, and H. A. Larson, M. '39

Engineers' Day is just like Halloween—on both occasions the Open Houses go over with a bang.

"I knew a girl named Passion,
I asked her for a date.
I took her out to dinner,
Oh Gosh! How Passionate."

Some of the boys were saying that during the last election the politicians were promising a chicken in every car and a flush in every pot. How about a Royal flush?

They tell me that Professor Comstock's "Pumping Plant" is a pipe course.

We wonder if "backfield in motion" didn't originate at the Gayety.

"Were you copying his paper?"
"No, sir, only looking to see if he had mine right."

The senior Civils made a coup the other day (almost a chicken coup). The pretty coeds from SLA that have been running up and down the corridors of the Engineering Building were dumbfounded when they found a slip on the door of the drawing room reading: "Please meet in Room 226 today." Up they all trooped to the senior Civil drafting room and made themselves at home among the Civils, taking out their instruments and all. The senior Civil who put up the notice forgot that Mr. Potter would also read it and come up to collect the bevy of young women. Perhaps the bashful senior who won't confess his name will know the ropes better the next time he posts a note.

Mary had a little lamp,
She filled it with benzine,
She went to light the little lamp
And hasn't since benzine.

Statistician: "Everytime I breathe a man dies."
Engineer: "Why don't you use a mouth wash?"

An M. E. Goes to the "Dark Continent"

Firestone Plantation Company, Duside, Liberia, West Africa

Dear People in Pi Tau Sigma:

Last spring I got a letter asking me to write and let you boys know what happened to me after I left school.

I left home last July and spent three weeks in New York enjoying myself and waiting for a strike to be settled so that I could get a boat out. Well, after paying wages and expenses for three weeks, Firestone became a little vexed and changed my passage from a direct run to Africa to a trip via England. More of the kindness shown me by "lady luck"—I never went too big with the women, but "L. L." is the girl that seems to give me all the breaks—even membership to Pi Tau Sigma.

So it was. I had a fine seven day voyage aboard the "Hansa" and a two day lay-over in London. That's quite a town too, what with all the king's guard in their bright red coats going around the parks slaying the young ladies of London. We saw all we could in two days and then took a cargo boat from Dover.

This was a little tub, but clean, and it had a good sociable crew and captain. We had a 16 day trip down the coast, stopping at the Canary Islands, Dakar, Bathurst, Freetown, and finally my home port, Marshall—a tiny place and almost devoid of white men.

We were taken up the river to the plantation and to our new homes which will hold us for two years unless the hook worms, malaria, tropical sun, driver ants, or cockroaches are more than we can stand.

None of them are so bad, but they are all here; and if a man makes up his mind that he doesn't like them, he might just as well go home. I can't say that I like them, but they don't bother me too much, either.

The place has its good points, too. A fellow can get a canoe and boys to paddle it for a whole day for a shilling or two. Such a trip is mighty good fun. There is fine hunting in the jungle along the river bank; birds of all sizes and colors, monkeys, crocodiles, and squirrels are in fair abundance and quite unafraid of the boat.

In addition to that, it is darned nice to be looked after and cared for by three or four house boys. They do everything for you—as one of the fellows said, "Two or three of these blacks, can *almost* take the place of a wife." And so they can; they are even better in some respects because they have a job to hold. That is, you can give them plenty h—— and get none back, which is just a bit the reverse of some of the stories of married life.

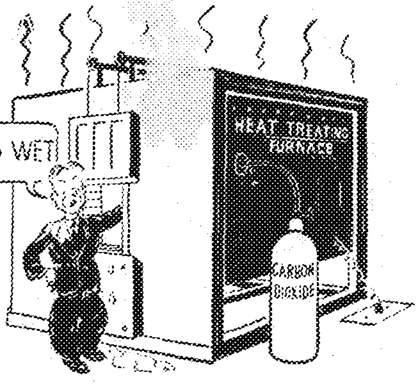
Now as for what I do. I am working with a crew of boys measuring the latex field of each of some 480,000 rubber trees and thinning out those with a low yield. It's not a half bad job either, if you like outdoor work. I am out in the field at 6:30 and work till noon. That is usually the end of my day's work unless there is a little data tabulation or map making in the afternoon. However, starting the first of next month when test tapping is under full swing, I will have to be out to muster at five o'clock—not so good.

