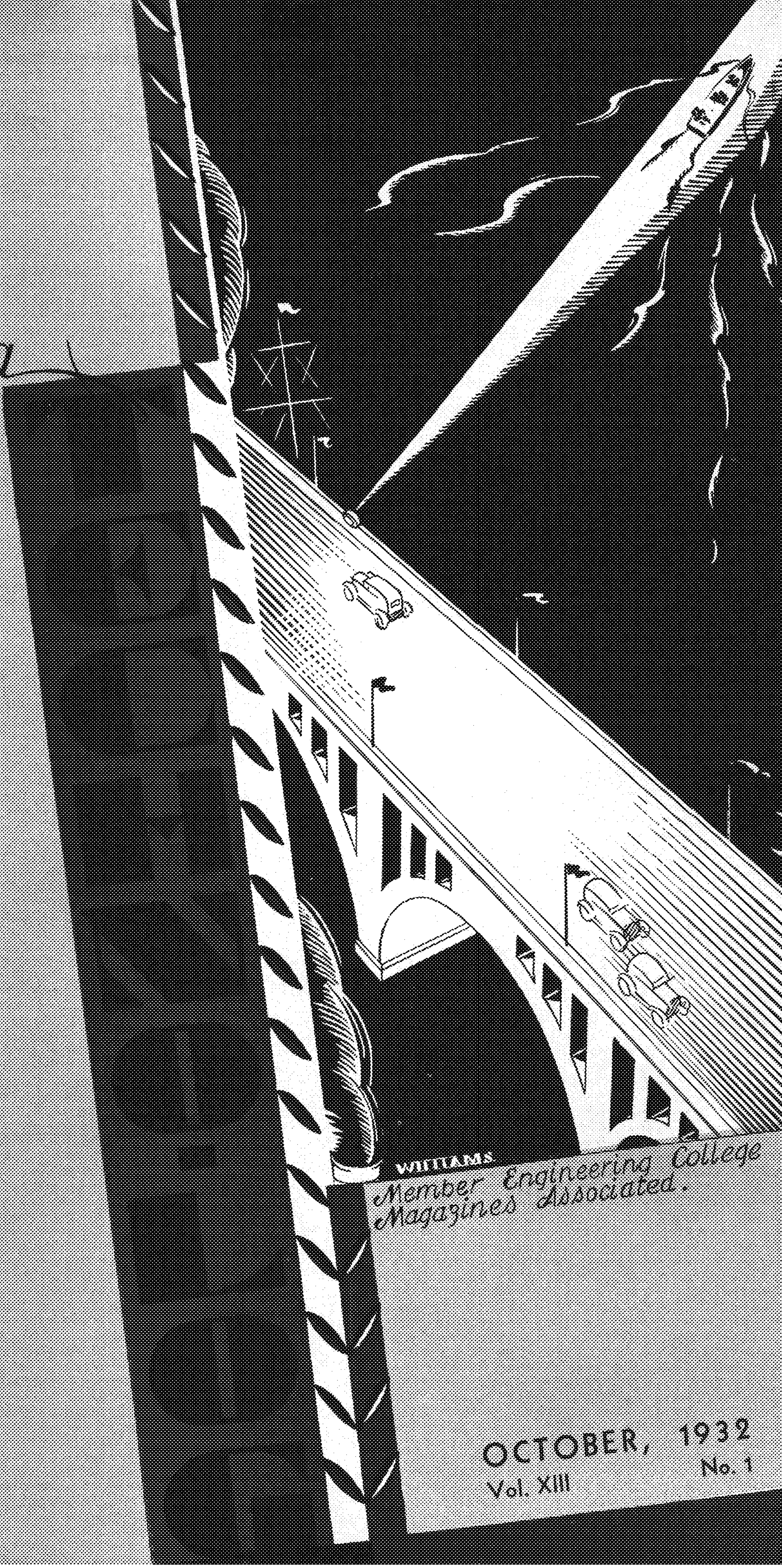
Minnesota



Member Engineering College Magazines Associated.

OCTOBER, 1932
Vol. XIII No. 1

OCTOBER, 1932
VOLUME XIII, NUMBER 1

Minnesota Techno-Log

37 ELECTRICAL BUILDING . . . U of M

Published monthly from October to June inclusive, by the students of the College of Engineering and Architecture, the School of Chemistry of the University of Minnesota

THIS MONTH

NEXT MONTH

A play by play broadcast of the Freshman Scrap will present the events of the day and the evening celebration in a truly unique manner.

Construction of WCCO's new 50,000 watt transmitter at Anoka will be described by Albert Upton, '25 E.E., who is now with the engineering department of Northwestern Broadcasting, Inc.

Bob Kranzfelder, '26 AE., will tell all about the magnificent new St. Paul City Hall and Courthouse.

The engineering wonders of the great Century of Progress Exposition will form the subject of an article by Gordon Rosholt, a sophomore Chemical Engineer. Some unusual views of the exhibition buildings will make this article truly interesting to all engineers.

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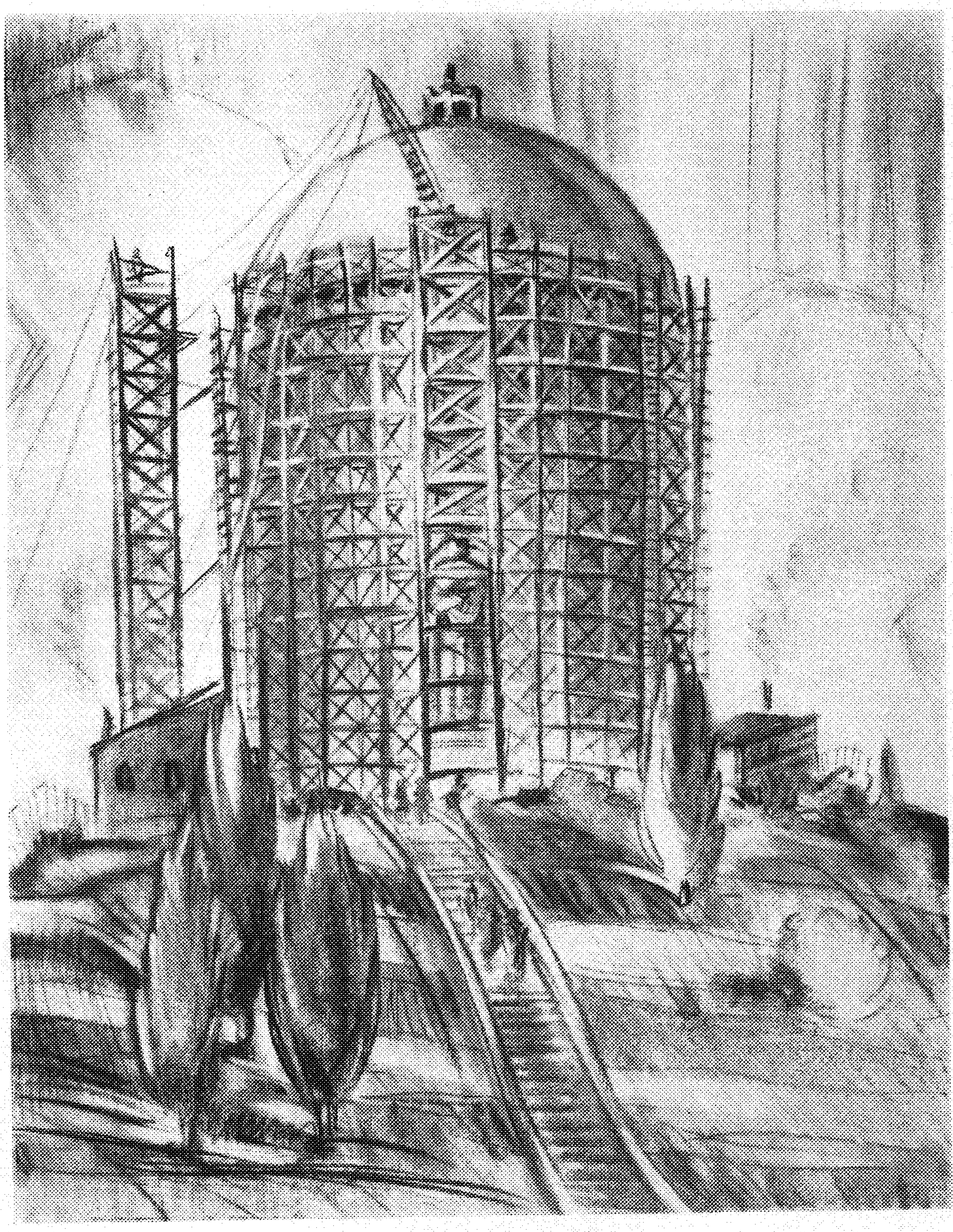
Entered as second-class matter April 9, 1925, at the post office at Minneapolis, Minnesota, under the Act of March 3, 1879. Office, 37 Electrical Building, University of Minnesota. Telephone, Dinsmore 2760. Contents copyrighted and permission must be secured for re-publication. Subscription rate, $1.50 a year. Single copies, 25 cents. Advertising rates upon application. Alumni Directory, 50 cents.



Washburn Tower
By Russell Williams

AT THE MINNESOTA STATE FAIR

A group of Minnesota engineers ramble through the Minnesota State Fair and have the time of their lives. In their wake are lecturers, salesmen, agents, and hot dog sellers, all completely bewildered by the battery of questions fired at them. Now just what is there at a state fair that might be of interest to the followers of good old St. Patrick?

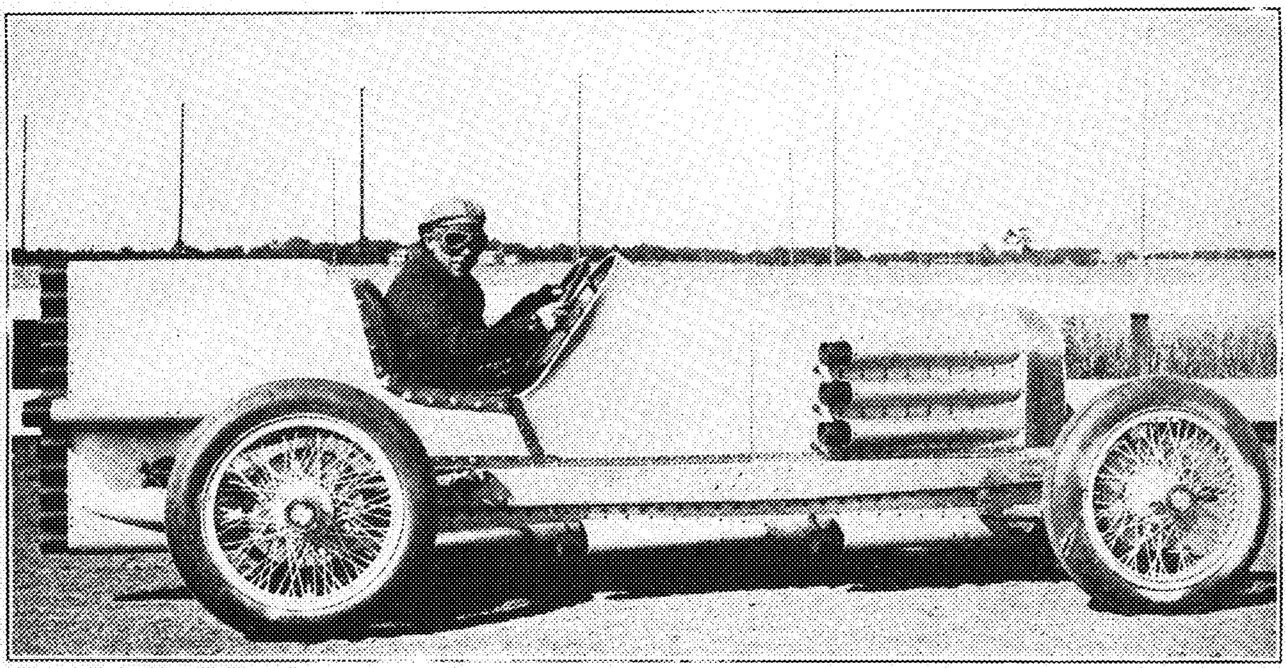
HEY come on ovah — they're red hot — those fresh, fat, flavory hot dogs — electrocuted before your own eyes in a scant forty-five seconds. But wait, perhaps we had better take time to explain that we have just started on a trip through the Minnesota State Fair. Let us see what we shall find. Now, of course, we wonder why the dogs are electrocuted instead of sizzled in the ordinary manner over a hot griddle. We'll soon find out, for here is the execution chamber. Look now, as that young man grabs an ordinary specimen of wiener, and spears it down upon two pointed metal rods. Carefully he adjusts this wiener, and then throws the switch. The electrocution is on, and how the dog does squirm and sputter. Why, he'll wear himself to pieces if the current isn't turned off soon. But there, the young man pulls the switch, and gingerly places the red hot wiener in a bun in the approved carnival manner. We taste carefully of the tip, and it seems to be very good, we take a larger bite, and that tastes better; we grab half the wiener with our next bite, and our stomach telegraphs for more. Electrocuted hot dogs are pronounced O.K. by our group of engineers. And now for the secret of these delicious morsels — just fasten a nail to each of the light wires coming from a wall socket, being careful of course that the nails can not touch each other, and poke each nail through an end of the wiener. Turn on the juice, and there you are.

Come on, gang let's move along and see that rocket car that's standing across from the roller coaster. Maybe we'll see Sig Haugdahl himself, and get him to tell a story in his inimitable Scandinavian manner. What, Mr. ticket taker, you say Sig isn't here now? Well, let's go in anyway, and see the car. We'll listen to the lecture on the car and find out just what it can do.

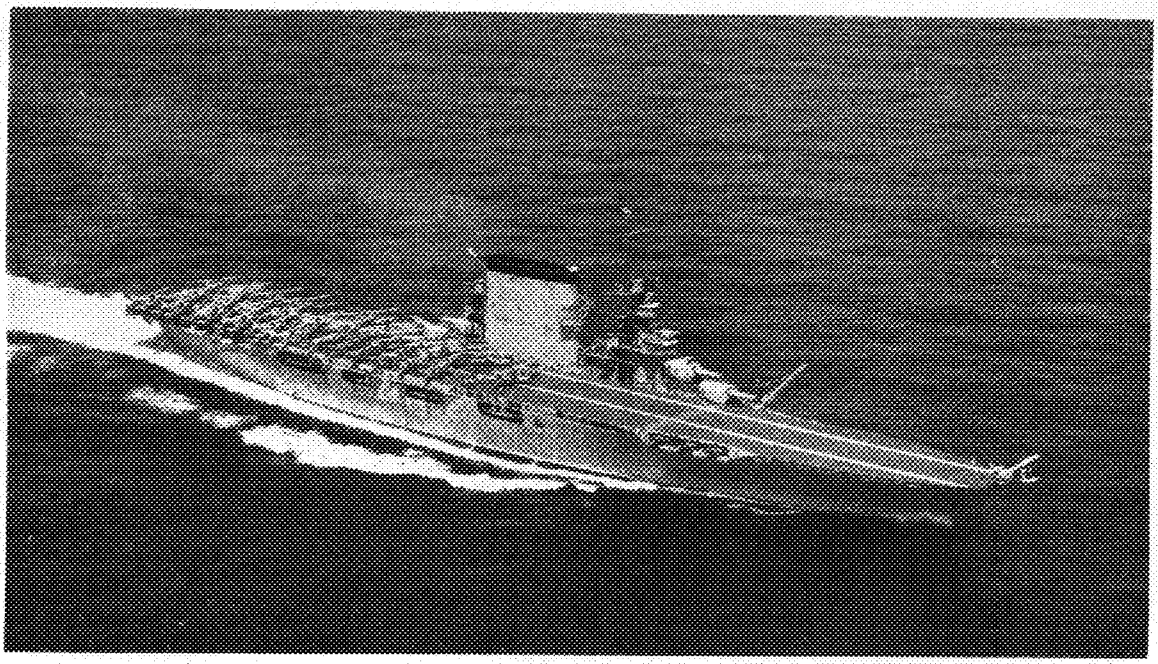
The car, he says, has thirty-two rocket holders arranged in a cross at the rear, along the sides near the front, and even underneath the car. A rotary switch on the dashboard fires electrically any desired combination of rockets, so that in a trial run, two rockets might be set off to get the car in motion smoothly, eight more might be fired at once after the first have gone out, and the twenty-two remaining rockets might be set off all at once for a speed test. This sounds all right, but Sig hasn't yet used that many rockets at once, even in his speed trials down at Daytona Beach, Florida. Thirty three pounds of the best artillery powder are used in each of the cylindrical rockets, with a tiny wire filament folded into the fuse for setting off the rocket electrically. The frame of the car is extended up to the back of each rocket by means of heavy steel brackets, in order that the enormous force of the rockets may be transmitted to the car.

Driving a rocket car is a thrill in itself, for it's just like driving a high powered automobile with the accelerator jammed at its lowest position. Once a rocket is ignited, it keeps going until it goes out, and the driver must grit his teeth and hang on. This is a tremendous drawback on the circular track here at the state fair, for even the most reckless of racing drivers slow down for the turns. Special brakes are used on each wheel, to partially control the car on the turns and cause it to skid in the desired direction. With this car a speed of up to 200 miles per hour can be obtained,

(*Continued on page 31*)



This rocket car, the only one in the world today, was designed and constructed entirely by Sig Haugdahl, a Minnesota man who made good in the racing world.



An OL-8 Navy plane leaves the deck of the carrier U.S.S. Lexington.

Official Photograph—U. S. Navy

AIRCRAFT CARRIERS

By LAWRENCE CLOUSING, E.E. '28, Aero. E. '32

Lieutenant Junior Grade, U. S. N. R.

NO airplane of the Navy can now cross the Pacific or Atlantic in one flight, and at the same time carry a service load. That military airplanes of such a capability will sometime be constructed seems quite probable, but present airplane developments indicate this will not be possible for some years to come. The Navy has therefore combined the utility of airplanes and their comparatively short range of action with ships and their long range of action by means of the aircraft carrier. This combination provides a modile air force readily available for need whether far at sea or near our coasts.

In bringing about the combination it was necessary to design a proper type of ship; invent equipment for landing the airplanes on the deck of a ship; devise a method of airplane operation for the landing, taking off and handling of the airplanes aboard ship; make safe the operation of landplanes over water; and design and construct airplanes for carrier use.

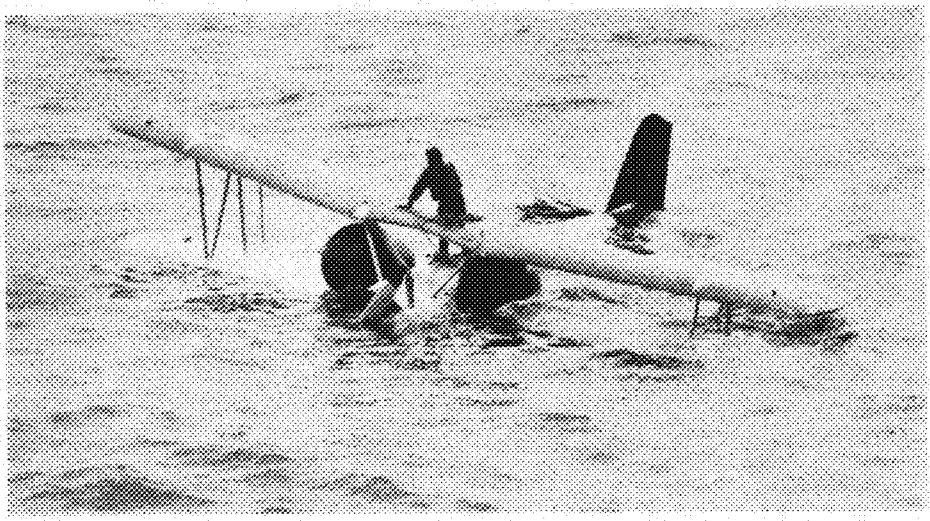
In the early days of carrier operation, airplanes were not specifically designed for this work. Airplanes designed as landplanes, or seaplanes on which seaplane floats had been replaced by wheels, were used. Consequently there was some damage to airplanes, and relative to modern carrier operations less effectiveness of operation was apparent than should have been possible. It was not known exactly what the desirable or different characteristics were that a carrier airplane should possess. Within the past few years a large percentage of the design work of the Navy has been directed toward better airplanes for the aircraft carriers. The results of this work are apparent in the design features of modern naval aircraft.

Before taking up some of the design features it might be wise to consider what the Navy would desire in an airplane if it could have just what it wanted.

Some desirable characteristics are so incompatabile of being included in one airplane that the thought of so including them seems ludicrous. For purpose of illustration, however, an ideal airplane should include all the following features. It should be capable of very high speed. It should be extremely stable and have safe flying characteristics, yet it should be as maneuverable as any fighting airplane. It should be large enough to carry at the least three men, a large, powerful radio set, enough fuel to cross an ocean and return, and a heavy load of bombs. Machine guns should be mounted so no angle of possible attack would be unprotected. In order that it could land either on the deck of a carrier or in the water alongside a battleship, it should be an amphibian airplane. It should be small enough to be able to be catapulted from a battleship. It should have a high rate of climb and a high ceiling. Moreover it should be strong enough to stand power dives of 10,000 feet or more, being able to pull out of the dive with bombs still attached and full load.

The idea of any airplane being built that could include such contrary ideas, especially in view of our present state of airplane design knowledge, is quite fantastic, but popular fiction would even go several steps further, and make an airplane that would not only have such features as mentioned above, but would also be a submarine and a tank at the same time! Needless to say we'll have to wait till we come to the Buck Rogers age before we see such a craft.

Although it is impossible to include all the above mentioned qualities in one airplane, it has been found possible to segregate some certain qualities and build planes to fulfill functions which these qualities give it. Thus there are constructed fighting airplanes which have maneuverable qualities and high speed, bombing airplanes that can carry heavy loads, and other airplanes of different qualities. Since the military organization employes many airplanes, segregation of function by types of machines does not cause very great inconvenience.



Official Photograph—U. S. Navy

Forced landings over water are no longer a terror to land planes, for the two flotation balloons, when inflated with carbon dioxide gas, will support the plane.

The functions for which Navy airplanes must be designed include the observing of gunfire from battleships, scouting for enemy ships, bombing and torpedo work, fighting of enemy craft in the air, guarding by means of amphibian airplanes the landplanes in their flights over water, patrol work near coasts, general utility and transport, and primary pilot training. Airplanes for these last three functions are not necessarily designed for going aboard a carrier and so airplanes for these functions may differ quite widely from planes designed for the functions which are best conducted from aboard a carrier.

Regardless of function carrier airplanes all have several common features. They are single motored, use air cooled radial engines, have landplane landing gear, are equipped so that in case of a landing in water they can be made to float, have oil and air landing shock absorbers, and have a hook at their tail for use in landing.

In order to understand why certain features are needed, a short description of a carrier is advisable. The carrier is about 900 feet long, with 300 feet at the stern being used for landing area. This landing area is covered with a number of wires which when the deck is rigged for landing are raised off the deck to allow a hook in the tail of the airplane to engage. When the tail hook of the plane catches on the cross wire, the wire plays out under resistance, bringing the airplane to a quick yet gentle stop. The space forward of the landing area is used for parking of airplanes, with the take-off section being at the bow.

Although almost all airplanes are landed without difficulty, some pilots may overshoot on a landing. Thus for such cases provision must be made to stop the airplane before it goes up the deck and crashes into the parked planes. A barrier of cables is stretched across the deck at the end of the landing area. Overshooting planes crash into this barrier, being wrecked in the process of stopping but invariably without injury to personnel in the airplane.

The fact that an airplane is liable to sometimes encounter this barrier makes it imperative that only single motored planes be used, for if a twin motored airplane were to crack up in the barrier the engines would be thrown in towards the fuselage, and chances of serious injury to the personnel in the airplane would be very great.

Air cooled engines present so many advantages that they have become standard for Navy use. In fact, their present high stage of development is due to no small extent to the money the Navy spent in aiding in research and development of the air cooled engines. The absence of a cooling medium and its attendant plumbing eliminates the nuisance of refilling radiators, decreases maintenance work, and eliminates cooling fluid bother in freezing weather. Aboard a carrier where space, facilities and time for action are precious, the value of such things should be readily realized. The fact that air cooled engines have proved most reliable is reason enough for insistence on their use.

To the uninitiated, landplanes and the Navy have never seemed a right combination. Popular opinion would give the Navy only airplanes that land and take off from the water. However, because the airplanes have to operate from a ship, they can do so much more readily and effectively as a landplane than as a seaplane. Operation as a seaplane would involve either catapulting or lowering into the water by means of a crane for a seaplane take off. Landings would have to be made alongside, and the seaplane hoisted aboard by a crane. If amphibian airplanes were used performance would be sacrificed because of their heavy weight as landplanes also have better performance than seaplanes.

Because the landings of airplanes on deck cannot be always accurately judged due to rolling and pitching of the ship, the small landing area, and the normal errors of pilots, the airplanes must be equipped with good shock absorbing equipment and must be made strong enough to stand more than ordinary

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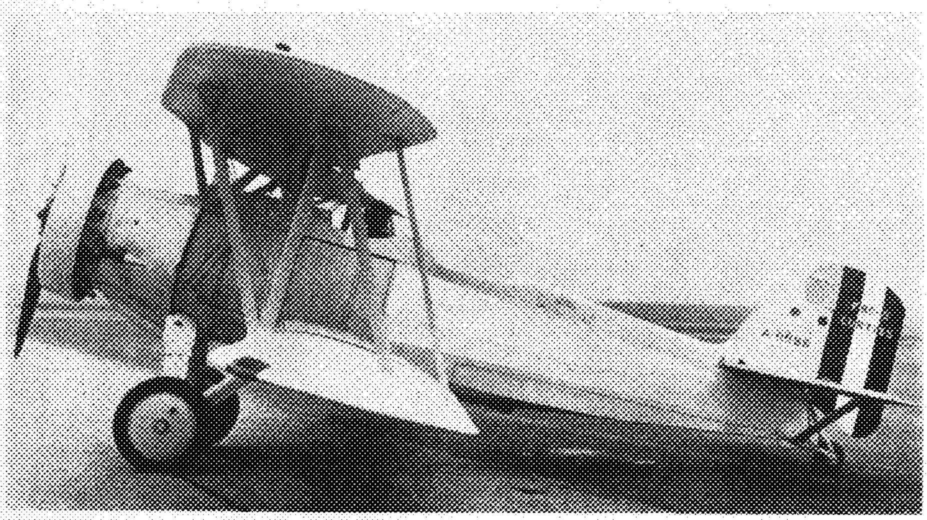


Official Photograph—U. S. Navy

The famed "Helldiver," a Curtiss 02C-1 with gill cowling.

A CATHEDRAL OF THE SKIES

By R. F. ARNOLDY, M. E. '33

The Adler Planetarium, one of the attractions of the Century of Progress Exposition to be held from June to October, 1933, in Chicago, will give visitors a chance to sit in comfort beneath an artificial sky and see the heavens revealed in all their glory of a million stars.

ILLUSTRATION of astronomical phenomena has been the subject of tireless effort on the part of scientists and astronomers for centuries, in order that some of the mysteries of the subject might be dispelled. Most of us realize how inconceivably great are the distances and sizes, and how very complicated are the motions found in the study of astronomy. Perhaps some of us remember the efforts of a patient school teacher to demonstrate to her class by means of a lamp and some oranges the relative motions of the sun and earth which cause seasons. The method of illustration used by the teacher was that of the simple orrery which, until the advent of the Zeiss planetarium, was the only method known.

A planetarium has been termed a playhouse in which the majestic drama of the firmament is unfolded. Let us imagine ourselves seated in the Max Adler planetarium in Chicago ready to view a performance of the instrument. The lights are turned down gradually, just as in a theatre before the curtain rises on a play. Gradually your eyes accustom themselves to the growing darkness. You lose all sense of confinement. In some incomprehensible optical way you have been transported out into the open on a marvelously clear night. What was once a naked white vault is now the deep blue nocturnal sky bounded by the skyline of the city, but strangely starless. A miracle happens. With the throwing of a switch the sky has suddenly become a firmament of twinkling stars. Like the spectators at a fireworks display, you emit a long drawn ah-h- of astonishment and pleasure when you behold this dramatically presented counterfeit of the heavens. The voice of the lecturer is heard from the reading desk, as he controls the weird apparatus in the center of the room by means of his concealed switchboard.

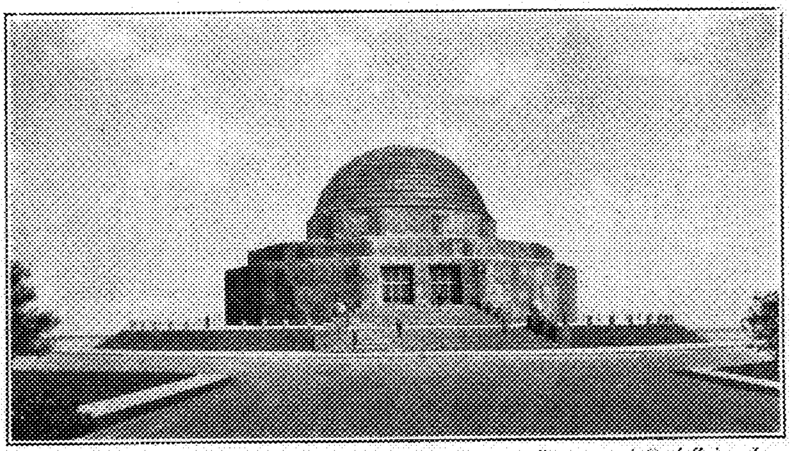
The lecture begins. "The sun has just set. Here is Venus shining as an evening star." And he points to Venus with a long finger of light. In his hand he holds a flashlamp on the lens of which is a transparent arrow. He throws the beam hither and thither so that the luminous arrow appears on the dome to direct attention to the specific body about which he happens to be talking.

"Venus appears," he continues, "only for a while before sunrise or after sunset. Its orbit is within that of the earth hence it can never be far away from the sun." He says that he will show us the stars as they appeared in the time of Christ and, throwing a switch, makes the heavens do his bidding. He carries us forward 12,000 years and explains what is meant by the precession of the equinoxes. We are told that the earth, like a spinning top that is dying down, wobbles about its axis of rotation with the result that the north pole of the heavens leaves the pole star and in the year 14,000 approaches Vega only to return again in another 12,000 years.

So flexible is the apparatus that the firmament becomes amenable to experiment. Suppose that the earth were to stop spinning on its axis or that the equinoxes would wobble or precess not in 26,000 years but in one year. Then, if that year were to last five minutes, how would the heavens appear to move? The operator has only to press the right combination of buttons in order to thus tamper with the universe. Similarly he can show how eternal spring or summer can be realized. He can take us to the poles or to the tropics and show us the heavens as they appear from parts of the globe that most of us never see.

The effects just described are accomplished through enormous accelerations. Because the constellations sweep across the sky with such amazing speed, the reason becomes immediately apparent. To follow in the open air even such comparatively rapid changes as the daily courses of the stars, the sky must be watched for hours at a time. Without a planetarium the study of the gamboling planets involves decades of time. To understand why the planets assume the positions they do at different seasons and to show the astronomical meaning of spring, summer, autumn, and winter, the planetarium reduces centuries and years to hours and minutes. The mechanism of our solar system is accelerated 125,000 to 4,000,000 times by this apparatus.

It took a man of extraordinary imagination to conceive the possibilities of the modern planetarium. That man is Dr. Oskar von Miller, creator and director of the famous Deutsches museum of Munich, an institution that popularizes science, engineering, and industry with moving models. Von Miller realized the need of some apparatus that would dramatize astronomy and thus teach it with vividness and directness.



Courtesy of Carl Zeiss, Inc.

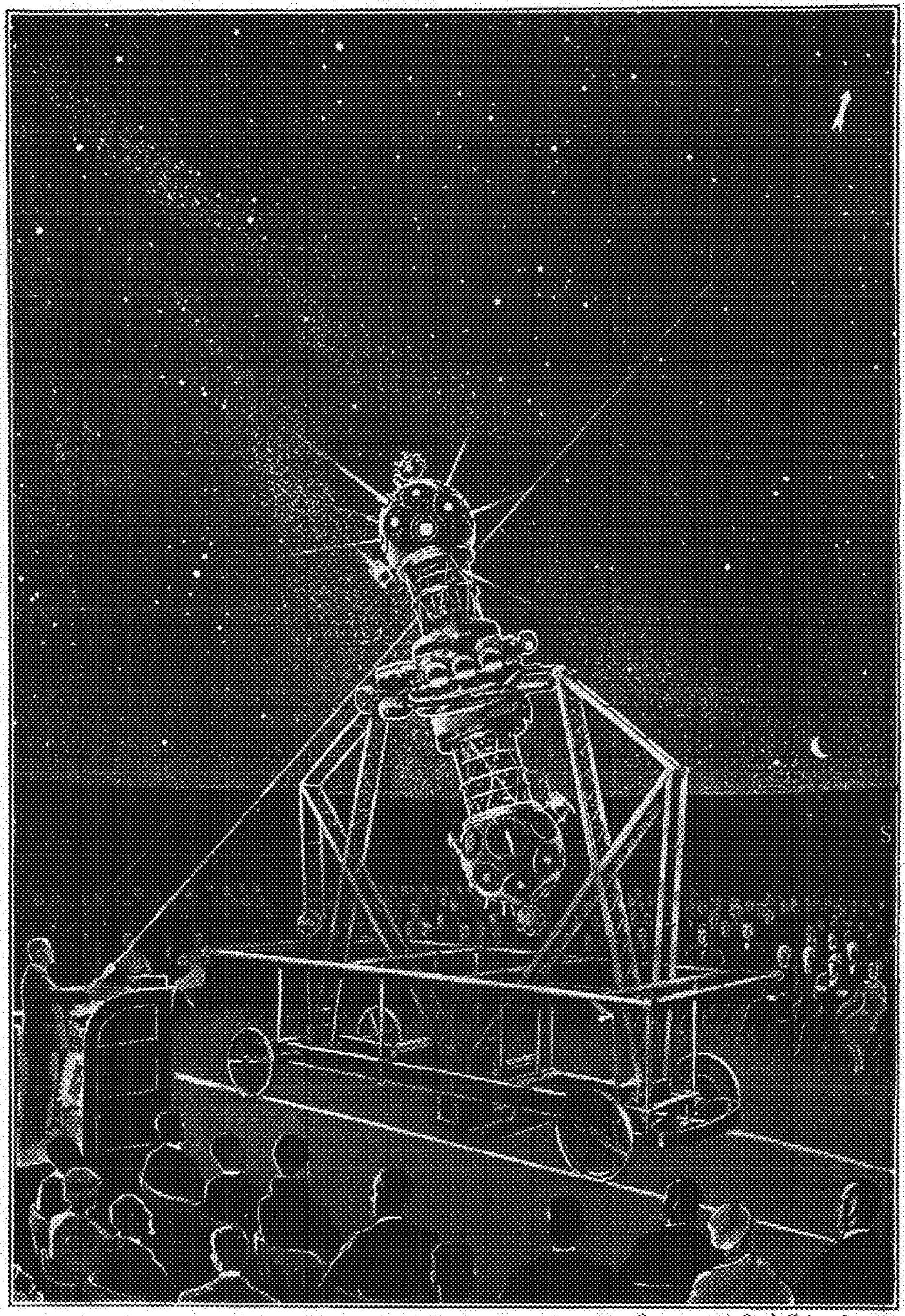
The planetarium and its equipment is housed in a dome-shaped building.

He said, "Build me a theatre in which astronomy will be stripped of its mystery, yet one in which we shall be overawed by the majesty of the heavens. Let us have a model that will be more than a bewildering collection of balls representing the sun and planets and only a little less difficult to understand than diagrams in textbooks."

That was in 1913. Dr. Baursfeld was the engineer selected to carry out von Miller's suggestion. After 12 years of hard work, the planetarium was finished. It cost $75,000, of which $70,000 was for the instrument.

People are often puzzled by the two bulbous ends on the instrument. The purpose of these ends is to project upon the dome the stars visible from either the northern or southern hemispheres. Ordinarily the stars of the north alone are used. At such times the lower end of the apparatus is not used. Of course if we wish to show the heavens at the equator, parts of both ends come into use and the dumbbell now assumes a level position. At such times, in order that stars supposed to be below the horizon may not be projected on the audience beneath, each of the lower projector lenses has a moveable mask arrangement in which the moveable part is a well of mercury which shuts off all or part of the light depending on its position. The same device serves to cut off gradually the light of each star as it approaches the horizon, thus imitating the same effect as occurs in nature.

Many are surprised to learn that not more than 2,700 stars, or at the utmost 3,000, are visible from any one place on earth at the same time. Yet an actual count reveals the truth of this statement. The Zeiss planetarium displays the entire complement of 9,000 stars visible to the naked eye from anywhere on the face of the earth. Not one is omitted.



Courtesy of Carl Zeiss, Inc.

The projection machine of the Adler planetarium is mounted on a carriage which moves along tracks in the floor.

The small spheres on the extreme ends of the instrument contain 32 projectors for the constellation names which appear beneath each constellation when a class is in progress. The pencil-like projectors on the bulbous ends, 18 in number, are for star clusters, naked eye nebulae, and the brightest star Sirius. The cylinders seen near the root of the bulbous ends are the projectors for the milky way. The balls and other accessories near the middle of the machine are for use in projecting technical features meant for astronomy classes. They project the eclyptic, celestial equator, north and south polar points, and the neon meridian line. Near the middle and inside are the motors, three in number, which rotate the machine about its three axes. The two halves of the cylinder or handle part of the dumbbell contain the planet projectors for the sun, Saturn, the zodiacal light, the moon, Venus, Mars, and Jupiter. Uranus, Neptune, and Pluto are omitted because they are invisible to the naked eye. There are two projectors for each planet as with one apiece the supports of the instrument would sometimes get in the way.

Almost as interesting as the instrument is the construction of the dome itself. A three inch thickness of concrete is sprayed on a network of preassembled reenforcing rods. Within this hemisphere a concentric hemisphere of white linen is attached leaving a space of two feet between it and the concrete dome. It is upon this screen that the stars are projected.

Out on an island in Lake Michigan, in the midst of the many weird buildings now being constructed in preparation for the Century of Progress exposition, is the Adler Planetarium. Its copper dome, resting on a twelve sided structure of great simplicity and beauty, might well be that of an Eastern mosque. Its surroundings carry a touch of the ancient world, for three tiers of terraces and balustrades surround the building.

A LETTER TO BRIGGY

Brigadier General Hughes
Commanding Officer
Fort Snelling, Minn.

Dear Briggy:

Now that I have had an opportunity to collect all possible hush money from the boys who attended camp, I shall comply with your request to cuss and discuss for you the night life at the Signal Corps encampment in Fort Snelling this summer. If the names of certain men appear more frequently than may seem deserving, do not judge them too harshly, for the depression makes it difficult for some to keep their imprudent actions from publication.

Things started popping that first Sunday night,—June 12, wasn't it?—when Privates Clifford Hauge and George Krauch experienced severe pains in the back. The entire camp was kept awake by the moaning and groaning until some thoughtful individual removed Private Paul Erickson's horseshoes from Hauge's bed, and the camp broom from the cot of Private Krauch. (Offenders have paid up.)

The fellows surely were a bunch of "soaks" after the rain storm that second day in camp. That was "processing" day, you know, and we were having our physical examinations and getting uniforms. Just as the storm broke several of the boys were in the "processing area" under the canvas covering between two barracks in the process of trying on the uniforms which had just been issued them. As the rain blew in from all sides there was one mad, futile scramble for shelter. But, as certain individuals were overheard to say later, a little drenching like that wasn't much compared to what they expected later. Probably the most unfortunate was Private Steve Gadler who attempted to break in his new pair of shoes by soaking them in water. Steve still claims that he didn't get his feet wet in that half mile hike back to the barracks through the mud and water.

On the second night Privates Sanford Hanscom and Thomas Hammond seemed to have drawn the long straws, and had it not been for Hanscom's super-human ability to sleep, there might have been a riot in camp. The first trick was to pour water in his ear, which merely drew a louder snore from the culprit and caused him to roll over. His rolling over presented another opportunity to his torturers for in so doing he left one hand dangling over the edge of the bed. A pail of water was promptly slipped up over his hand, soaking his arm above the wrist, but in no way disturbing his slumbers. As a last resort, three fellows (paid in full) tipped over his bed, which was one of the folding type, and abruptly terminated his slumbers for that night. The evening's excitement was promptly stopped as Captain Minkler's voice from the door sounded out, "Let's have it a little more quiet in here, boys."

As I said, the excitement for the night was ended, but not so with the noise—far from it. In fifteen minutes practically everyone was asleep, and the chorus of snores which reverberated throughout the barracks threatened at times to shake loose the rafters. Outstanding among the soloists accompanied by the chorus could be distinguished the deep bass of Private Bill Hartman, the inimitable baritone of Hammond, and the rollicking tenor of Private Adolph Kupka. One especially sound sleeper, though not a member of the above chorus, was Private Herman Westover. We strongly suspect that his steady hand, which won honors for him in the pistol matches, was in some manner aided by the few extra winks of sleep he caught each morning.

The food was especially good although it proved a bit distressing to particular individuals on several occasions. Here again, the depression seems to have hit Hammond and Hanscom particularly hard. Hanscom was a trifle underweight, and was determined to come up to normal. Hammond, though not underweight was running a close second to Hanscom for the the extra piece of pie. However, after the first few cases of indigestion, the boys were a bit more careful. Hauge ran without competition in the bread and jam eating contest.

During the first two weeks at camp, the only word which seemed to be in the vocabulary of the officers was drill—d-r-i-l-l—DRILL, but after the drill period was over, the signal corps had the distinction of being the best drilled unit in camp. Ask any one of the boys who attended if my word seems exaggerated. Oh, yes, relative to the afternoon parades—the day that Colonel Moorman, commander of the 7th corps area from Omaha, was present and reviewed the R.O.T.C. units on parade, it was Hauge's good fortune to be selected battalion commander. He had his picture taken with the Colonel, but spent the evening sewing new buttons on his coat and stretching his cap so that it wouldn't be so tight.

Although no awards were made for the

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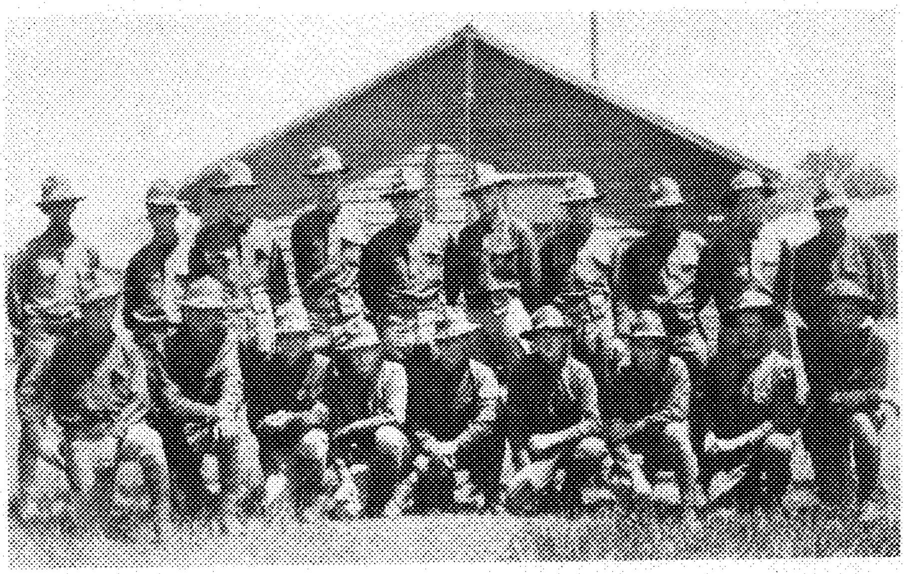


The Signal Corps gang at ease. Front row, left to right: Hanscom, Beightol, Erickson, Hartman, Hauge, Nuffer, Vorlander, Kaliher, Lommen, and King. Back row: Westover, Anderson, Stoddart, Graves, Hammond, Kupka, Gadler, and Krauch.