How about a small letter from some of you boys I know? I'll answer any I get, and even if the letter is n. g. you can add a Liberian stamp to your collection.

Yours truly,

Wm. Hansen

G-E *Campus* News

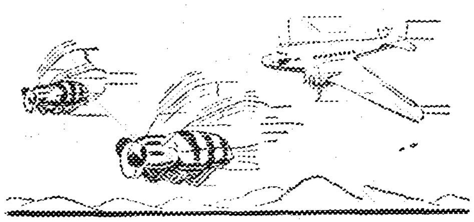


DEW-POINT POTENTIOMETER

DEW on the grass may be fine for the farmers and an indication of fair weather, but it has no place in metal heat-treating furnaces. Moisture in the atmosphere in furnaces causes corrosion on the metal, thus decreasing the size of the part. Because it is impossible to tell the amount of moisture in such a furnace by sticking your hand into it, General Electric engineers have developed a dew-point potentiometer to do this job, and do it accurately.

The potentiometer consists of a metallic mirror located in a small chamber into which gas from the furnace is passed and condensed on the mirror. By means of a thermocouple, a balancing circuit, and a direct-reading meter, the weight of water vapor per cubic foot of gas may be derived. Thus the furnace operator can tell if the furnace atmosphere is suitable for the treatment of the metal.

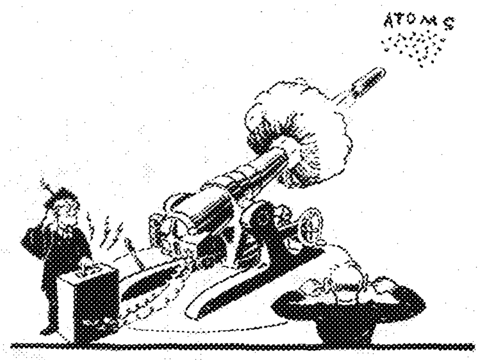
Many of the G-E developmental engineers working on this and similar apparatus are former Test men. The General Electric Test Course augments the theoretical training received by engineering graduates, giving them a practical training in industry.



SPEEDY FLIES

THERE are many legends of nature which have remained for many years, eventually being refuted by naturalists, but one which has persisted up until a few weeks ago is that of the phenomenal speed of the deer botfly. While man plods along at a speed of 400 miles per hour in his airplane, one entomologist calculated the speed of the deer botfly to be 800 miles per hour. Digressing from his usual type of experiments, Dr. Irving Langmuir, Nobel Prize winner in the General Electric Research Laboratory, exploded this entomological myth by means of a series of tests.

Using a piece of solder the size and shape of a deer botfly, Dr. Langmuir showed that if this insect traveled at 800 miles per hour it would encounter a wind pressure of 8 pounds per square inch—enough to crush it, and that maintaining such a velocity would require a power consumption of one-half horsepower—a good deal for a fly. He also demonstrated that the insect would be invisible at speeds in excess of 60 miles per hour, yet the entomologist estimated the speed of the fly at 400 yards per second because he saw a brown blur pass by his eyes. Finally the calculations showed that if the fly, while traveling at this speed, struck a human being, it would penetrate the skin with a force of four tons per square inch and bury itself deep in the flesh.



BOMBARDING ATOMS

The modern miracles of aviation, television, and World's Fairs are taken quite calmly in this twentieth century of progress. But it is a different matter when scientists start snapping the whip with ions to smash ultramicroscopic particles called atoms into even more minute portions. And that's just what scientists are doing over at Harvard University.

Using a machine called a cyclotron, devised by Prof. Lawrence of the University of California, the Harvard physicists are bombarding atoms by accelerating ions to a tremendous speed and shooting them out through a hole in the side of the machine. But people are talking about this barrage of ionic ammunition because the results have proven successful in the treatment of cancer.

This is the third of such atom-smashing machines for which the General Electric Company has furnished parts. Even in such academic and highly specialized fields, Test men are called upon to make their contributions.

End

GENERAL ELECTRIC

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