ENGLISH FOR ENGINEERS

A PAGE devoted solely to our English department has been the dream of many a TECHNO-LOG editor, and this year when all engineering executives are demanding graduates who have a cultural as well as technical training, a page of this sort is especially appropriate. For our first page then, we offer a selected bit of poetry, an impromptu theme, and one of the best essays in the English language.

You have all read "Invictus" in your grade school days, but read it again, and try to live up to it.

"Of Studies," too, has been read by all, but a new appreciation of its power and beauty is gained with each re-reading.

The theme of the month is one of the most unusual received by the English faculty last quarter. Can you, after reading this impromptu theme, picture in your mind the student who wrote it?

BACON'S ESSAY "OF STUDIES"

STUDIES serve for delight, for ornament, and for ability. Their chief use for delight is in privateness and retiring; for ornament, is in discourse; and for ability, is in the judgment and disposition of business. For expert men can execute, and perhaps judge of particulars, one by one; but the general counsels, and the plots and marshalling of affairs, come best from those that are learned. To spend too much time in studies is sloth; to use them too much for ornament is affection; to make judgment wholly by their rules is the humor of a scholar. They perfect nature, and are perfected by experience; for natural abilities are like natural plants, that need pruning by study; and studies themselves do give forth directions too much at large, except they be bounded in by experience. Crafty men condemn studies, simple men admire them, and wise men use them; for they teach not their own use; but that is a wisdom without them, and above them, won by observation. Read not to contradict and confute; nor to believe and take for granted; nor to find talk and discourse; but to weigh and consider. Some books are to be tasted, others to be swallowed, and some few to be chewed and digested; that is, some books are to be read only in parts; others to be read, but not curiously; and some few to be read wholly, and with diligence and attention. Some books also may be read by deputy, and extracts made of them by others; but that would be only in the less important arguments, and the meaner sort of books: else distilled books are like common distilled waters, flashy things. Reading maketh a full man; conference a ready man; and writing an exact man. And therefore, if a man write little, he had need have a great memory, if he confer little he had need have a present wit; and if he read little, he had need have much cunning, to seem to know that he doth not. Histories make men wise; poets witty; the mathematics subtle; natural philosophy deep; moral grave; logic and rhetoric able to contend. *Abeunt studia in mores.* Nay, there is no stond or impediment in the wit but may be wrought out by fit studies: like as diseases of the body may have appropriate exercises. Bowling is good for the stone and reins; shooting for the lungs and breast; gentle walking for the stomach; riding for the head; and the like. So if a man's wit be wandering let him study the mathematics: for in demonstrations, if his wit be called away never so little, he must begin again. If his wit be not apt to distinguish or find differences, let him study the Schoolmen, for they are *cymini sectores.* If he be not apt to beat over matters, and to call up one thing to prove and illustrate another, let him study the lawyers' cases. So every defect of the mind may have a special receipt.

INVICTUS

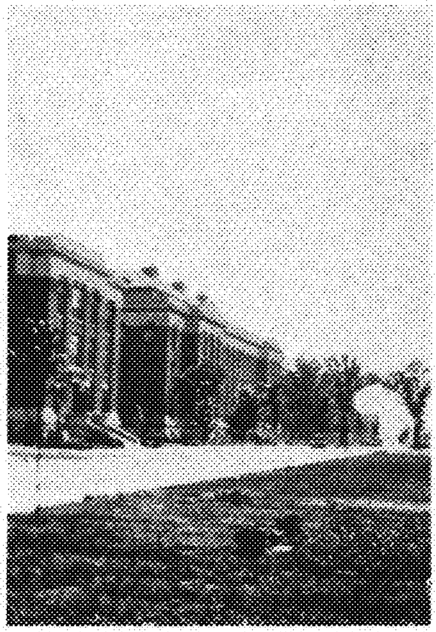
Out of the night that covers me,
Black as the pit from pole to pole,
I thank whatever gods may be
For my unconquerable soul.

In the fell clutch of circumstance
I have not winced nor cried aloud.
Under the bludgeonings of chance
My head is bloody, but unbowed.

Beyond this place of wrath and tears
Looms but the horror of the shade,
And yet the menace of the years
Finds and shall find me unafraid.

It matters not how straight the gate,
How charged with punishments the scroll,
I am the master of my fate:
I am the captain of my soul.

—WILLIAM E. HENLEY.



Engineering Buildings

MY FRESHMAN ENGLISH

I AM, one would think by perusing my records here at college, one of the most (truly) unique, or better to say, the most conspicuously poor student in English of all students registered in the College of Engineering, present and past. Nevertheless, the constant repetition of my registration in English finally brought to my inalienable mind the colossal value of good reading as an antidote for illiteracy. Huxley says any one can learn to write. I say to do so, one must read; read essays and anecdotes of reputable authors whatever their subject may be. I am not given to vainglory when I say I have learned to write as a result of gratuitous reading, for I say so only in comparison of my former theme writing. Of course some will say that two times nothing is nothing, but there can be no zero mark in writing. Thus I can easily claim to be twice as good a writer as I was before I started reading, or to say, before I learned to read in a fair to middling manner, which I now believe I can do.

This lesson which I have learned is one which will abide with me for the rest of my days, and if I live long enough, who knows but what I may learn to write well enough to pass an English course in an Engineering college, and perhaps, though very improbably, learn to spell somewhat.

AUTOMATIC SYNCHRONIZING

By PERRY PETERSON, E. E. '19

President, General Control Corporation

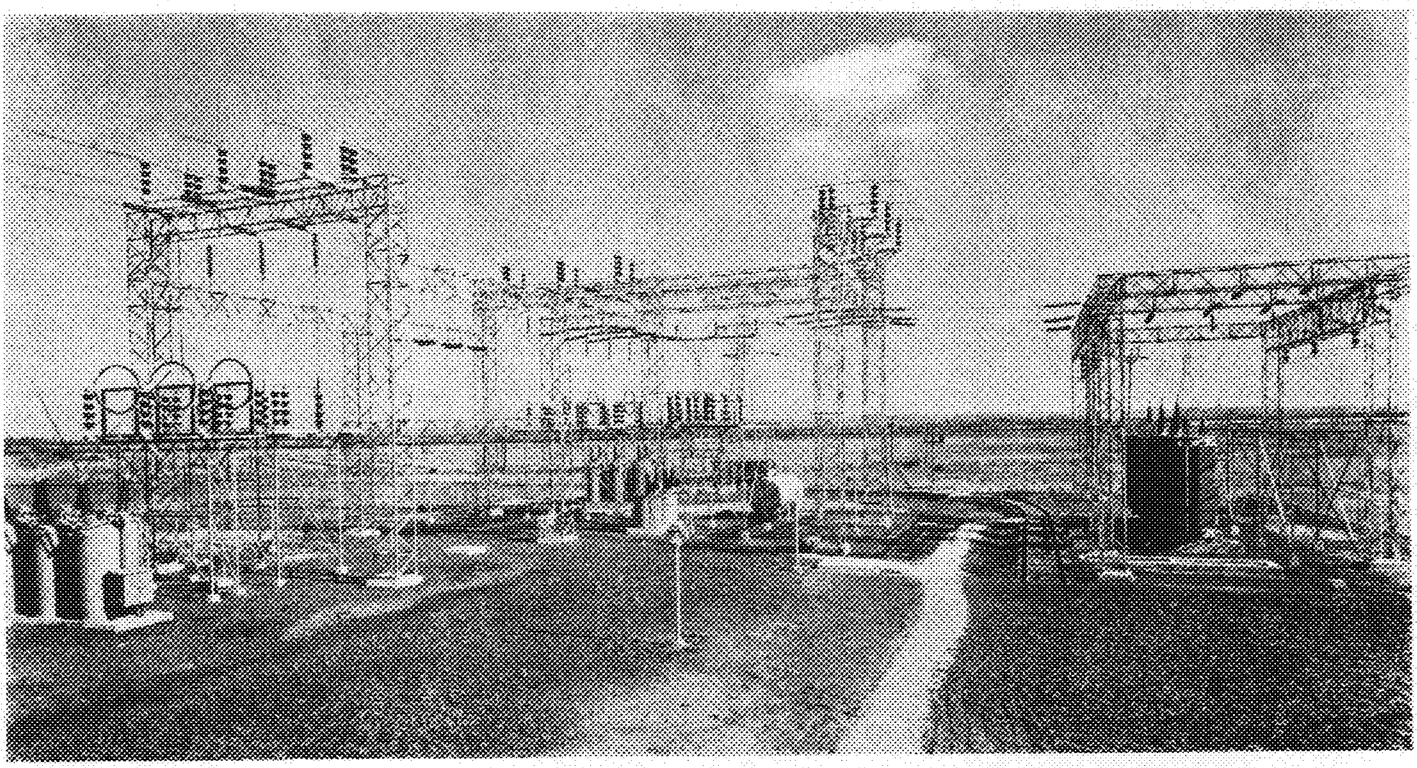
CLOSING an electric switch or circuit breaker is in itself a simple task, but when that closing means the paralleling of two different sources of alternating current it is another story. Alternating current, as its name applies, is constantly changing its direction, usually one hundred and twenty times a second or sixty complete cycles. Therefore, when one alternating current system is to be connected to another it is necessary not only to have the frequencies the same but to have these changes taking place in unison or "in step." Getting a generator on the line quickly and smoothly or connecting two large transmission systems without a "bump" or disturbance is not the easiest task of a station operator. If this stunt is accomplished properly it is a "good shot," but if not it may mean a city thrown in darkness or a generating unit wrecked. Fortunately, "poor shots" are infrequent, but it is much better to avoid them altogether.

Let us imagine two passenger trains traveling on parallel tracks, each going sixty miles an hour but in opposite directions. Were they to be tied together in some manner as they came side by side it is not difficult to imagine the result. With thousands of electrical horsepower surging through each of two transmission systems at the rate of sixty cycles per second, it is likewise possible to picture the impact if they were brought together when traveling in opposite directions.

Now let us picture the two trains traveling in the same direction but one going faster and overtaking the other. Should they be connected as they came abreast, it would mean that something would have to "give." The one with the least momentum would be jerked into step with the larger train in "nothing flat," if the coupling stood the shock. The same is true of two alternating current systems. Where the frequencies are near enough so that the circuit breaker will remain closed, the smaller system will be jerked into step with the larger.

Before a generator is connected to a distribution system to which other generating equipment is supplying power, its speed or frequency must be synchronized exactly with that of the system. Then and only then is it permissible to close the circuit breaker tying the two together. Heretofore this operation has been accomplished by the operator observing an instument known as a synchroscope. The driving mechanism of this device consists of a small and very sensitive electric motor with two special windings. One of these windings is connected, through potential transformers, to the system and the other to the incoming machine. On the shaft of this motor is mounted a pointer which revolves in front of a suitable dial. If the frequency or speed of the incoming machine is too high, this pointer will revolve in one direction designated "fast" or vice versa. The speed with which it revolves is proportional to the difference in frequency between the two systems, i.e., one revolution per second for each cycle difference.

It is on this instrument that the station operator has depended for indications when to close his circuit breaker. With the pointer or hand slowly approaching "twelve o'clock," or zero phase angle, and knowing how long it takes the circuit breaker to complete its closing operation, his judgment tells him



All switching at this North Fond du Lac interconnecting substation of the Wisconsin Power and Light Co. is done through General Control automatic synchronizing equipment.

when to give the breaker the closing impulse. However, with changes in frequency often taking place without notice, and the operator's judgment sometimes proving wrong, it is not surprising to hear of an occasional "poor shot." Depending on how far out of step the connection occurred, various serious consequences may result. A twisted generator shaft, a generator moved from its foundation, or a city thrown into darkness are not uncommon.

Today, however, automatic equipment is available that accomplishes the desired result accurately all of the time. Such an automatic synchronizer is shown on this page. Its driving mechanism is exactly the same as that of the synchroscope, but instead of the pointer is a contact bearing rotor with its contacts C, D, and S establishing at the proper time circuits through the rollers 25e, 25f, 25h, and 25k. In conjunction with suitable relays the closing of the circuit breaker is achieved only when the two frequencies are within permissible limits and when the phase angle is within the extremely narow arc of four electrical degrees or less. For the very large circuit breakers whose closing time is a matter of ½ to 1 second, a special advance closing mechanism is provided which initiates the breaker closing in advance of exact phase coincidence so as to accurately compensate for this time lag.

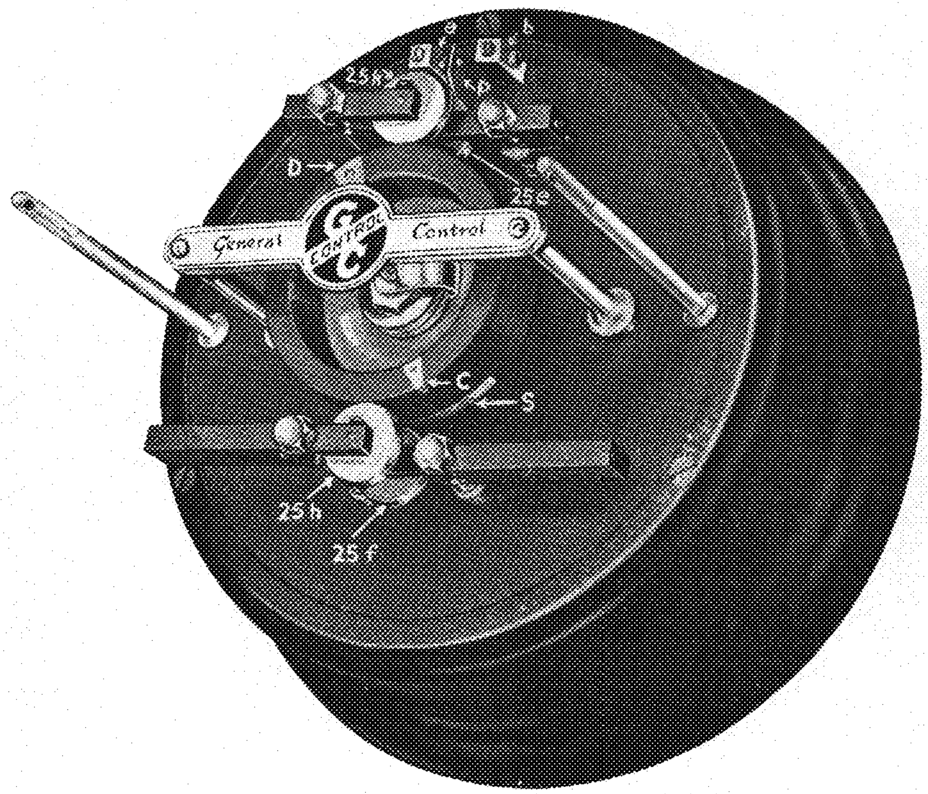
Through the use of this new equipment, not only is uniform and unerring accuracy substituted for the hesitating and variable human element, but it is possible to operate hydro-electric generating plants and interconnecting substations without the presence of an operator. Automatic equipment opens the water turbine gates, brings the generator up to the exact speed required, closes the circuit breaker putting it on the line, causes the unit to carry its share of the load, and in the event of any trouble shuts the plant down.

One of the photographs accompanying this article shows one of the most important interconnecting substations of a large power system where all switching is accomplished by means of this automatic synchronizing equipment. The potential of these lines is 132,000 volts. No operators are stationed at this point, but instead the Selectrol system is employed over a circuit leased from the telephone company. Supervision is exercised by an operator in a steam generating plant three miles away. By means of this system of remote control the operator is kept constantly informed of conditions at the automatic substation. In the event a circuit breaker opens, a horn calls his attention to the "outage," and upon receiving permission to reclose the breaker from the system load despatcher, he merely has to close a switch on his control panel. The Selectrol receiving unit located in the substation responds by setting the proper automatic synchronizing equipment in operation, and as the latter attempts to close the breaker, indications are constantly transmitted showing the operator at the control point which system is "fast" or "slow." A later development transmits these indications by sound as well over the regular telephone system direct to the generating station operator whose frequency needs correcting. Thus automatic equipment makes it unnecessary to constantly maintain operators at a substation or to send men out to reclose the breakers. Service is resumed in the shortest possible time and there is never an objectionable disturbance to the system.

In the above installation, the 132,000 volt transmission potential is stepped down to 110 volts which is the usual operating voltage of relays and control equipment. This transformation is accomplished by potential transformers but a later development of the General Control Corporation engineers known as the Amplitrol achieves the same result through a minute condenser coupling. The Amplitrol is a mercury vapor vacuum tube device utilizing direct current from the station storage battery as plate current. This direct current is then "inverted" to alternating current, and with a very small control or grid current obtained from the condenser coupling (as low as 0.00006 volt amperes) the alternating current output assumes the same frequency and wave form as that of the transmission system. With this device an output as high as 5,000 watts may be obtained.

In the past the tense moment came when the big generators were brought on the line, the pilot lights becoming dim and then bright, the pointer of the synchroscope turning slower and slower, the operator fearfully alert, a quick decision, then slam went the switch. Next a groan from the machine or a sigh of relief from the operator.

But now dependable automatic synchronizing equipment eliminates the variable and hesitating human element in the closing of important circuit breakers, whether it is to put a generator on the line or to bring two large transmission systems together. Gone is the grunt and groan of the generator when the Switch is thrown; gone is the "bump" on the line, when automatic synchronizing equipment is used.



This automatic synchronizer is but little larger than an ordinary panel meter, but it is easily capable of tying in two gigantic power systems with no disturbance.

THESE FRESH FRESHMEN

By JOHN HARRISON MOFFETT
Instructor in Foundry Practice

THIS article is not intended to be an indictment against the address and approach of first year men. Instead of presenting a flippant and impertinent demeanor, the average freshman is shy and reticent. This conclusion is based upon observation made in teaching a course in foundry practice to between four and five thousand freshmen. During this time there even have been occasions when there seemed to be justification in reminding the "yearlings" that they are so young and tender and unsophisticated. Nevertheless, the beginner in college exemplifies the acme of vigor and enthusiasm. He is brimful of action, life and energy. This characteristic often has brought him to the realization that there frequently has been made a headlong rush into a sequence of thought and movements that ultimately proved to be the wrong procedure. As it were, the irrational act was committed first, and the thinking done afterwards—a rushing in where angels fear to tread.

Isn't Foundry Work Easy?

Fortunately the writer teaches a course that is elemental as well as fundamental in industry. The creative nature of it at once becomes attractive. It is an art with which the majority are unfamiliar, and the urge to learn something about a strange industry becomes impelling. There is the inmost desire to get one's hands in the "dirt" which can be formed into so many complicated and attractive shapes. The forming of intricate cavities in sand; the life of the molten metal, and the resultant ornamental casting as an exact replica of the pattern, are fundamental steps that quickly induce enthusiasm in students pursuing the course. However, to a great many gullible beginners the steps in the production of a mold seem so simple and easy of accomplishment the first time, that it is deemed good pedagogy to warn the initiate. This is done because the student will encounter so much difficulty in controlling the many variables in his first attempt at making a mold. Since the struggle of the beginner is pitiful in the eyes of the experienced craftsman, the freshmen are reminded that in all probability they will encounter a great deal of discouragement, until repeated endeavor has provided the repetition that will make the detail apparently insignificant.

Learning to Drive . . .

With the plight of the novice under consideration, encouragement is offered by reminding him that the expert himself endured the same torture when he, too, was a beginner. The writer again had forcibly impressed upon himself the truth of this when he attempted to learn driving of an automobile under the tutelage of his brother, who also is a teacher. There were so many levers and pedals to be shifted, and so many dials and traffic conditions to be watched, that the smooth handling of the car was impossible before sufficient practice had been taken to make many of the movements subconscious. This occasioned much disappointment because the writer was confident he would meet little difficulty in operating a car. After much shouting and forcible language, the brother virtually concluded that the author could not be taught to drive a car. But the tables soon were turned, when the brother started at molding in the writer's little foundry, and experienced the same difficulty of detailed movements that the writer had in learning to drive. The millstone around the neck of a beginner is in that he has to first think out each step; whereas an experienced person simply gives his attention to new features as the routine has become automatic.

Casting a Morning Glory

At the commencement of the course in foundry practice it is difficult to induce freshmen to ask questions when the opportunity is presented during a lecture or demonstration. Presumably it is through the thought of being embarrassed by asking something that might be irrelevant to the work at hand. To lead them out, they are reminded that what might seem to them a trivial thing is frequently important in the judgment of one versed in the subject. To stimulate and put them at ease in this respect their incredulity is augmented by asking a question about a seemingly impossible accomplishment. A favorite one is about a morning-glory casting being obtained by using a morning-glory blossom as a pattern. When asked how that can be done, they are reassured on being told that if a nail hole is punched in the center of the bottom of a tomato can; the stem of the blossom inserted therein from the inside of the can; the can filled with water to suspend the blossom in its natural position; fine molding sand introduced in such manner as to support and cover the blossom; the water evaporated, and the temperature raised high enough to burn out the blossom, there will be left a cavity of the desired shape. Then when cast iron of the necessary chemical composition, at a sufficiently high temperature is poured quickly into the hole left by the blossom stem, a very delicate and light-weight cast-iron morning-glory blossom casting will be produced. Such a discussion instils the confidence that the art of founding is based upon common sense and rational principles. Thus the mystifying aspects of the foundry art quickly vanish. Thereupon, some one of the pupils will venture the assertion: "I didn't think such pretty things could be made in a foundry," after the class is asked what it thinks of such a feat. To dissipate their perplexity, the class then is asked to consider the lily which springs from the dirt as paralleled by things of beauty being produced in a "dirty, old" foundry.

The morning-glory possibility afterwards is used as an example to impress upon the freshmen one of the outstanding advantages inherent in founding—an advantage which gives it a great margin over other processes used in the shaping of metal. In the foundry the metal is used in the fluid state as compared to the semi-plastic and solid states in other processes. This situation enables the foundry to produce cheaply, complicated shapes in enormous quantities. All that is required is the production of the molds on rational principles, the pouring of the molten metal into them at a sufficiently high temperature, and a short enough time to insure its reaching and filling every nook and crevice of the mold cavities. The feat will be accomplished because the metal in the fluid state obeys the law of liquids, and in so doing will fill the mold cavity

(Continued on page 29)

The Engineer—"If"

If you can swing an axe or wield a brush-hook,
Or drive a stake or drag a chain all day.
If you can scribble figgers in a notebook,
Or shoot a range-pole half a mile away;
If you can sight a transit or a level
Or move a target up or down a rod.
If you fear neither man nor devil
And know yourself and trust the living God.

If you can wade a swamp or swim a river,
Nor fear the deep nor yet the dizzy heights.
If you can stand the cold without a shiver
And take the Higgins ink to bed at night;
If you can turn a thumb-screw with your finger
When every digit's like a frozen thumb,
If you can work as long as daylight lingers
And not complain and think you're going some.

If you can run a line where you are told,
And make it stay somewhere upon the map,
If you can read your notes when they are cold
And you know that contours mustn't lap;
If you can line a truss or tap a rivet
Or make a surly foreman come across;
If you can take an order as well as give it
And not make secret pity for the boss.

If you can sight through tropic heat refraction
Or toil all day beneath a blistering sun:
If you can find a sort of satisfaction
In knowing that you've got a job well done,
If you can be an Eskimo and nigger
And try to be a gentleman to boot,
If you can use a guessing stick to figure,
And know a coefficient from a root.

If your calculus and descriptive are forgotten.
And your algebra just serves you fairly well,
If your drafting and your lettering are rotten,
And your Trautwine's always handy by to tell;
If you can close a traverse without judging
Or check a line of levels by a foot,
If you can set a slope stake just by judging
And never kick a tripod with your foot.

If you can climb a stool and not feel lowly,
Nor have your head turned by a swivel chair;
If you can reach your judgment slowly
And make your rulings always just and fair
If you can give yourself and all that's in you
And make the others give their own best too;
If you can handle men of brawn and sinew
And like the men and make 'em like you, too.

If you can't boast a college education
Or, if you've got a sheepskin, can forget;
If you can get a living wage for compensation
And give a little more than you can get,
If you can meet with triumph and disaster
And treat them without favor nor with fear.
You'll be a man, and your own master
But what is more—you'll be an ENGINEER.

—Author Unknown.

The MINNESOTA TECHNO-LOG

UNIVERSITY OF MINNESOTA

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LADDY MARKUS . . . . *Managing Editor* TOM ROGERS . . . . *Business Manager*

HELMER BROCKHOFF, *Arch.*; M. ARTHUR ROLLINS, *Chem.*; HAROLD SUNDSTROM, *Civil.*; NORBERT MENGELKOCH, *Mech.*; *Chairman*, PARKER LOWELL, *Elect.*

Staff positions for the year will be announced in the November issue of THE TECHNO-LOG, *which will be out November 18th.*

WELCOME, FROSH

HAIL, freshmen! We welcome you to our college. You will find that in the Engineering colleges a friendly spirit exists, and in a short time you will become well acquainted with many of your fellow engineers. You will find among the many students in your classes several who have ambitions and hobbies and interests similar to yours, so look for them soon, and gain their friendship.

You must remember that these first days of college life mark the culmination of years of hope and of work; they mark, too, the beginning of a new era in your lives.

You will be granted much more freedom than you ever expected in a school, but you are men and women now and we hope you will learn to appreciate your independence. You won't be forced to attend a study hall—you won't even be compelled to study. If you are interested in engineering you will study and get to be engineers; if you aren't you won't study, and you'll soon drop by the wayside.

If you are to succeed in your college work, you must have a goal to work towards. Set this objective now—set it high—and then double it. If you aspire towards research or work of a highly technical nature, aim for a Tau Beta Pi average; if you have hopes of being a business executive—a leader among engineers—seek for leadership among your classmates, and work for high grades in those courses which will better your judgment and knowledge of men.

Freshmen, set your goal high, and make each course a stepping stone in the long uphill path to that chosen goal.

OUR IDEALS

TO be of service to the technical students of the University of Minnesota has been the aim of the MINNESOTA TECHNO-LOG ever since its first issue was printed in November, 1920. Our past editors have gained for us a high position in the field of technical journalism—they have given to the engineering students many pages of valuable material—material worthy of any commercial engineering magazine in this country. There has, however, been a tendency for students to pass over this highly technical material in the past few years.

This year will mark a change in the policy of the TECHNO-LOG. No longer will highly technical articles, full of equations, tables, and graphs, be found in the pages of our magazine. We believe that engineering students are already too greatly burdened with technical matter, and that a bit of more interesting material is needed. The TECHNO-LOG will, therefore, give you articles which you will read, not for your own good, but because you will enjoy reading them. We will take you to the far-off corners of the globe, to tell of engineers in difficult but thrilling situations; we will take you into the out of the way places in our large cities, and show you how thrilling an engineering career can be, and we will take you around our own campus to show you that the life of an engineering student is not all work.

We will appreciate your help in making the TECHNO-LOG a real student magazine. Tell us about your likes and dislikes; write us a letter about them, call us on the telephone, or better yet, come into the office and get acquainted with our staff.

« « « SLIP STIX » » »

greetings

In June we said, "Farewell until October." Now we say "Cheerio until next June." That is, of course, assuming that nobody steals ye editor's pants so he can't bring in ye olde tripe. But then anyboy who'd write this hash (and a little scandal if we can get the scent) would probably come to school without his pants anyway. So what?

wanderers

You've heard of the professor who ate a package of frogs and opened his lunch before the biology class, but not very often does a professor really forget to appear before his class. But Mr. Wilcox did. And two days later he appeared with a look on his face similar to that of a dog who has forgotten where he buried his bone. On that day Mr. Miller wandered in with an equally blank look on his face.

Quoth Mr. Wilcox: "Is this my class?"

Gurgled Mr. Miller: "I'll admit I'm going around absent-mindedly."

Mr. Wilcox took charge of his flock; Mr. Miller strode out calculating stresses on memory brain cells.

yes or no?

Engineers can always be agreeable—at least when they don't know what they are agreeing to. One professor suggested to his class that the angular velocity of an angle at the circumference of a circle would not be half as much as the angle at the center if one side was a diameter.

The class immediately agreed: "Noooooo."

"Yes!!!" bellowed the prof.

Moral: Don't be a yes man.

honesty minus

An anonymous person has said that golf is a form of work made expensive enough for a man to enjoy it. Golf is what letter-carrying, ditch-digging, and carpet-beating would be if those three tasks had to be performed on the same hot afternoon in short pants and colored socks by gouty-looking gentlemen who required a different implement for every mood.

After each hole has been completed the golfer counts his strokes. Then he subtracts six and says, "Made that in five."

"After the final hole, he adds up his score and stops when he has reached eighty-seven. He then has a swim, a pint of gin, sings 'Sweet Adeline' with six or eight other liars and calls it the end of a perfect day."

George Washington wouldn't have a chance with this golfer.

just try it

What M.E. instructor, sporting the same name as a famous brand of soup, nailed on his bulletin board the following engine room rules?

1. If you want to know who is boss around here, start something.

2. Be sure and tell the engineer if his engine is pounding, as he would not know it otherwise.

3. Advise him what to do as you will know best.

4. Stay in the engine room as long as you can. The engineer has nothing to do but entertain visitors.

5. Rub your hands on all polished work. It will give some one work and use up the surplus polish on hand.

6. Ask why all the engines are not running. They will be started immediately.

7. If the engineer is busy or making repairs, tell him all about the ball game you saw the other day and if possible get in his way.

8. When you enter the room spit on the floor. We have water, soap, lye, mops and brushes and will clean up as soon as you are gone.

9. Be sure and tell him all you know. It won't take long.

Come again.

these modern gals

"Girls were harder to kiss in your day, weren't they grandpa?"

"Mebbe, mebbe," ventured the old man, "but it wasn't so blamed dangerous. The old parlor sofa wouldn't smash into a tree about that time."

locker room chatter

Explosion!—no, just Moffett hollering — lockers — these damn Chemists — fight to the lockers — between that big bum's legs — climb into my coveralls — underwear shows, but you're an engineer — chew the fat with other late arrivals — everybody gone — Harry! — wink — Rogers — heard this one? — workup time out — back to work — ruined a piece — bum lathe — start another —going fine — what? — quitting time — washing — the liquid lye takes off the skin but leaves the dirt — borrow some soap — clean? — who cares? — who threw that towel? — sock — Ye gods, another day!

That split atom must feel like most of us with our pocketbooks split wide open.

a midnight bath

At what R.O.T.C. camp last summer was a certain cadet officer drenched with four pails of water as he slept at the bewitching hour of midnight. And was it a ghost that the Sergeant saw sizzling by in the dusk ahead of the wetted slumberer?

Senior: You flunked that math course again? How come?

Frosh: Well, what do you expect? They gave me the very same exam again.

those saturday classes

In what Saturday morning class was a discussion waxing warm as to what other day of the week the class could be changed to, when the instructor suggested: "Why not have a Sunday class, and then not come at all?"

The professor scowled at the student.

Student: "You don't expect me to stop cheating, do you?"

Instructor: "No, but you can't smoke cigarettes while writing an exam."

Oh, oh. Time to go swat flies again.

As Bill says, call your shots. Gotta go rassle with the printer.

HERE AND THERE WITH OUR ALUMNI

Architecture

'17—Floyd W. Brown has his home in St. Louis Park, Minnesota, at 2915 Oakdale Ave., and is doing architectural work in the Soo Line Bldg., in Minneapolis.

'21—Milton L. Anderson is an architect in sunny California. Los Angeles is his place of residence, and he now hangs his hat at 1104 W. M. Garland Bldg., during the daytime and at 4635 Brynhurst Avenue the rest of the time.

'31—Milton V. Bergstedt is at Harvard University continuing his study of architecture. During the summer he was working as a draftsman for the Lambert Bassindale Architectural firm of St. Paul. He may be reached through his parents at 1152 Ashland Ave., St. Paul.

'31—LeRoy O. Anderson, who now works as draftsman for the Minnesota State Highway Department, has a very philosophical way of looking at the present depression. He says, "the nice thing about the depression is that as long as it lasts, there won't be another." LeRoy's residence is 2726 Girard Ave. N., Minneapolis.

Chemistry

'11—William F. Cantwell, M.D., graduated from medicine in 1921 and is now practicing General Surgery at International Falls, Minn., the same being his home address. He is a Surgeon Fellow in the Fellow American College of Surgeons.

'13—M. G. Mastin tells us something new. He mentions that he is broke, but still going. Development Engineer for the California Chemical Corporation of Newark, Calif., is what he does for a living. Mail will reach him at P. O. Box 933, Redwood City, Calif.

'27—Edgar G. Anderson writes that he is chief chemist for the Ducktown Chemical and Iron Co. of Isabella, Tenn. Oscar Lee, '19E, Vern L. Kegler, and O. J. Benston are also Minnesota men connected with the company. Lynn Hendry is a free lance geologist in this vicinity.

Chemical Engineering

'97—Herbert C. Hamilton, Chief Pharmacologist for the Parke, Davis & Co., manufacturers of drugs, Detroit, Mich., sends us the note that his work has diverged widely from his education. He has found that unforeseen circumstances and opportunities create havoc with well laid plans even in the best of families. His address is 160 Webb Ave., Detroit, Mich.

'23—Clifford E. Peterson, Chief Chemist for the Riegel Paper Corporation at Riegelsville, N. J. Cliff is a protege of Dan Beard, it seems, for he has twenty live-wire boys in his troop. He indulges in deep-sea fishing now and then, and says he caught some nice flounder and weakfish on his last expedition in Delaware Bay.

'24—Karl F. Paul has production worries. He is production chemist for the R & H Chemical Co., Niagara Falls, N. Y. Incidentally talking about production he says "we now have three children ranging from one to five years of age."

Electrical Engineering

'26—Charles J. Berghs, operation engineer for the Public Service Co. of Northern Illinois, writes to let us know that he was married in 1931 and is now the proud father of Richard Lee, who was born in February of this year. Richard can't walk as yet but he is pretty good with a slide rule already. Charley may be reached at 126 Callan Ave., Evanston, Illinois.

'31 Ex—Page Simpson is dragging suits of clothes around Minneapolis in a Ford truck, for the King Cleaning and Dyeing company. He claims he's married to a young lady down in Menominee, Wisconsin. The evidence is that he spends all his week-ends down there. Simp is staying at 92 West Minnehaha Parkway, Minneapolis, and eating at the White Way Cafe.

"As we stroll down lover's lane—"

'06—George M. Albrecht is mentioned in the preface of a new book, by VanBrunt and Roe, entitled "Rewinding Data for Direct-Current Armatures," as having given assistance in the preparation of those chapters of the book relating to "Frog-Leg" armature windings, the name of the windings being suggested by the peculiar shape of the coils. These windings, which comprise lap and wave windings on the same armature, were developed by Allis-Chalmers Manufacturing Company, Milwaukee, and Mr. Albrecht, at that time patent attorney for that Company, prosecuted the patent applications relating thereto. Mr. Albrecht is now engaged in the independent practice of patent law with offices at 807 Mariner Tower, Milwaukee, Wisconsin.

'28—Lawrence Clousing is also back with the boys, taking Theoretical Physics and a few of the other courses that he was so careful to keep away from in his undergraduate days. Lawrence knows many a tale of excitement and glory concerning the navy, and can tell all about the navy's aircraft forces. His article on aircraft carriers in this issue brings back memories of those days when Larry used to put out the Techno-Log. Many of the boys will remember that he was Managing Editor for 1927-28. This summer he was doing some research in communication and in magneto-striction in the electrical and the physics departments here.

'29—Wesley Gray is back at school again, after three years out in the cruel, cruel world. Wes was at Minnesota all last year, and gained his Master's Degree in June. Now he is taking courses in the electrical engineering and physics departments. Wes worked for some time on the business staff of the Techno-Log during his undergraduate days, and dropped into the office the other day to tell of the struggles and triumphs of the Techno-Log in those days when national advertising just about paid for the printing of our magazine.

Civil Engineering

'07—H. F. Blomquist, who is now superintendent of the Cedar Rapids, Iowa, water works, has made something of a record for on June 1, 1932, he successfully completed twenty-five years of continuous service as engineer and superintendent of waterworks in four municipalities. We congratulate you, Mr. Blomquist, for your record and wish you twenty-five more years of success.

'08—James W. Ash, formerly landscape architect for the American Horticultural Company of Des Moines, Iowa, has now gone into the contracting business, and says that being in business for one's self is very interesting. Mr. Ash is at home at 1535 W. 11th Street, Des Moines.

'21—H. A. Barber is living in Springville, California, and is building flumes in the Sierra Nevada mountains for the Southern California Edison company.

Mechanical Engineering

'00—Lewis Ashbaugh writes that he is now a consulting engineer. Lewis has been engaged largely in mining work, making examinations and reports for financing. His home and office are at 1635 Court Place, Denver, Colorado.

'09—Charles B. Beery is still in Minneapolis. He has now risen to the position of President of the Prudential Co. of Minnesota. His home address is 420 Morgan Ave. S., Minneapolis. The Prudential Company is located at 1700 Portland Ave.

'30—William F. Barstow was married recently to Jane May Barrett of Minneapolis, and is living at 3536 Emerson Avenue S., Minneapolis. Bill is Sales Engineer for the Minneapolis Honeywell Regulator company.

AROUND THE CAMPUS

Chemistry Faculty Tells Fish Stories

A summer replete with conventions, high golf scores, and big fish was enjoyed by members of the faculty of the school of chemistry. The national conclave of Alpha Chi Sigma, chemical fraternity, was attended by Dr. Charles A. Mann, head of the department of chemical engineering. Incidentally, it might be said that Dr. Mann failed to shoot better than a 93 in golf. A new set of clubs was responsible, according to Dr. Mann. The Denver convention of the American Chemical Society, held in August, was attended by a large group from Minnesota. Papers were presented by Drs. Lind, Livingston, Smith, Glockler, Gortner, Bailey, Sandstrom, Reyerson, Wilson, G. W. Smith and Aronovsky of the University of Minnesota. In their less serious moments the delegates visited such places of interest as Coors Porcelain Co., where free beer was served, and the U. S. Bureau of Reclamations, where a four million pound tensile strength testing machine was seen in operation.

Dr. Brewer spent a part of his summer making a survey of Twin City motor gasolines and co-operating with Dr. Barber in experiments to determine the value of certain commercial soap powders.

Dr. Geiger, whose knowledge of fish has made many a class in analytical chemistry extremely interesting, spent part of his vacation on a camping trip north of Lake Superior. The remainder of the summer, better to be forgotten, was wasted in trying to teach Dr. Sneed the art of muskie fishing.

It seems that Dr. Sneed had a strike, a vicious strike, and as all good fishermen would have done Dr. Sneed reeled in. To the side of the boat came the fish—without a struggle.

"Wait until you see the white of his eyes," whispered Dr. Geiger, "then do as I said."

Dr. Sneed complied—in part. He saw the white of the muskie's eyes. All of the doctor's rational impulses became submerged in a sea of glorious imagination. He shot out with his hand, seized the line, and yanked. So did the muskie, and the Sneeds had sunfish for dinner. Dr. Geiger then repeated his lesson on the use of the gaff in muskie fishing.

George Lorenz, assistant in inorganic chemistry, also went fishing, but in a big way. George spent his vacation on a fishing schooner plying between Norfolk and Charleston. One hundred thousand fish was not at all unusual for a single haul.

John Beal, assistant in chemical engineering, and Don Fuller, Shevlin fellow, made a canoe trip into the wilds of Northern Minnesota and Canada during their vacation.

Mechanical Engineer Is Captain of Gym Team

Don Rollins, M.E. '32, is culminating an active athletic and scholastic career this year as captain of the Minnesota gym team. His athletic prowess has gained him recognition as one of the foremost gymnasts in the Big Ten. In the past three years of his activities, he has gained many honors, including seventeen first places in intercollegiate competitions.

In the spring of last year Coach Ralph Piper awarded Rollins his personal trophy as the most valuable man on the Minnesota team. He also was recognized by the administration as one of the six foremost scholar athletes in school last year.

Rollins' scholastic ability has also gained him the vice presidency of Pi Tau Sigma, honorary mechanical engineering fraternity.

We Apologize

The Minnesota Techno-Log wishes to call the attention of its readers to an error in the June issue regarding the announcement of the winner of the Shevlin fellowship in chemistry. It was reported erroneously in that issue that Erling J. Ordahl received the honor.

The announcement should have stated that Donald Fuller received the Shevlin fellowship in chemistry, and that Erling Nordahl was awarded the Shevlin fellowship in medicine.

Montgomery Publishes Freshman English Text

Mr. Franz Montgomery, instructor in the English department, in his textbook, "Essays in Science and Engineering," has attempted to present to the students a collection of essays which will be of real interest to those who have chosen engineering as their profession. This book is now being used by the freshman English classes in the College of Engineering.

The book is divided into two parts, Orientation and Expository Models. The first part introduces the student to good form in essay writing, and the second division gives different types of essays upon which to model his own assignments.

Mr. Montgomery, aided by other members of the English department, collected the material for the book during the spring quarter last year. At present Mr. Montgomery is in Germany studying for a Ph.D degree.

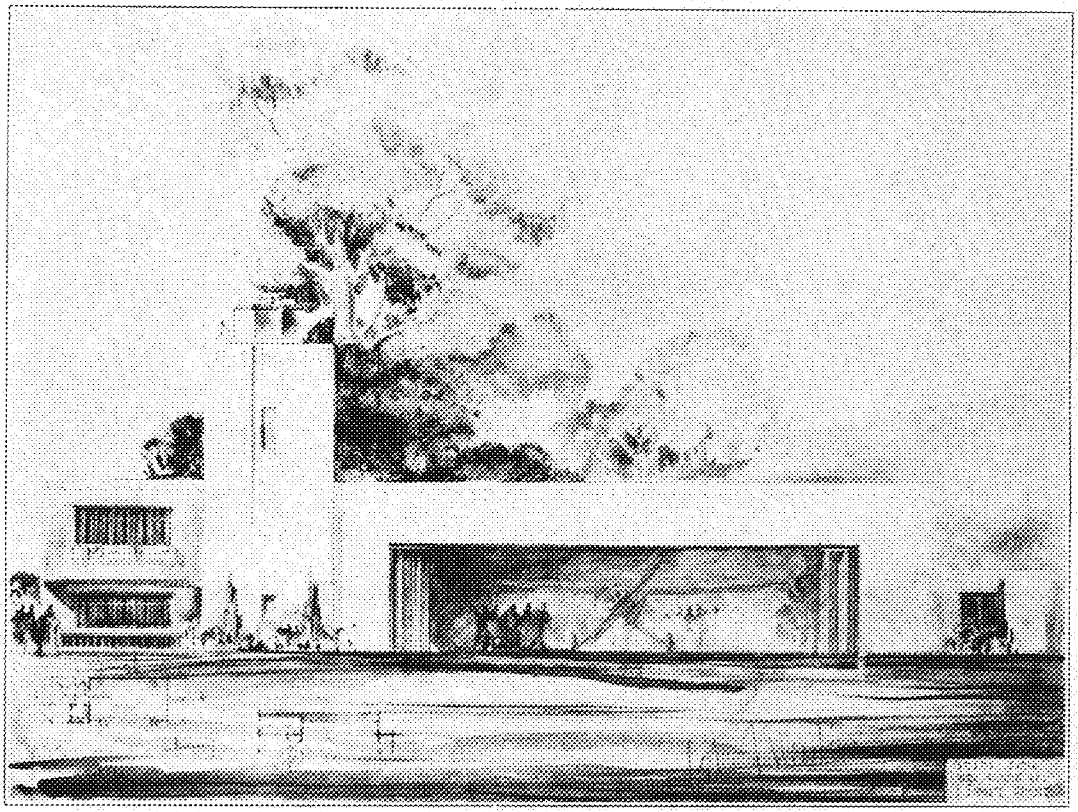
Hovde Returns from Oxford

The Board of Regents recently has appointed Frederich Hovde, '29 Chem., assistant director of the new University Junior College. Mr. Hovde, a former University of Minnesota student and All-American football star, lately returned from England, where he studied at Oxford University for three years as a Rhodes scholar. At the English institution, he won his blue in rugby, and at present satisfies his interest in athletics helping coach the freshman football squad.

Life at Oxford, according to Hovde, differs widely in important respects from that in an American college. There, he says, celibacy is a strict prerequisite to scholastic and intellectual development, and a rigid balance is struck between athletic and scholarly life.

Attendance at lectures is not mandatory, but devolves entirely upon the whim of the student, Hovde states. This freedom from routine makes for intellectual freedom for which Oxford is noted. The school year is broken up pleasantly, consisting of three terms of two months each, with a Christmas and Spring vacation of six weeks apiece, and the usual summer vacation of three months.

WITH OUR ARCHITECTS



A Private Hangar

MARK HAYES

By MARIAN ANDREWS

WITH the starting of a new school year, the architects drag out their T-squares and paint brushes and sigh again for elevators to the third and fourth floors of Main Engineering. Talk starts anew about esquises, sketch problems, the free-hand models, etc., until about the second Wednesday afternoon, when faculty members gather in 320E for the first "Judgment Day."

FRESHMEN have yet to learn the suspense of standing outside the door of that room on notable Wednesday afternoons, perhaps talking with others, but always alert for the click of the latch as the door opens and a pile of problems is handed out. They have yet to experience the thrills and disappointments as problems are grabbed off the pile and hung up. "How many mentions?" "Who came out first?" "Where is mine?" "If I got another Con. . . ."

IT is for these freshmen, and all engineers interested in architecture, as well as for the upper classmen in the department, that this page is written. We ask the cooperation of all of them, not only in the form of "moral support" but also with articles and sketches.

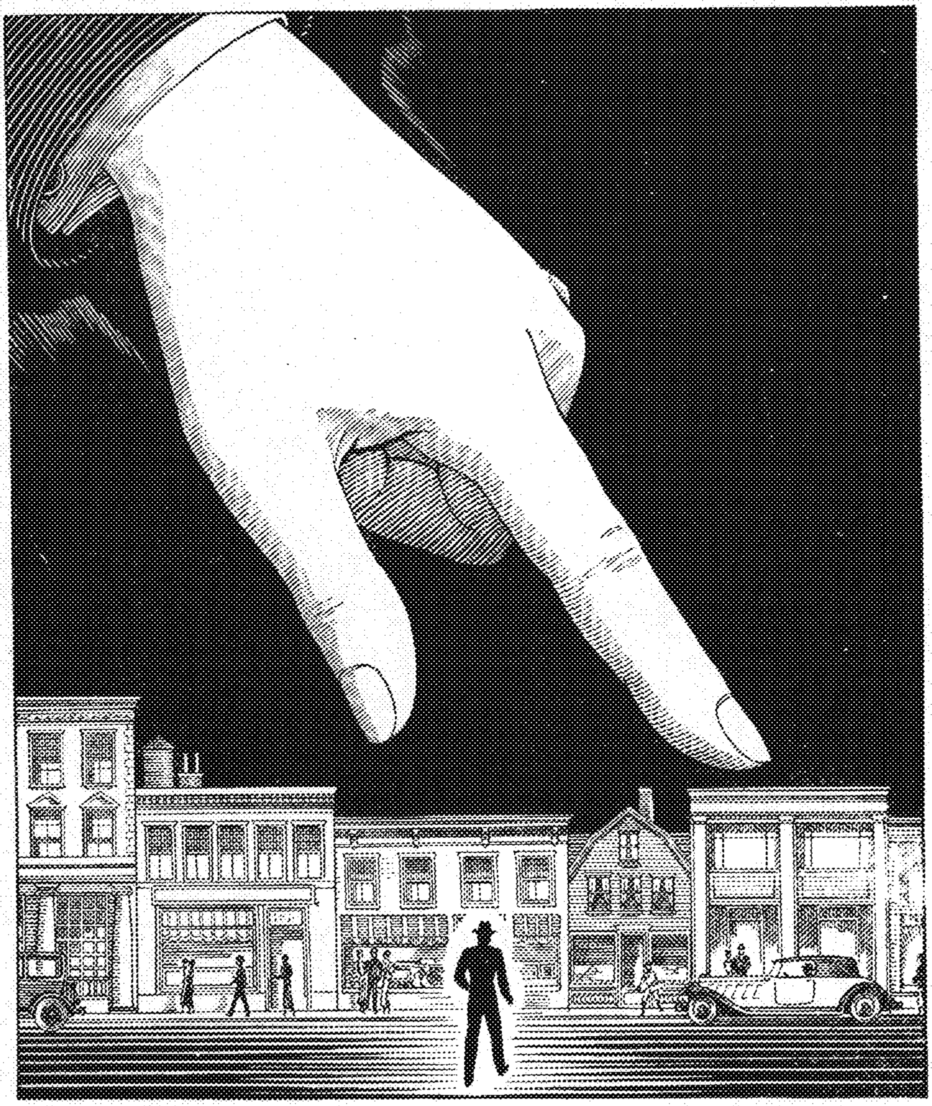
PLANNING MEMORIALS

By DEAN BALL, E. '32

WHEN an architect is awarded a commission for a work of art to be known as a "Memorial," he realizes perhaps more than at any other time the responsibility his fellow citizens place upon him. For he is building in stone a monument to some being, deed, or ideal that will be open broadside to criticism, perhaps centuries of it. He will not be criticized so much for the materials that he specifies for the construction of that memorial but he certainly will be for its character—the story it tells in its graphic way. Beauty, proportion, and scale are all desirable qualities but if a memorial has all these and does not tell its raison d'etre simply and clearly, it is a failure, and it joins the list of works only half done.

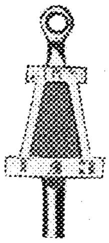
If the Great Pyramid of Egypt did not depict tremendous strength in a centralized rule; if the great Cathedrals of France, such as Chartres, did not tell vividly of the intensely religious character of the community! and if the Goddess of Liberty statue did not give instantaneous welcome and feeling of freedom, these monuments would not interest us today.

The architect of today has all of history behind him to draw from, yet in his own imagination—from within his own soul—must come the picture of a structure embodying all or none of the other arts in its form, that will explain easily the date of erection and express clearly its purpose for being built. The time and circumstances under which the job is assigned to him are necessarily so different for all previous that his personality, living in that age, is allowed more or less free reign in expression of the memorial. And so, necessarily, his plan for it must be far beyond the noblest dream of the layman; practical influences of cost and effort must be temporarily laid aside and he conceives, secretly hoping that his employers, the building committee, will not curb his dream nor even wish to compromise.



AROUND THE CAMPUS

Tau Beta Pi



Tau Beta Pi is a scholastic all engineering honorary society that is known and respected wherever engineers may be. Student officers of the Minnesota chapter are: president, Archie Japs; vice president, Don Leslie; recording secretary, Fred Baumann; treasurer, Associate Professor Elmer W. Johnson; corresponding secretary, Benjamin Axilrod; associate Bent editor, Samuel Levy.

Aeronautical Club

Actual flight training for aeronautical engineering students was discussed at the first meeting of the Aeronautical engineering club which was held October 7th in the main engineering auditorium. Thurman C. Erickson, acting chairman of the club, asked that the club be increased to thirty members and be limited to aeronautical engineering students who want to receive flight training.

Prof. Ackerman, head of the aeronautical engineering department, and Mr. Barlow, instructor in the department, are advisors of the club. Election of new officers will be held sometime in October.

Zelner Sets Oct. 22 for Frosh-Soph Scrap

On the afternoon of October 22nd the sophomores will have their annual opportunity to avenge their just as annual defeats at the hands of the freshmen. So far as anyone can determine, the sophs have never decisively beaten the frosh, although last fall the second year men very nearly triumphed.

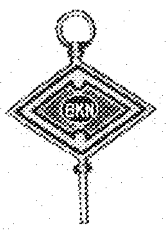
Events of the afternoon include the "burlap bag battle," which this year requires pull rather than push; "jousting" or "tournament"; the "greased pole," which, by the way, involves not a vertical but a horizontal pole, the antagonists sitting astride and each endeavoring gently but firmly to knock the other off, using a padded club. "Push Ball" is also on the program, as is the "tug of war."

The "tug" is usually a decisive factor in the scoring, and is very popular with the winning side. A stream of water from a fire hose crosses the center of the rope at the beginning of the "tug," and the winner must pull the other side completely through the water.

A score board shows the relative standings of the sides as the games progress. Class spirit runs high; partisan spectators are tempted to join in the scrap when things look bad for one of the sides. It is great fun—to watch!

Frosh and sophs declare a truce for the evening, as they shout and cheer in their annual snake dance through the downtown district. The evening's celebration ends up at the Gayety theatre, where doors are thrown open to all who show signs of participation in the afternoon scrap. The management of the theatre wishes to announce that this year all engineers will be searched for stray tomatoes and eggs, before they will be allowed to enter.

Eta Kappa Nu



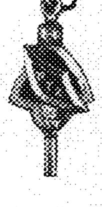
Eta Kappa Nu, the electrical engineering honorary fraternity, bases its membership on scholarship, character, and leadership. The familiar Wheatstone Bridge emblem on the key is known throughout the world today by electrical engineers.

Officers for this year of Omicron chapter, the Minnesota chapter of Eta Kappa Nu, are as follows: president, Ray Milner; vice president, John Hancock; secretary, Jay Mangan; treasurer, Jerry Shepherd; corresponding secretary, Robert Haxby; associate Bridge editor, Laddy Markus.

A. I. E. E.

Paul Erickson presided at the first meeting of the student chapter of the American Institute of Electrical Engineers on October 12. Fred Hovde, faculty member and Rhodes scholar, gave a very interesting and informal talk on his impressions and experiences while a student at Oxford. The committee chairmen and Professor Kuhlman gave several short talks on the plans for the year. The meeting was concluded by a two reel comedy and refreshments.

Pi Tau Sigma



In the annual election o Pi Tau Sigma, honorary me chanical engineering frater nity, which was held las spring, Donald Leslie wa elected president. The othe officers elected were Donald C. Rollins, vice president George Graetz, treasurer, and Roy King corresponding secretary.

Technology Lectures Begin

IN the first of a series of lectures give to students registered in Mechanica Technology, Mr. Harry E. Gerrish, '05 President of Morgan and Gerrish, Heating and Ventilating Engineers, gave a informal talk covering the qualities necessary in an engineer for success in the engineering field. He stated that only those people who today use initiative who use new methods in manufacture and sales, who modernize old and inefficient equipment, will come out of these times successfully.

The great majority of engineers are in the business branch of enginering today. These men must have training in psychology, in politics, in public speaking, and in salesmanship. Every engineer has to sell himself many times during his life, if he is to succeed.

In the second talk of the series, Mr. Charles Hatch, referee for the Industrial Commission of Minnesota, presented a picture of conditions in Minnesota with regard to the employer's compensation laws. Mr. Hatch cited the great number of accidents where some form of compensation is necessary, and showed that a form of compensation insurance is necessary for any large industrial plant. He strongly urged that responsibility be clearly fixed within any organization if accidents are to be a minimum.

The compensation laws of the State of Minnesota provide on an average a greater compensation for injury than did the old common law settlement of accidents, according to Mr. Hatch, and in addition eliminate all the court delays and lawyer's fees incident with the settlements. Where permanent injuries to employees occur, the amount of the award is set by one of the four referees of the Industrial Commission.

The Minnesota Union
University of Minnesota
October 18, 1932

Engineers, Architects, and Chemists:

Committee meetings at the noon or dinner hour are a nuisance—but not when served by the new Union staff in the charm of the Spanish Room—or the quiet of the Colonial Room—or the modernly progressive atmosphere of the Russian Room.

Those who knew the Union last year will be greatly surprised by what the summer has done. Everything is changed and every change is for the better—a pleasanter, more serviceful Union. Lounge—study—billiards—soda fountain—barber shop—and such a cafeteria—at your service.

Those who are new to Minnesota expect the best—and at the Union they will get it.

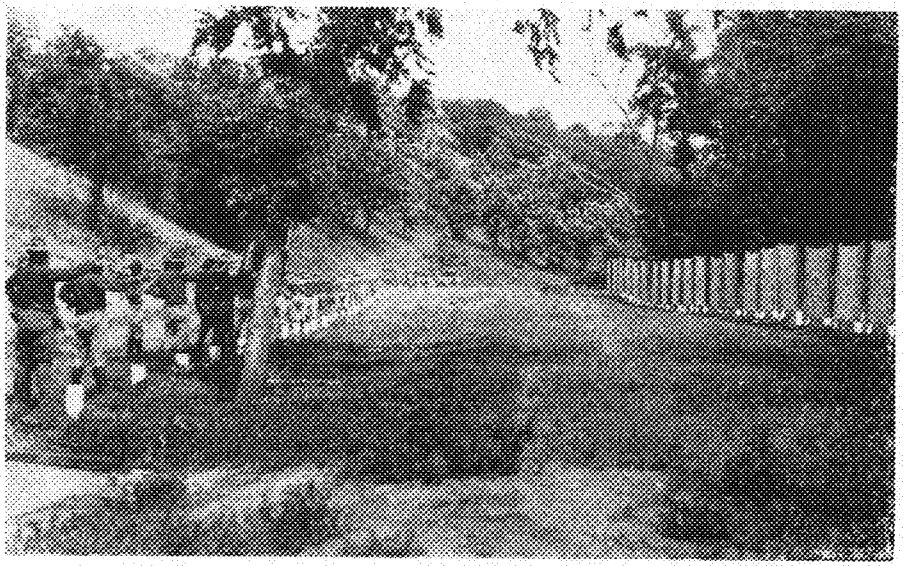
Listen to broadcasts—chat with your friends—carry out extra-curricular activities—read—study—take advantage of *your* Minnesota Union.

A cordial welcome to all.

THE MINNESOTA UNION BOARD OF GOVERNORS.

A LETTER TO BRIGGY

(Continued from page 10)



Target shooting among the beautiful trees and hills of Fort Snelling was a real pleasure

pole climbing contest, the "pole descending contest" was undisputably won by Gadler, who came down a telephone pole in almost nothing flat. Several pictures of the event are on display at the "studio" of the writer. Your photographer was caught napping and missed what might have been some very good shots of Hanscom "burning" the pole.

The periodic dances and boxing matches were fully enjoyed by members of the Signal Corps, but as the boys spent most of their time and all of their energy in fighting among themselves, a lot of good boxing talent went to waste. However, although none of our boys appeared in the ring they made frequent appearances on the dance floor. Among the most successful "lady-killers" were Hanscom, Hammond and Jerome (Bugs) Baer. Steve Gadler monopolized a dizzy looking blonde throughout the entire camp period. (You're entirely correct, Steve couldn't scare up the hush money.)

During the week of the Fourth, a mimic battle was staged in the barracks each night, firecrackers being the chief weapons, although fists and feet not infrequently augmented. The only casualties were several badly frightened men, and one shoe which was blown to bits. Peace was restored in the camp after a surprise attack, staged by the officers, caught the fellows off guard about midnight one night and resulted in the loss of all munitions.

One particular case of great injustice occurred when Erickson, upon entering the barracks one night was greeted with a pail of cold water from above. As we know of nothing which poor Paul had done to deserve such treatment, we conclude that the pail was really meant for someone else, but Paul unfortunately got there first. Lieutenant Schorr was another victim of misfortune, and is still nursing bruises obtained when he tripped over a broom which someone had "accidentally" placed between two cots. Let this be warning to the guilty person, as Schorr still has "blood in his eyes."

Privates Gadler and Krauch won the "favor" of the camp over the Fourth of July. It seems that these two boys not having lived up to the required standards, were forced to remain in camp over the Fourth while the rest were on a brief vacation. Upon returning to camp the next day, the rest were much "pleased" to find all the cots piled in one corner, all the mattresses and blankets in another and all the shoes in still another. Gadler and Krauch, of course, pleaded not guilty, and were acquitted for lack of evidence—not however, without many harsh looks, and harsher thoughts.

Gadler was again on the black list at the time of the overnight hike, this time accompanied by Westover. This time, however, they were under close watch, and succeeded only in getting themselves the job of digging the company latrine at the camp. Boy, was the weather hot that day! Fortunately the weather is one thing which affects the officers as well as the men, so there was no work until evening when a mimic battle was staged.

A most amusing event occurred one evening when Private Nuffer was scheduled for guard duty. Captain Minkler personally took him out to explain his duties and the location of his post. "Your post," said Captain Minkler, "Extends from the corner of this building to that red light over there." Private Nuffer then proceeded to walk his post. When the guards had all turned in at midnight, Nuffer was missing. The morning came, and at breakfast Nuffer was still missing. The entire day passed and still Nuffer did not appear. Two days later Nuffer limped slowly into camp, and was immediately spied by Captain Minkler. Said the Captain, "Where the h— have you been?"

"Well," replied Nuffer, "You told me my post was between the corner of the Post Office building and a red light, and I didn't discover until I passed through Duluth that that light was on the back of a truck."

Well, Briggy, if I survive the publication of this I'll take out another life insurance policy and write some more later.

Lovingly yours,

PRIVATE PHILIP KING.

Fall Quarter Engineering Enrollment

	Fr.	S.	Jr.	Sr.	Total
Electrical Engineering	49	96	86	60	291
Civil Engineering	55	61	59	41	218
Chemical Engineering	57	63	74	47	241
Chemistry	29	34	36	28	127
Architecture	22	40	25	22	110
Architectural Engineering	3	13	7	14	37
Mechanical Engineering	42	70	61	47	221
Aeronautical Engineering	46	64	43	33	186
Agricultural Engineering	3	12	6	4	25
Eng. Pre-Business	28	18	2	1	49
Interior Architecture			4	7	11
Total	334	471	403	304	1,512

AROUND THE CAMPUS

Engineering Receives Large Research Fund

Through a bequest from Major Max Toltz of St. Paul, who died January 11, 1932, the Engineering Experiment Station is to receive its first permanent endowment for the support of engineering research, amounting to $15,000. This is an event of epoch-making significance in the history of this College.

According to the terms of the bequest, the principal sum will be invested and the income only will be available for expenditure from year to year. The provisions are very flexible and the money may be used for fellowships or scholarships, assistance, supplies, or apparatus. Unexpended balances may be carried forward or added to the principal of the fund.

The establishment of the Max Toltz Research Fund in the Engineering Experiment Station will perpetuate his memory forever in this College and in the University in a manner which will provide continuing contribution to the advancement of knowledge in the profession to which he was devoted and which he so creditably and honorably represented.

Madaras Wind Rotor Withstands Hurricane

Professor John D. Ackerman, head of the department of aeronautical engineering, and his Madaras wind rotor tower successfully rode out a hurricane this past summer. The shanties about the construction field were damaged but the wind driven electric power plant escaped all injury.

The twister came up a narrow section of the Delaware river valley and damaged everything in its path. The wind, rain, and dust was so thick that Mr. Akerman, who was only two hundred feet away from the rotor and entirely outside of the path of the storm, could not see the tower. Mr. Akerman was working on the tower and looked up and saw the storm coming. He dropped everything and ran for cover but was only about two hundred feet away when the storm struck. So restricted was the area covered by the twister that as close as he was to the tower he was entirely out of the path of the storm. Mr. Akerman said that the dust and rain, followed by the rain was so dense that it completely enveloped his rotor tower and hid it from sight.

The Madara Rotor Tower is designed by Professor Akerman and it is proposed to capture the wind and generate electric power. It is entirely in the experimental stage of development as yet, but there is a great future for the machine, according to Mr. Akerman.

Each tower has capacity to generate one thousand kilowatts and fifty such towers constitute a plant, making the output of each plant fifty thousand kilowatts. The chief advantages of this new design are that it produces much cheaper power, has a lower cost of upkeep, and gives a steadier output of power than even a steam plant.

« « MENTAL TILTS » »

OUR Mental Tilts column reappears once more in the pages of the TECHNO-LOG, after an absence of many months. There is a little story connected with the sudden disappearance of this column that might be of interest now. Some of you may remember the puzzle "Bug Velocity" in the February, 1932, TECHNO-LOG—last year's editor certainly does. All went well with the puzzle until the time came to print the answer—but where was the answer? George couldn't work it, the staff couldn't do a thing with it, and even versatile Steve Gadler, who can do everything else, couldn't make head or tail of this little bug sliding down a chain. Worst of all, no one knew where the puzzle came from—and so endeth our tale, and Mental Tilts for the year 1931-32.

GOLD DUST

It seems that three miners became tired of moving the Black Hills in their search for gold-bearing sand, and decided to return to the cities. Their pannings just happened to fill a 24 ounce box, and there were three other boxes laying around the camp. These three empty boxes held five, eleven, and thirteen ounces of gold respectively. Now how did these miners, who, by the way, were all Tau Betes, divide their gold into three equal portions?

A FARMER'S NIGHTMARE

And now for an adventure in agriculture, dear disciples of St. Pat. Just a few weeks ago, a shrewd farmer who was a former Phi Beta Kappa decided to take advantage of the current low prices on livestock and stock up his farm. The Rural Credit Bureau obligingly lent him \$500, so he went to the market and bought eighty animals. The horses cost \$20 each; the cows cost \$8 each; the sheep were practically given away at \$3 per head, and all he had to pay for a fat pig was \$2. Now if the number of horses and cows was two more than the number of sheep, just how many pigs did the gentleman buy?

HEADS—YOU WIN

In days of yore, would-be engineers could often be observed tossing pennies in the air, in the out of the way corners of our dear old engineering buildings, and it is rumored that last year's high mucky-mucks in room 37, Electrical building, even tossed their pennies at a crack in the floor. Our last puzzle will, then, tell you how to make a fortune merely by flipping a coin a few times. Set up a table up in Main Engineering, grab the first prosperous engineering grad that comes along, and get him to flip a coin. If at the first flip heads are up, pay the gentleman \$1, but if tails show, give him another chance; if he gets heads on the second flip, give him \$2, and likewise another chance if tails appear; give him \$4 if he gets heads on his third trial, and another chance if tails come up, and so on, with the customer's prize increasing with each trial as follows: \$1, \$2, \$4, \$8, \$16, \$32, \$64. . . . Of course, you must charge the customer a slight sum for the chance to play with you, so here's the question: How much should you charge the customer in order to break even in the long run?

The Minnesota Techno-Log will give a credit slip good for \$2.00 in goods at the Engineer's Bookstore to the first student who turns in to the Techno-Log office the correct solutions to this month's Mental Tilts. Faculty members are asked not to aid anyone with these puzzles until the name of the prize winner has been posted on the Techno-Log bulletin board. Answers will be published next month.

AIRCRAFT CARRIERS

(Continued from page 7)

jolts of tails and wheels on the deck. Rubber shock absorbers as used on earlier models gave the effect of rebound to any airplane that landed hard. This rebound resulted invariably in damage to an airplane, in that while the airplane was up in the air on the bounce it would be slowed down by the arresting gear. Then having lost the lift of the wings it would hit the deck hard enough to cause damage. Air and oil or spring and oil shock absorbers as are used on many commercial airplanes have provided means of overcoming hard landings without much rebound.

As a matter of safety to personnel and to a lesser extent as a matter of saving material a method of floating a landplane forced down at sea must be available on each airplane, as operations are at times conducted several hundred miles from land. Such equipment has been devised and placed on carrier airplanes. By a pull of a handle a pilot can open the valve of a cylinder of compressed carbon dioxide. This carbon dioxide operates the bag container releases and fills two large rubberized fabric bags, one on each side of the fuselage, thus keeping the airplane afloat.

One of the late types of carrier airplanes, it being less than two years old as a type, is the "Helldiver." Design features of this airplane, in addition to those mentioned above which are brought out primarily because of its carrier use, are an inertia electric starter, a very narrow landing wheel tread, brakes, and generous sized hand hole grips at the wing tips. It is very strongly constructed.

The value of the electric inertia starting equipment lies in the elimination of personnel from the cranking of airplane engines. This eliminates much confusion and hazard to men during the time of operations on a deck in which airplanes are crowded as closely together as whirling propellors will permit. Motors can also be started faster.

With the split type of landing gear that must be used in order that a large bomb or smoke chemical tank can be carried directly under the fuselage the narrow landing wheel tread is best for strength. Wheel brakes simplify tremendously the handling of an airplane after landing on a deck, the brakes effectively taking the place of four to six men otherwise needed on wings in order to guide an airplane rapidly up the deck. Grips in the wing tips aid the work of such men when they are needed.

As the function of the "Helldiver" airplane is that of light bombing in addition to that of observation, it has been constructed strong enough to withstand 10,000 foot vertical dives for dive bombing. Dive bombing is particularly suitable to small airplanes such as are most efficiently handled aboard a carrier, and also is the most accurate method of bombing. This is a great asset when the bombing target is as small an item as a ship.

In major features the "Helldiver" is

(Continued on page 28)

(*Continued from page 27*)
similar to the conventional design of a military plane. It is a biplane. The upper wing is staggered forward as the center to give the pilot and observer a better view and also to increase the airplane stability. Wings are of wood and fabric construction. The fuselage is novel in that it is constructed of duraluminum tubing, all pieces of which are fabricated by riveting. A well equipped instrument board, navigation lights, a locker, map carrying cases, adjustable seats and rubber pedals, in addition to other minor conveniences to the military pilot round out the equipment.

Facilities are provided for installing radio receiving and sending equipment. Fixed machine guns can be installed in the wings to fire just outside the track of the propeller. Free machine guns may be mounted on a scarf ring in the rear cockpit. Bomb racks may be mounted on either wing or under center of fuselage.

All in all the designing of an airplane for carrier use brings up many problems not ordinarily thought of. Good for ward visibility to the pilot is importan as is every practical contrivance for sav ing space, so that on a given deck mor airplanes can be carried. On large bomb ers folding wings are incorporated as a space saving measure. For large air planes the additional operation involved by the crew in folding the wings is war ranted. For small airplanes, as the "Helldiver" (which does not seem smal compared to many airplanes), such an additional operation does not seem to be warranted in that not much space, if any can be saved. Furthermore, the quickness with which their use may become necessary with the carrier at sea in time of war demands that they be ready to fly instantly.

Space saving is effected to a large extent in design by the use of biplane structure, making the lower wing span as great as the span of the upper. A monoplane for the same lifting qualities as the biplane would require a longer span and consequently more deck area. Also the airfoil section having highest possible maximum lift, taking into consideration other factors, is used, thus enabling some decrease in span. A larger chord and decrease in tail length are also helpful in space saving.

Much advance has been made in this relatively new arm of the Navy since the aircraft carriers U. S. S. Saratoga and U. S. S. Lexington were placed in service in 1927. With continued development of both military and commercial aviation it will be interesting to see what changes will take place in Navy aircraft carrier operation in the next ten to fifteen years.

THESE FRESH FRESHMEN

(Continued from page 14)

throughout, even though it be so delicate and complicated as to produce the morning-glory in cast iron.

Do Freshmen Ever Think?

To set the freshmen thinking for themselves, which in itself is starting them off on the right foot in a collegiate career in contradiction to the "hand led and spoon fed" type of training to which they previously have been subjected, an impulse is given by asking them to observe closely the bronze Pillsbury statue at the west side of the knoll, and that of the Spanish-American War veteran across the street at the front of the Armory building. They are requested to ponder on how the foundryman removed such a complicated pattern from a sand mold. This assignment is given to ascertain if there will be seen any connection with the same basic principle involved in producing the morning-glory casting and a bronze statue. In the latter case the "cire-perdue" or lost wax process may be employed. However, they are reminded that these bronz statues are not as complicated as they appear on casual observation, since they usually are made in sections and the joints fitted so perfectly they are not perceptible unless a close inspection is made.

The inexperience of freshmen has brought forth many ludicrous situations and happenings. A selection of these now will be presented to the reader in the hope that they indicate what may happen when a foundryman attempts to operate his shop with all of his help of the untrained type. Of course such situations must be viewed with tolerance. The freshman's viewpoint and capacity is limited. He is without the experience which develops mature judgment and mechanical insight. If he possessed these qualifications there would be no need for him to take the course.

A Vesuvius of Molten Iron

On one occasion the freshmen who were in the class at the time a shop full of molds was poured, were given a glaring and conclusive example of what will happen when steam becomes pent up in a mold. After pouring cast iron at a temperature of 2400 degrees Fahrenheit into one of the molds, it let go like a Vesuvius. Of course the freshmen obeyed that first law of nature—self-preservation—and made hasty, headfirst exits through the open windows that early October afternoon. While the instructor was attempting to calm the two pupils who had poured the mold that became a volcano, he was distracted by a commotion across the shop. On looking around he was dismayed to see two other pupils with another ladle of iron, most of which had been spilled on the floor,

(Continued on page 30)

THESE FRESH FRESHMEN

(*Continued from page 29*)

dancing in the hot metal while attempting to go into the office with the ladle and what little molten iron there remained in it. When asked: "What on earth happened to you?" the boys replied that the fellows who dove through the windows had gone in a straight line to safety, and since they happened to be standing in their path the collision that caused them to spill the metal was inevitable.

The Blast Furnace Stampede

One incident which brought more laughter than any other from students and instructor, too, occurred one day when metal was to be poured. The class had been on the charging platform to be shown how a cupola furnace should be charged with coke, flux, and iron. After starting the fan blower, which at that time was located on the charging platform, the instructor with the class at his heels descended the stairs to the foundry floor only to be confronted with the unbelievable paradox that with the cupola blower humming away merrily no air blast was entering the furnace. While the instructor stood puzzled in the real of the furnace the freshmen gathered around him innocently ignorant as to an explanation. As quickly as he could recall that a class in mechanical engineering a few days before had shut the blast-pipe gate while running a test on the blower motor, the instructor instinctively reached up and pulled out the gate. Instantly the inquisitive faces of the freshmen were filled with dust, sparks and flame forced out through the open slag hole. The first year men reached a hasty, false conclusion that the bottom had blown out of the furnace. Then came a scene of pandemonium when all of them tried to escape at once through an open door just back of the furnace, many of them did not have even an opportunity to turn around, and were bowled over backwards by the onrushing, terrified front columns. After they had rushed pellmell outside and had regained their poise, all the breath the instructor could gather amid his tears of laughter was used to say: "Boys! Now that you have received your first baptism of fire no doubt you will be able to handle the molten metal without flinching."

Green Sand and Freshmen

Often freshmen who have had a blackboard course in molding practice before they get to the course at the University possess humorously, and to a foundryman pathetically, confused ideas about green sand. Some think that the descriptive adjective refers to the color of the sand. The instructor is able to easily and quickly clear away this erroneous conception when he tells his proteges that metal cast into a green sand mold is poured into one of sand in the damp condition and not into a mold made of Paris Green. But this is graciously overlooked because the freshmen will be the seniors of tomorrow. The writer, too, was once a fresh freshman come from a small town to the complexities of a great university in a busy city.

AT THE MINNESOTA STATE FAIR

(*Continued from page 5*)

but on the circular track at the fair, it isn't safe to go much faster than fifty miles per hour in the rocket car.

Here, you fellows, quite playing with that rotary switch, and listen to the gentleman. Sig Haugdahl has already started on his plans for a newer and larger rocket car which he will construct in his own machine shop at Daytona Beach, Florida. This car will use a liquid fuel having 250 times the explosive expansion of nitro-glycerine, but the fuel will be controlled from the dash board, making the car practical for ordinary driving. With this car Sig expects to show that rocket propulsion may be made practical, and at the same time he hopes to break the world's speed record for racing cars. The present car was built entirely by Mr. Haugdahl in his shops at Daytona Beach. The shiny metal covering formed entirely by hand of sheet aluminum, testifies to Mr. Haugdahl's skill as a mechanic.

At present rocket cars are a trifle expensive. This first model represents an expense of around $16,000 for materials alone and each one of the thirty-two rockets costs $10 to make. So important is the quality of each rocket to the safety of the driver that Sig trusts nobody but himself to make the rockets. If through careless handling or severe temperature changes a crack develops in the firmly packed powder of the rocket, then when the fuse is lighted, the rocket would ignite right down the crack, and the entire rocket would explode at once with the force of an artillery shell. Down at Davenport, Iowa this summer, one defective rocket exploded before the grandstand and set off nine more rockets at once, blowing the whole tail of the car apart. Only the heavy metal partition between the rockets and the driver's seat saved Mr. Haugdahl from serious injury. Minnesota state fair visitors had a thrill at the last demonstration of the rocket car here, when one of the rockets blew up in the same manner, with a terrific noise and flash of light.

Now that we know enough about a rocket car to make one ourselves, let's move along to Machinery hill. Listen to the noise those tractors are making, and look at the road machinery over there. We're not going to be farmers for a while yet, so here goes for the fish and game building. Look here, boys, doesn't this fish remind you of a zeppelin? See how slowly it moves its fins, how gracefully it glides through the water, and how smoothly its sleek brown body bends as it turns around. I'll bet they modelled the Akron after a sturgeon just like this big fellow. And look at these other beauties in the next tanks. Engineers are just as interested in fishing as anyone else, aren't they, boys?

On to the television show, for we must see what a televised picture looks like. We'll go right up to the transmitter and have the operator explain the works. First there is a strong tungsten bulb operating on 32 volts, and focused through a series of lenses to shine through 60 spirally located holes in a revolving

(*Continued on page 32*)

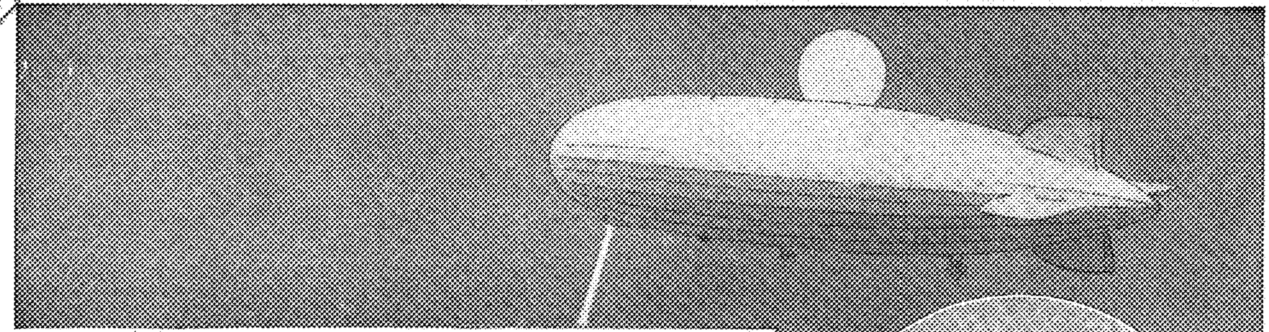
(Continued on page 31)

disc. The light passing through the holes passes over the artist's face and scans it. A bank of eight caesium oxide photo-electric cells in special reflectors catches the light flickering from the face of the television artist, and changes it into electric impulses. The impulses are then built up through many stages of amplification, and are ready to go on the air in much the same manner as sound impulses. Here at the fair, however, electric conditions would not allow any actual transmission through the air, so wires are used to connect the transmitter and receiver. The sound is likewise picked up by a microphone and brought by wire to an ordinary radio receiver. At the television receiver a crater neon lamp changes the electrical impulses into light variations. This varying light beam is focussed by a series of lenses and passed through another 60 hole disc which revolves at the same speed as the transmitting disc. This disc has lenses in each of the holes, which throws the beam of red light on a ground glass screen two feet square. The audience, looking at the opposite side of the glass, sees the television image which is remarkably clear, but has a reddish tint. Faint dark lines are seen crossing the picture when tone is near the screen, but at a distance the television image is very similar to ordinary talking movies.

Well, we've had our first glimpse of television, and have decided that it's something more than a scientific curiosity. Let's wander around in the same building and see what there is to see. There's a funny word — phrenologist — now what or who can that be? And look at that funny jigger standing in the corner — with a hundred claws dangling from it much like an octupus. The young lady says that the machine will measure the bumps on our heads, and then tell us everything we don't know about ourselves. Well, I'd never trust my head in that tangle of machinery, and I don't think you boys want to risk your head for a half a dollar, so let's move along.

There certainly are some real engineering exhibits at this fair. Why, here's the short-wave receiver that was used in New York City to keep in touch with Commander Byrd at the South Pole. It's operating, too, and sending messages free to all parts of the world for state fair visitors. I envy the boys who are running the set, for they have absolute control over the operators of the television equipment. If they turn on their short wave transmitter while the television set is running, then it's good bye picture, and we see what static looks like on a screen. Boys, be nice, and don't make the television gang feed you more than seven times a day.

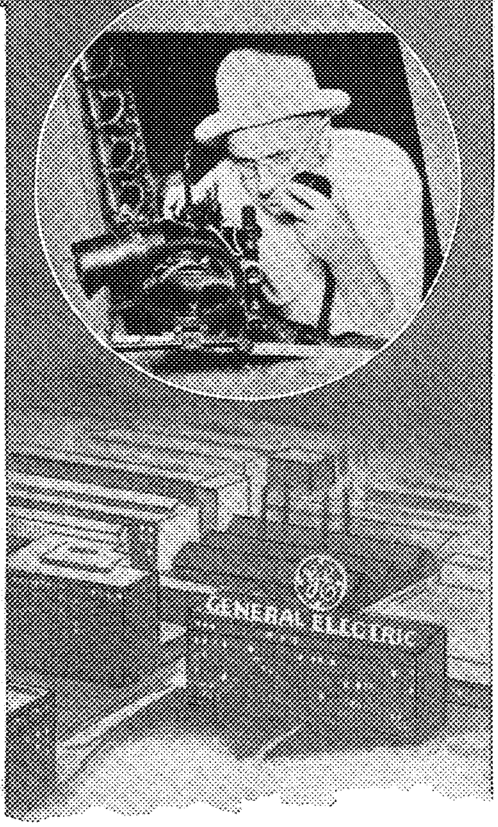
Now for a bit of fun at this fair, for we've learned enough already to keep our heads buzzing. Down to the Midway we go, and pay our money to see the "greatest shows in the world." Doesn't the time fly around the carnival shows? Why, it's time for the night grandstand performance, and we can't miss that and the grand fireworks display. You chemists must come along and tell us just what is in each one of the colored rockets that are shot up in the air, for all I know about pyrotechnics is that you can't hold a skyrocket in your hand and light it.



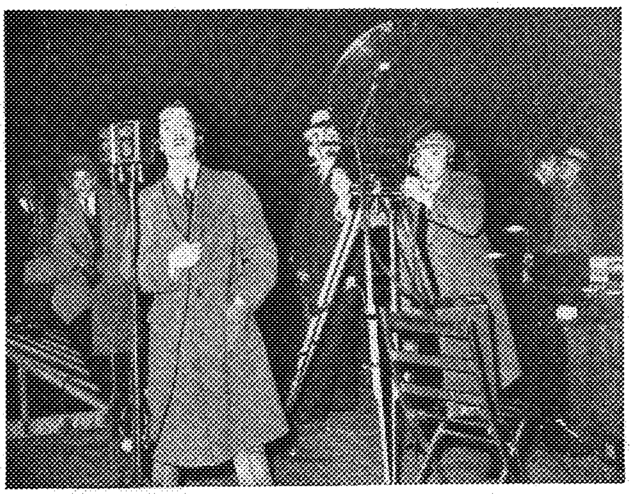
Talking from the sky on a beam of light

THE huge U. S. Navy dirigible, Los Angeles, is roaring above the General Electric Research Laboratory at Schenectady. On board the airship, an almost invisible beam of light is aimed at a 24-inch mirror-target a half-mile below. The mirror, turning as it follows the dirigible's course, catches the slender beam. Voices transformed into electric impulses in the airship are carried to the mirror by light waves. A photo-electric cell picks up these waves and they are reconverted into sound, which is broadcast to the world by radio.

A "voice on the air," with a "voice from the air"—the official opening of radio station WGY's new 50-kw. transmitter is taking place. One millionth of a watt—generated from the blast of a police whistle in the dirigible—is transmitted to the ground on the beam of light and to a Thyratron tube. The tube magnifies the whistle energy 50,000,000,000,000 times to operate the switches that start the transmitter, five miles away.



(Insert) John Bellamy Taylor, General Electric research engineer, operating projecting apparatus



Receiving mirror on roof of General Electric Research Laboratory

Thus was "narrowcasting," a possible means of secret communication, recently demonstrated to Military and Naval experts by General Electric engineers. The future will demonstrate its commercial value. Electrical developments such as this are largely the accomplishments of college-trained engineers. They are leading the way to even greater progress in the electrical industry and are helping to maintain General Electric's leadership in this field.

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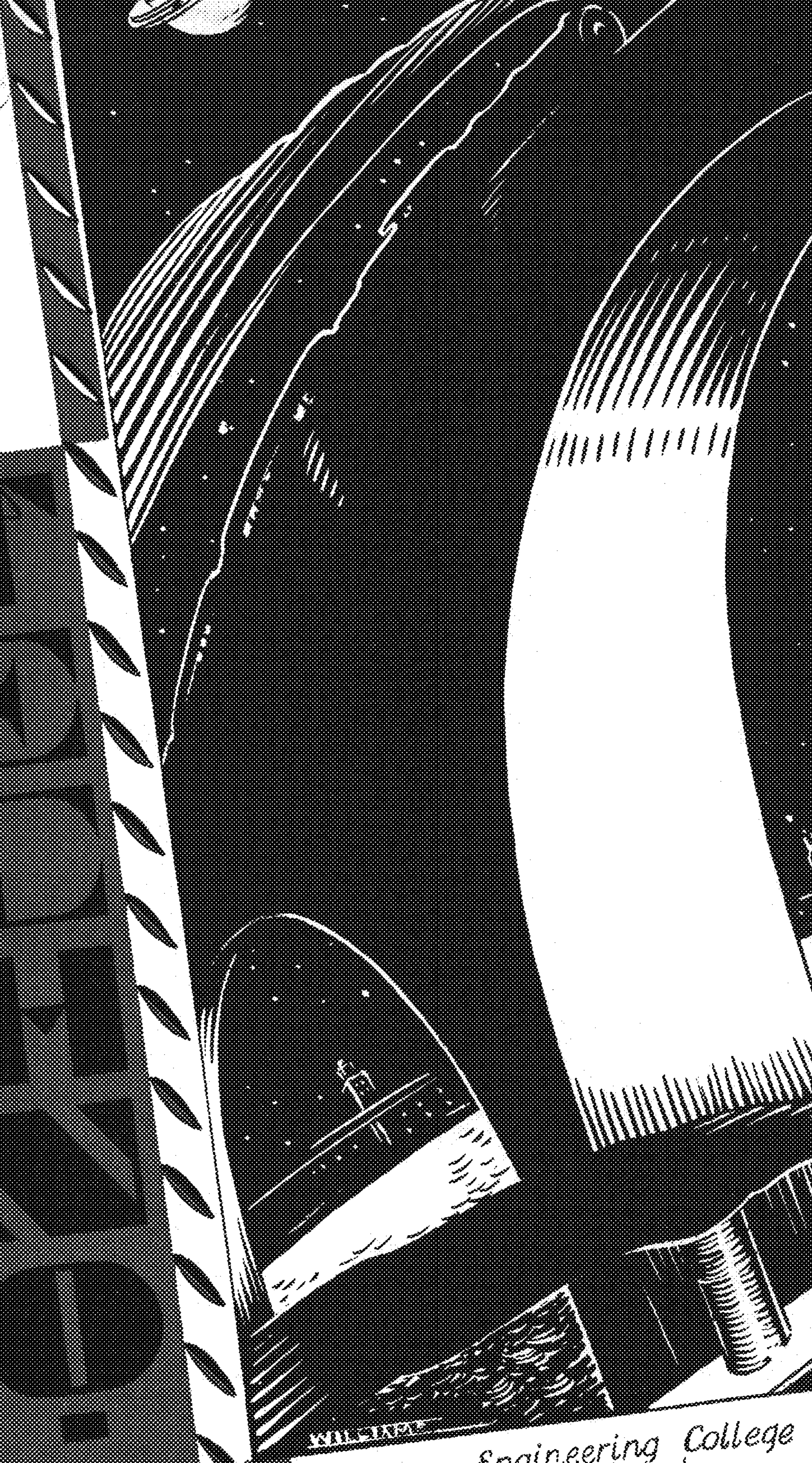
GENERAL ELECTRIC

Minnesota



Member Engineering College Magazines Associated.

NOVEMBER, 1932
Vol. XIII No. 2

NOVEMBER, 1932
VOLUME XIII, NUMBER 2

Minnesota Techno-Log

37 ELECTRICAL BUILDING . . . U of M

Published monthly from October to June inclusive, by the students of the College of Engineering and Architecture, the School of Chemistry of the University of Minnesota

THIS MONTH

NEXT MONTH

Modern high speed newspaper presses will be described by Leo E. Owens, '11M, publisher of the St. Paul Dispatch and Pioneer Press. There will be several interesting photographs of the new presses now being installed in the Dispatch plant.

Music for engineers will be covered by Clayton Evert, '33M, in a story telling all about the followers of St. Pat who are members of the University band and other University musical organizations.

The story behind the Northrop Auditorium organ will be presented by Robert Marshall, E.E. '34. Only the console of the huge organ is in view of the audience, but Bob will take us above the proscenium and explain just how electricity is used in connecting the keys of the console to the many organ pipes concealed above the stage.

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Entered as second-class matter April 9, 1925, at the post office at Minneapolis, Minnesota, under the Act of March 3, 1879. Office, 37 Electrical Building, University of Minnesota. Telephone, Dinsmore 2760. Contents copyrighted and permission must be secured for re-publication. Subscription rate, $1.50 a year. Single copies, 25 cents. Advertising rates upon application. Alumni Directory, 50 cents.

—St. Paul's New City Hall

Station T-E-C-H Broadcasting

The Soph-Frosh Scrap

JOHN HANCOCK, E. E. '33 announcing

BZART — — ! ! crash tzart! zrt tzt! — — "This is station T-E-C-H broadcasting from its powerful transmitter located somewhere in the vast wastes of the great Northwest. In exactly eight and one-half seconds we will take you to the campus of the University of Minnesota, where Gnigder Mdejawski will bring you a play-by-play report of the Class Scrap being held there between the freshman and sophomore classes of the engineering college. O Kay, Gnigder!"

"WELL, folks, here we are out in Memorial Stadium—er—I mean Nicollet Park—er— — well, maybe I *am* wrong—here we are out on the Parade Grounds of the university—a spot heretofore sacred to the Army and the Buildings and Grounds Committee. It's a beautiful day folks, cool enough to make it good fighting weather. There's a vast crowd gathered here today to witness this exhibition of brute strength and class loyalty. The spectators and the players have been gathering for hours; all we lack now is an official. Ah!—the stands are hushed—the band strikes up a martial air— — well that's my story and I'll stick to it —anyway that was the psychological time for the band to play.

"IS it possible?—Yes, it is; a whistle rends the air—the teams form—they get instructions—ah folks you should see these two masses of brawn and brains as they line up on the field—two grim fighting machines. They take their places. It is to be the push-ball contest. A shot rings out—they are off—they're up—they're down—a man breaks away —no, he is stopped—this way—that way—oh! What a thrilling spectacle to see them pushing that immense leather sphere around! It goes up in the air over their heads—it's down again, but on they push, rolling the opponents under the ball. On it goes—they stumble! —what can it be—two men break away and go running down the field with that immense ball. They're away—they're free—they're over the goal line before they are caught—a score for the Freshmen—They change goals and start again.

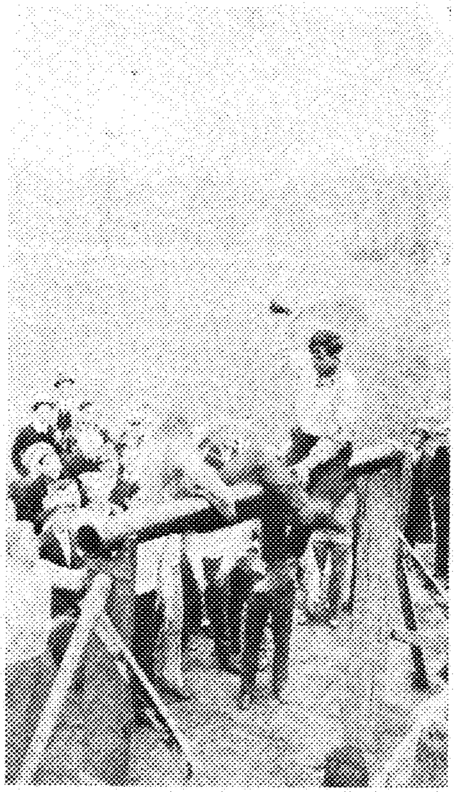
"THE players are resting now. Ah! I tell you folks, it was a great contest—Oh here's Al Shean; come on over Al, and tell the folks about it—"

Al: "Say folks it sure is a great battle— — I'm all right, Mama!"

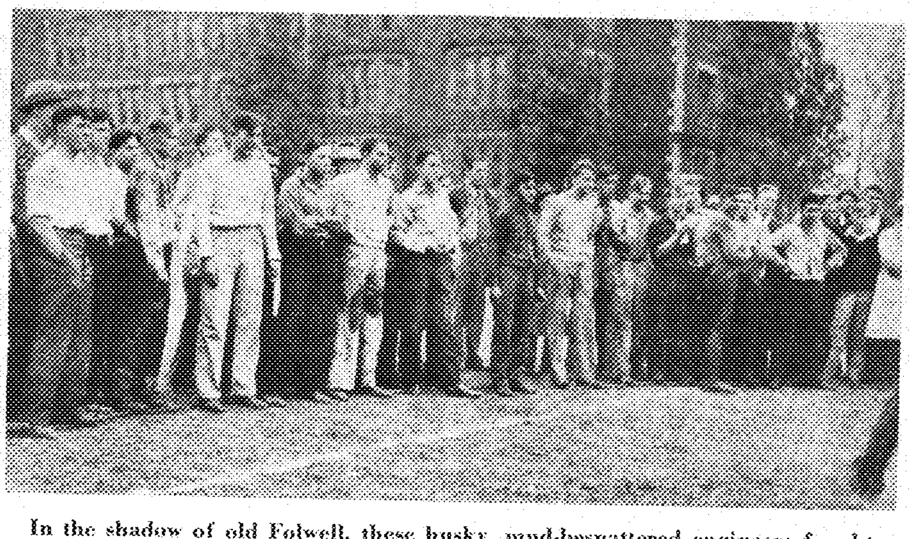
"The players are up again—they begin to crowd around the greased pole—the sophs get their chance to win a victory. Two men get on that pole; they face each other—each is armed with a loaded sack—at the whistle they begin flailing at each other with their weapons. One loses his balance—no, he has regained it—the other seems about to fall —they clinch — break — feint — pass — swing again with their sacks—it's an even match—no, one has lost his balance and tumbled down into the arms of his team-mates waiting below. The freshman has won—but wait—there are to be more of these trials—the pole is greased again.

"Folks, this milling horde is breathless with the excitement of this thrilling contest. Like one they move across the field to the tournament ground. They form a ring. Teams are selected; they mount; they start — — — — — — — — — — — — — — — —

This is station T-E-C-H back on the air again, after two hours silence which we spent in digging sparrows' nests out of our transmitter. We will now give you the results of that glorious battle over at the University. This afternoon, after winning, hands down, every part of the traditional class scrap, the freshmen took the sophomores to the cleaners by pulling them through the stream from a fire hose which marked the center line in the tug-of-war contest.



A bit of action on the greased pole.



In the shadow of old Folwell, these husky, mud-bespattered engineers fought for fame and Alma Mater.

ST. PAUL'S NEW CITY HALL

By R. H. KRANZFELDER, Arch. E. '26

TOWERING over St. Paul's loop, 261 feet above the sidewalk, stands the new St. Paul City Hall and Ramsey County Court House. A structure of beauty and durability, this newest and most imposing of St. Paul's buildings represents also a feat of modern structural engineering. The elaborate interior and exterior have been built from materials brought from practically every corner of the globe.

The structure is located in Saint Paul between Saint Peter and Wabasha, and Third and Fourth Streets. Construction was started in June 1931 and is now nearing completion. As part of Saint Paul's $15,000,000.00 improvement program, it commands the most prominent location on the Third Street Improvement. From the top of the tower one gets a panorama of the surrounding country. It stands as a sentinel along the banks of the Mississippi River and will be a landmark to the modern navigator of the air as the white sandstone bluff upon which it is built stood as a landmark to the early voyagers.

Covers Entire Block

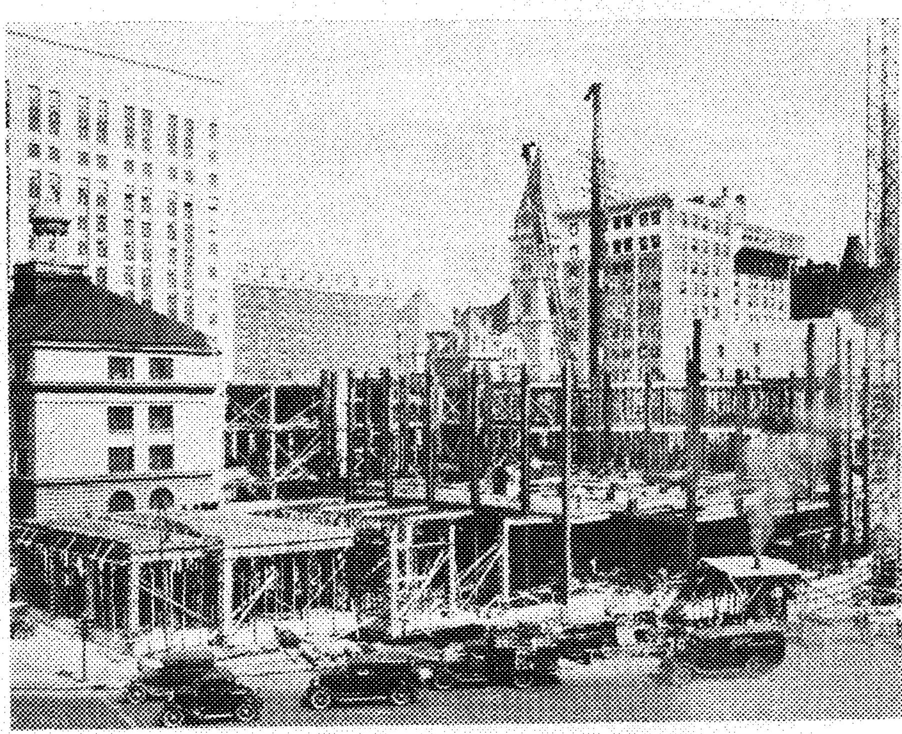
The structure covers a complete block with the exception of a small space occupied by the existing City and County Jail, located at the corner of Saint Peter and Fourth Streets. The structure is symmetrical about a central axis from Third to Fourth Streets. It is planned that at some future date a new jail will be built on the location of the present building, and provisions have been made for this future addition.

Excavation was started the last week in June, 1931. Old foundations and footings had to be removed before actual excavation could be started. To expedite construction, two shifts were used during the excavation, so that the concrete work could be completed before the weather became severe. The first concrete footings were placed before the middle of July and the main excavation was completed one week later. Very little difficulty was encountered in securing proper footings. The location of the site is well out of the old Mississippi River bed on one of the familiar sandstone formations along the river's edge. At the bottom of each footing five holes were drilled, each eight feet deep, to ascertain that there were no cavities or unusual strata below the footings. Several footings were directly over abandoned tunnels which necessitated the lowering of these footings to solid rock below the bottom of the tunnels.

All Materials Tested

The lower stories flanking the tower are of reinforced concrete construction. Work on this part was carried ahead while the steel frame for the tower section was being fabricated. As soon as the lower stories of the steel work had been completely erected the concrete fireproofing was started and followed close behind the steel erection. The structural steel work was completed the first week in November and within the following week the final concrete was placed. The entire structural frame was erected before the stone setting was commenced. Stone work then progressed rapidly, after which the steel window frames were installed, the sash hung, and the building closed in early in 1932. During the time the exterior work was being carried to completion the interior work was progressing rapidly. No floors were typical in their layouts, as each floor was designed for a special purpose. The closest of supervision was necessary in order to co-ordinate the work of the various trades and to make it possible for these trades to work to the best advantage. All materials on the job were handled with one small tower on Wabasha Street and one three hundred foot double steel tower on Third Street, adjacent to the tower section of the building. The large tower was operated with a 125 horse power high speed electric hoist. All concrete was delivered to the site ready-mixed, thereby eliminating a concrete plant on the job. The usual tests were made of concrete materials, chemical analyses of stone back-up material, plaster inspection, tests of acoustical material, and physical and chemical tests of steel. Bronze and nickel silver were specified according to definite chemical proportions.

The completed building faces Third Street with the tower section extending 261 feet above the sidewalk level and flanked on each side with a three story, a two story and a one story section. The



Giant cranes, moving upward floor by floor as the building rises, rapidly push the sturdy girders upward to the sky.

portion directly back of the tower and extending to Fourth Street is a three story section forming the Concourse.

Has Stone Exterior

The exterior has a facing of select Indiana Limestone with the base course of Black Granite from Mellen, Wisconsin. Dark vertical panels are formed by metal sash and dark aluminum spandrels tied together by highly polished stainless steel ribs extending the entire height of the building to make a single vertical unit. The contrasting colors of the black and white stone, the contrast of the dark and highly polished metal gives the keynote to the color scheme in this structure of modernistic design. There are no heavy cornices, no elaborate decorations, nor deep reveals, the whole beauty of the exterior lying in the frank simplicity of detail and the pleasing proportions of the mass.

There are two entrances, one on Third Street, the other on Fourth Street. The Third Street entrance leads to the ground floor elevator lobby and then to the Concourse. The Fourth Street entrance leads directly into the Concourse, which will be the decorative feature of the building.

Indian Statue in Lobby

This Concourse extends a full three stories in height and approximately one hundred feet in length and will present a most impressive public space. At the end directly opposite the Fourth Street entrance, there will be erected a statue of an Indian to commemorate the passing of the red man who once pitched his tepee on the very site of this modern public building. The statue will be approximately thirty feet high and will be specially lighted. The walls and the sixteen columns supporting the Concourse ceiling will be faced their entire height with Blue Belge marble. There will be balcony floors supported between the columns at the second and third floor levels. The entire ceiling will have amber mirrors set in heavy brass frames. The lighting will be recessed into the sides of the columns, effecting a striking contrast with the black marble. The reflection of the lights in the mirrored ceilings will accentuate the actual height of the Concourse.

Floor Space Apportioned

The floor space is so arranged that all business offices will be located on the lower three floors, easily accessible to the public. The space in the tower section will be used for offices and court rooms. The structure was designed to accommodate the natural growth of the city and county. The fifth, thirteenth and seventeenth floors have been left unfinished and will be completed as required. The City Council Chamber and Mayor's offices are located on the third floor, the Court Rooms on the eighth, tenth, eleventh, fourteenth and fifteenth floors. The eighteenth floor has been reserved for the law library. The nineteenth, twentieth and twenty-first floors will be used for storage, water tanks and elevator machinery. All intermediate floors will be used for the various offices. All rooms in the tower section will have an outside exposure with ample light and air because of the set back from the building lines. On the floor of the second story elevator lobby there will be a large scale map of Ramsey County done in terrazzo, showing the highways, lakes, rivers and points of interest within the county.

Marble From Many Lands

The marble work was actually commenced months before a single piece of marble was brought to the site. Approximately eighty per cent of all the marble used was imported from foreign countries, the remaining twenty per cent being domestic marbles. The Concourse and First Floor Elevator Lobby floors will be made of alternate squares of Champville marble from France and Hauteville marble from Italy. The second and third floor elevator lobbies and balcony floors will be of Roman Travertine from Italy. The Concourse walls and columns will be of Blue Belge from Belgium. The vestibule and stair cases will be of Loredo Chiaro from Italy.

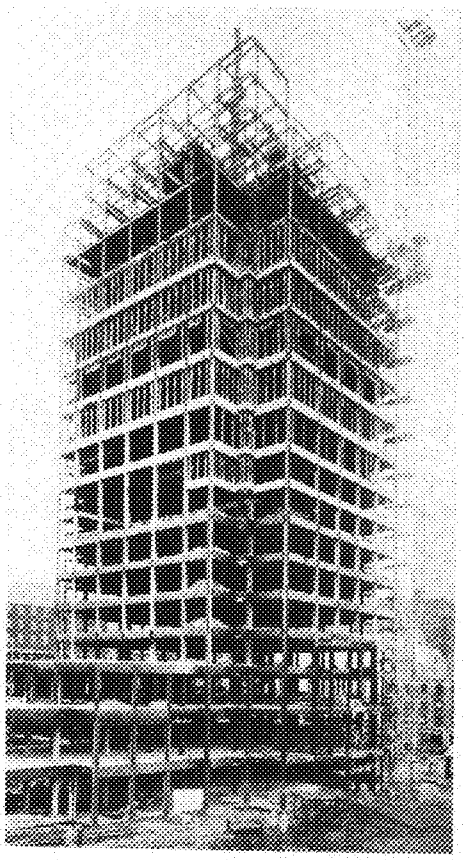
Unique Lighting Effects

The lighting in a modernistically designed building is of paramount importance in producing both proper illumination and the desired effect. There will be many new and interesting lighting effects to give distinction to this new building. Each side of the tower section will be illuminated with two 2000 watt spot lights located at the base of the tower and shooting the beams upward. The section above the offset at the seventeenth floor will be lighted with mobile color produced with 162 five-hundred watt lamps and General Electric Thyratron controls. This will be the first installation of this type of lighting in the Northwest. The lighted tower will be visible over a wide radius and will present a most unusual spectacle. Equally as interesting will be the interior lighting, one feature of which will be a false window lighted to give the effect of sunlight which will be over the Fourth Street entrance to the Concourse. This effect will be produced by decreasing the intensity of light from the top to the bottom of the window. The offices on the first four floors will depend largely on artificial light, the fixtures for which will be of the flush ceiling type, producing as nearly as possible the effect of sunlight. Variations will be used in the treatment of the surface of the glass in order to meet the different requirements. Tower office lighting fixtures also will be selected to meet the individual requirements for the type of work to be performed in each office. Special care was taken in selecting proper lighting for the drafting room in the engineering department.

Imported Woods Used

Among the many interesting features of the interior is the cabinet work, consisting principally of wainscoting doors, counter fronts, etc. Office spaces have wainscoting of chair rail height while the court rooms, council rooms, executive rooms, and elevator lobbies have full height wainscoting. The design is mod-

(*Continued on Page 55*)



Steel girders encased in concrete form the framework of St. Paul's new City Hall, which is shown here before any building stones were laid.

WCCO A 50 KILOWATT TRANSMITTER

By ALBERT UPTON, E. E. '25
Engineering Dept., Northwestern Broadcasting, Inc.

WCCO originally came into existence September 1, 1924, when the Civic & Commerce Association of Minneapolis and the Saint Paul Association joined with Washburn Crosby Company in taking over WLAG, which had gone off the air due to financial difficulties, and the Northwest was without radio service. Work of installing the new 5,000 watt transmitter and new studios in the Nicollet Hotel was immediately begun. The new equipment was formally presented to the public on March 4, 1925, the Coolidge inaugural address of that day being the first broadcast.

Anoka Site Chosen

The site for the 5,000 watt transmitter, near Anoka, Minn., was chosen because of the excellent telephone and power circuits that were available as well as the altitude of the site. The transmitter was originally of the (then) usual Self-Master-Oscillator, Power Amplifier type which was later rebuilt to the modern crystal driven type providing for one hundred per cent modulation of the output. Still later, improvements in the temperature control of the quartz crystal compartments were made which insured operation of the station within a very few cycles of the assigned frequency of 810 kilocyces.

Because of the quite satisfactory results obtained with this transmitter in this location, it was decided to erect the new 50,000 watt station on the same site. The new equipment then, stands within a few hundred feet of the old station and the transmission line to the present radiating system crosses under the position of the old antenna.

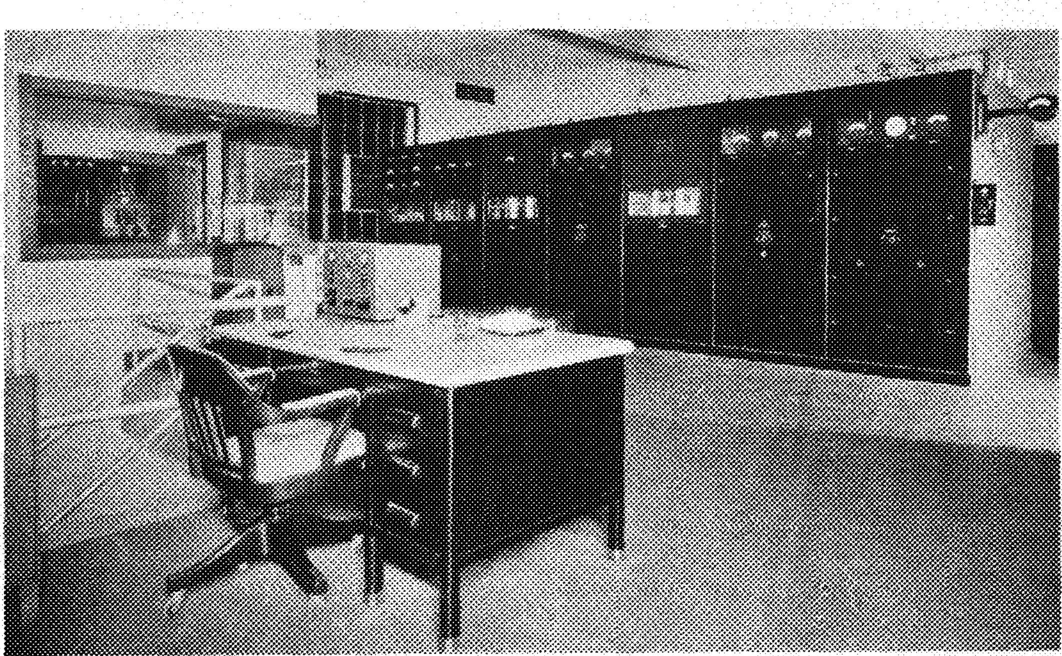
Equipment Equals Best

The present installation represents the last word in modern super power broadcasting stations. There is nothing in the country at the present time in regular broadcast equipment and installation that exceeds in power, excels in effectiveness in modulating this power, or in the quality of output of this plant. However a page or more of superlatives extolling the merits of this or any other similar installation does not have the dollar and cents value of actual results. Proof of the worth of this $190,000 installation in putting out a satisfactory signal within the recognized service range of a transmitter of this power and at distant points is shown by tests and by the receipts of communications from listeners within this area and of several hundred letters from listeners in distant points such as in New Zealand, Australia, Hawaii, and the Philippines.

Building Well Shielded

The new transmitter is housed in a 50′ by 50′ fireproof building of brick, concrete, and steel construction which is well insulated against heat and cold and is thoroughly shielded electrically, since metal lath is built into the walls and ceiling and all sections are carefully bonded together and the whole grounded. The speech input equipment is still further shielded by being placed in a room whose walls contain two additional copper screens, the outer one of which is grounded while the inner one "floats" ungrounded. All of the interior walls of the transmitter and control rooms are covered with special acoustic plaster to reduce operating noises to a minimum and to give better quality from the monitor speakers without the the usual reverberations which occur in the rooms with ordinary plastered walls.

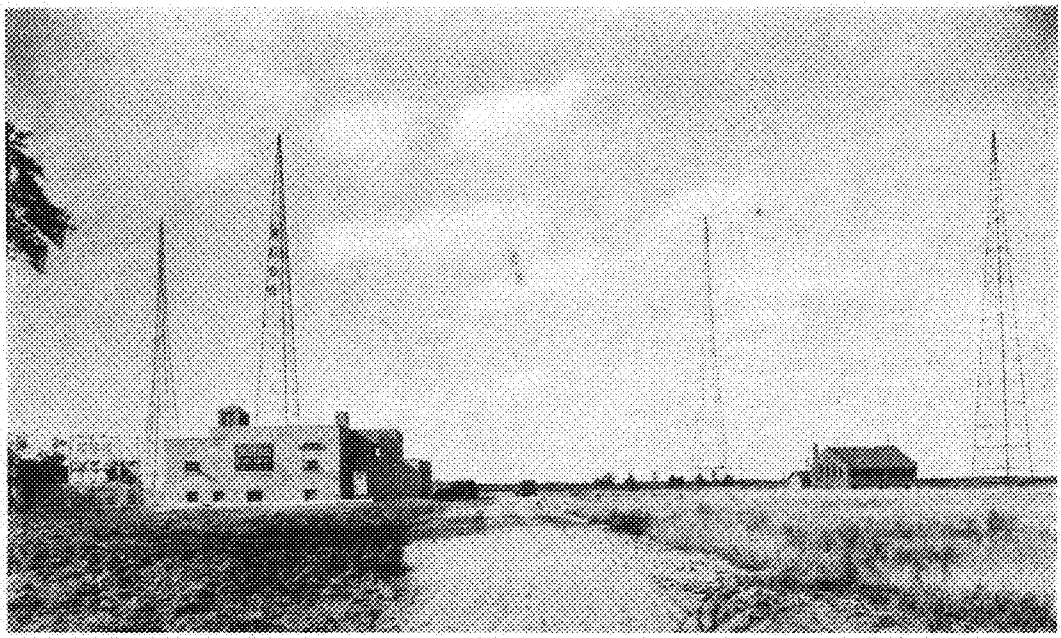
Some six-hundred feet north of the main building is a smaller one of similar con-



An interior view of the new transmitter. All switches and meters are visible from the sound proof control room at the left.

struction, directly under the antenna system. This building houses the antenna coupling equipment which is fed by a two-wire transmission line from the transmitter.

The antenna is a single wire, three-eighths vertical radiator, with a short flat-top portion, suspended midway between the two three-hundred foot insulated towers ers which are spaced six-hundred feet apart. The ground system is centered around the "tuning shack." Entirely surrounding it is a buried copper ribbon. Brazed thereto and radiating therefrom like the spokes in a wheel from the hub, are sixty-three two-hundred foot No. 10 copper wires. At the circumference of this 400 foot wheel, the wires are about twenty feet apart and are not connected together. Motor driven controls operated from the transmitter panel make it possible to tune the antenna system within certain limits and to ground the antenna or connect it to the transmitter respectively, from within the main building. The antenna current can also be read from the transmitter as well as in the coupling house by means of a thermocouple ammeter whose couple is in the antenna circuit and whose meter is on the panel of the output stage of the transmitter.



WCCO's new transmitter at Anoka. The new transmitting building and the 300 foot towers are shown at the left.

Seven Unit Transmitter

The main transmitter consists of seven units which contain the crystal driver units, the two buffer amplifiers, the 50 watt amplifier whose output is modulated by a 250 watt tube, the speech input tube of 50 watts rating, the two 250 watt, push-pull linear power amplifiers, the two 35 kilowatt, push-pull linear power amplifiers, and the final push-pull 200,000 watt peak, linear power amplifier containing six 35 kilowatt tubes with the necessary tuning and transmission line coupling equipment.

The Buffer Stage

In the transmitter, the crystal stage is followed by a buffer stage using the same type power tube. The output of this feeds a 50 watt tube stage which excites the modulating amplifier and a 50 watt tube. The radio frequency input to the first buffer is controlled by a potentiometer that is operated from the front of the panel. This varies the bias on this buffer.

The tube which varies the modulating amplifier tube output is of 250 watts power and the speech amplifier tube swinging it is of 50 watts power. This tube is actuated by the speech input equipment in the control room and complete modulation is realized with an input to the transmitter of minus ten DB. The overall frequency response of the transmitter is flat within 2 DB from 30 to 10,000 cycles per second.

Direct Current Tubes

With the exception of the crystal and first buffer tubes, the tube filaments are supplied with direct current from either of two 24 volt, 550 ampere generators with the proper voltage dropping resistors in the air cooled tube filament circuits. The 35 kilowatt tubes have filament ratings of 21 volts at 61 amperes. All C bias voltages are obtained from either of two 300 volt machines. The output of both filament and bias generators is very carefully filtered.

Power is supplied to the building at 440 volts from the 13,200 volt line on the highway through a small substation just outside the building. Most of the power transformers, fan motors and motors on the MG sets operate at this voltage.

Plate supply for all of the air cooled tubes in the transmitter is furnished by a three phase, half wave, mercury vapor well filtered supply which delivers approximately three-quarters of an ampere at 1600 volts. This complete supply occupies part of the space on one of the three power panel units. The tubes are the WE 258-A which have an inverse peak voltage rating of 6300 volts and a maximum peak space current of 1.1 amperes.

Tubes Tested Daily

The 17,000 volt supply for the water cooled tubes supplies approximately ten amperes at this voltage. Six WE 266-A mercury vapor tubes make possible full wave, three phase rectification from the delta connected secondaries of the three 83.3 KVA oil immersed transformers used. A fourth transformer of the same rating is in readiness should any one of the first three fail. The 266-A's have an inverse peak voltage rating of 20,000, and the maximum current rating is 20 amperes. Provision is made for testing these tubes and this is done daily so that the condition of each is known at all times. This test simply gives an indication of the voltage drop across the tube under test when operating under the maximum (20 ampere) load. When this drop becomes excessive, the tube is replaced. This insures a minimum of trouble with these tubes during the time the station is on the air. These tubes are also mounted in the power panel units with individual filament transformers mounted directly under each. The transformer room containing the high voltage transformers and the filter system for the 17,000 volt supply is immediately below the power panels. In this room also are the primary resistors which auto-

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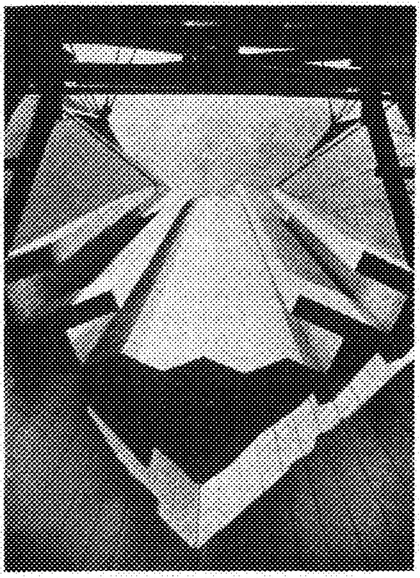


Looking skyward through a light trough of the Travel and Transport building.

A CENTURY OF PROGRESS IN ENGINEERING

By GORDON ROSHOLT, C. '35

THE chances are that sometime next summer you will visit Chicago. Whether or not you are planning at present to attend the World's Fair, it is highly probable that you will, because it is estimated that fifty million people will visit the exposition and fifty million is a good-sized slice of our population!

The official name of the exposition is A Century of Progress. What a century it has been and what a fair it will be!

Star "Arcturus" Opens Fair

The exposition will be officially opened at 9 p. m. on June 1, 1933 by ponderous machinery started by the effect of the impact of a tiny beam of starlight on a photoelectric cell in Yerkes observatory at Williams Bay, Wisconsin. This tiny beam of light which started from the giant star Arcturus during the Columbian Exposition of 1893 will arrive just in time to open Chicago's second great world's fair.

As soon as the fair opens, everyone in America will have a desire to visit Chicago. Certainly every student of engineering will find a way to fulfill this desire, for next year's fair will be an exposition of engineering accomplishments, arranged and prepared by engineers to appeal to the scientific curiosity of the layman. Never before has such a show been staged. The application of science to every human activity from the grocery business to astronomy will be displayed in the most fascinating manner.

Fair Site Was Once Lake

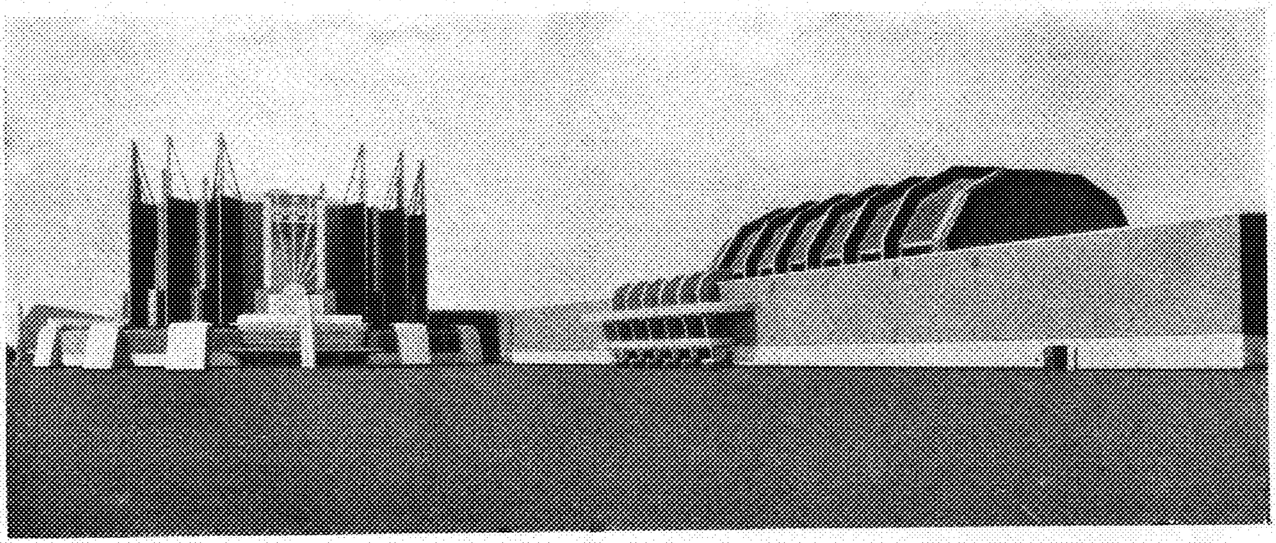
Even the ground on which the fair is built is a product of engineering skill. Until only a few years ago the entire area, over seven hundred acres, was part of Lake Michigan. Engineers have constructed machines with which to suck sand from the very bottom of the lake; they have built ships to carry this sand from the shores of Michigan and Indiana; and they have built of this sand a front porch for Chicago on which they are now constructing a fleeting monument to the century of progress that has made that city famous.

In the century since its incorporation as a village in 1833, Chicago has grown to be the second largest city of the Western Hemisphere, and this growth is primarily due to the development of science and its application to human affairs. It is only natural that Chicago's Centennial Exposition should take science for its theme.

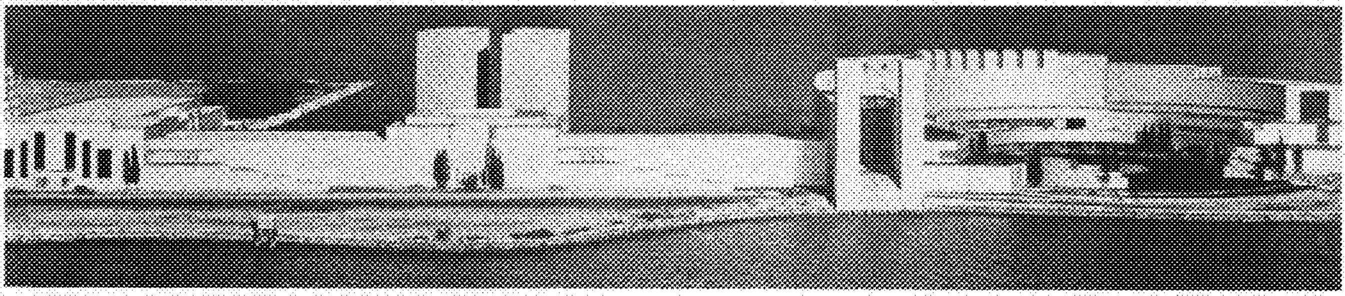
Now people take all this progress for granted. They use a telephone without the least knowledge of the scientific fundamentals underlying its operation; they drive automobiles without the slightest appreciation of the innumerable engineering problems that were encountered and surmounted in its manufacture. A Century of Progress, Incorporated, (which is the name of the private corporation putting on the fair) has assumed the task of educating the people, first, in the fundamental principles of science, and second, in the application of these principles to our daily welfare.

Electroplating Experiments

The method of accomplishing the first objective I can explain more or less in detail, for I had the privilege, about



A general view of the Travel and Transport dome (to the left) and Steamship hall.



Embellished with hanging gardens, steel cypress trees, electric cascades, and gilded pylons, the Electrical group presents the last word in modern architectural phantasy. Generation of power, telephone and telegraph communication, and the wonders of radio and television will be portrayed.

eight weeks ago, of visiting the laboratories in which the exhibits were being prepared for that purpose. These exhibits, dozens of which are already completed, consist of the identical experiments that we conduct everyday in our classrooms. The apparatus is so constructed, however, that every experiment is entirely automatic. Consider, for example, an experiment in copper plating. The apparatus for this experiment consists of a glass tank containing the plating solution and two electrodes in the form of zinc plates. These plates dip repeatedly into the solution, and each time they dip the current through them is reversed, so that the plating of copper is seen first on one plate than on the other as long as the apparatus is running. Each time the current is reversed tiny illuminated signs appear which explain clearly and in detail just what is going on.

Buildings Are Inexpensive

The buildings which will house these displays are themselves illustrations of the latest developments in scientific building. The steel skeletons are made of sections bolted together instead of riveted. The walls are made of wall board and insulated with an inexpensive material made from waste newspaper and an emulsified asphalt. The materials used are selected according to the following specifications: they must be inexpensive; they must be easily and quickly constructed and easily and quickly dismantled; they must have a high salvage value.

No Windows in Buildings

Certain modern principles of architecture are followed to their fullest extent. First, very few of the buildings have any windows. All the interior illumination is artificial, allowing for the most ingenious application of decorative illumination. The colored exteriors too are illuminated at night with stationary and moving lights producing a myriad of absolutely new and original lighting effects.

Second, the buildings are built with their skeletons on the outside. That is, all supporting beams and trusses are visible. In many cases the projecting members are exaggerated in size or emphasized with color, but there are none of the false plaster porticoes, spires, statues, and cornices that are so familiar to us.

Escalators Handle Crowd

Third, the buildings are so constructed that the visitors will enter the buildings at the second story which is generally the "main" floor. Then by means of ramps and high capacity escalators they will filter down to the ground floor. This system promotes one-way traffic which is much easier to handle.

The Travel and Transport building is at present one of the most popular points of interest for the citizens as well as the visitors of Chicago. It is a two story building a thousand feet long, with the famous transportation dome at one end. This unusual building contains one large room 300 feet in diameter and as high as a twelve story building. It has a metal dome shaped ceiling which is entirely suspended on cables strung between steel towers rising on the outside of the building. This metal dome together with the concrete floor causes a repeating echo which can be heard for several seconds after the origination of the sound. At present an ordinary conversation is almost impossible in the center of the room because of the interference of the echo. Of course the phenomenon will be eliminated when the interior of the building is decorated.

The Travel and Transport building will house exhibits of every imaginable mode of travel, including actual full size sections of ocean liners. It will also be the scene of what will be popularly known as the T. and T. show, a dramatization of the progress of the transportation industry since its very beginnings.

The Electrical group, consisting of the Radio, Communications, and Electrical

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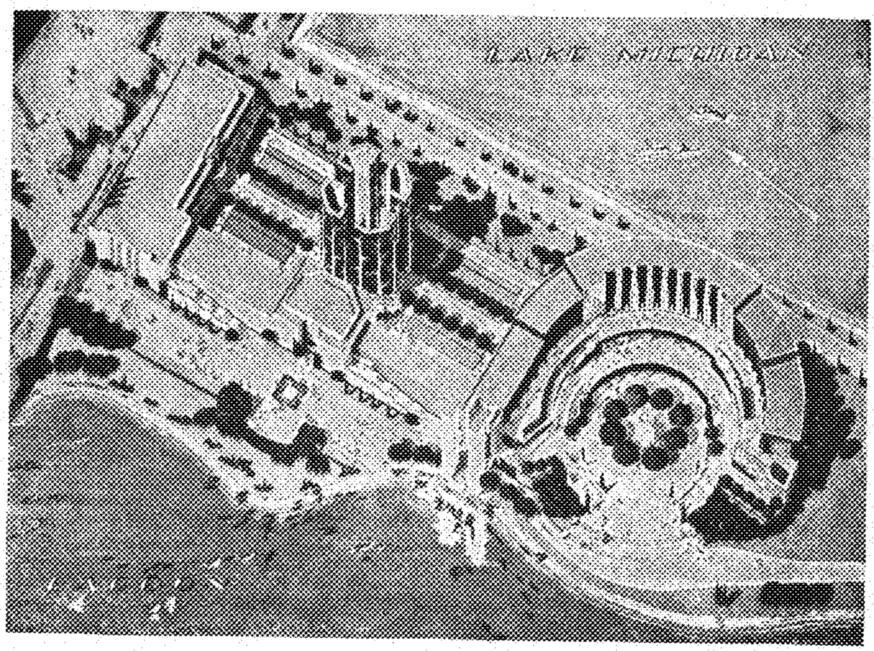


Architect's rendering of the Electrical Group on Northerly Island. This site was once a part of Lake Michigan.

YOUR ENGINEERS' BOOKSTORE

Annual Financial Report of the Engineers' Bookstore

Profit and Loss Statement for the Year Ended May 31, 1932

Sales	$58,396.91
Inventory	
June 1, 1932	10,530.05
Purchases	42,994.40
Freight Charges	1,123.14
	54,647.59
1932 Inventory	11,460.61
	43,186.98
Gross Profit on Sales	15,409.93
Operating Expenses	8,837.78
Operating Income	6,572.15
Additions to Income	
Cash Discounts	338.54
Interest on U. S. Bonds	433.90
Other Interest	81.00
Profit on Sale of Bonds	164.35
Check Exchange	5.95
Bank Exchange Operation	56.66
Total Income	7,652.55
Deductions from Income	
Bad Debts and Losses	107.67
Net Income	7,544.88
Reserves and Surplus June 1, 1932	11,274.18
1926 Dividends Cancelled	138.67
Cap and Gown Adjustment	5.50
	18,963.23
Less Adjustments of Bonds to Market	596.56
1932 Dividend	**6,854.23**
Reserves and Surplus May 31, 1932	11,512.44

Balance Sheet as at May 31, 1932

Current Assets	
Cash on hand in bank	$1,214.47
Certificates of Deposit	6,000.00
Accounts Receivable	748.03
Inventory	11,373.21
Accrued Interest	205.06
Supplies	65.00
Total Current Assets	19,605.77
Investments, U.S. Bonds, and Notes	695.00
Fixed Assets	
Store and Office Equipment	265.00
Cap and Gowns (for Rental)	400.00
Total Assets	**31,965.77**
Liabilities	
Vouchers Payable	195.72
Deposits on Orders	142.59
Dividends Payable	8,170.02
Membership, Reserves and Surplus	
Membership	10,595.00
Cap and Gown Replacement Reserve	1,350.00
Reserves and Surplus	11,512.44
Total Liabilities	**31,965.77**

TWELVE years of profitable operation of the Engineers Bookstore to its members has established it solidly as an example of a successful student cooperative. It was that many years ago that the Engineers realized a need for a cooperative store. Some steps were taken in that direction by the Engineering Student Council in the purchase of books and other supplies through the University Purchasing Department. This method was too slow and cumbersome for efficient service and the plan of buying books through the Minnesota Co-op. company at a fifteen per cent discount was tried. It was impossible by this connection to adequately supply the incoming freshmen with books and equipment, for the orders had to be placed far in advance. The upper classmen were dissatisfied and many purchased supplies elsewhere rather than bother with the red tape and delay found in this operation.

In May, 1920, the first election for the Board of Directors of an Engineers' Bookstore was held, and after a year of successful operation of the store, it declared the first dividend of $2,127.98. The Board then felt that it might successfully establish a Branch in the School of Business. This was found to be unsuccessful and was closed in the spring of 1925. In the succeeding years the dividends declared mounted steadily as did its membership and in 1931 the largest dividend so far of $8,579.28 was declared.

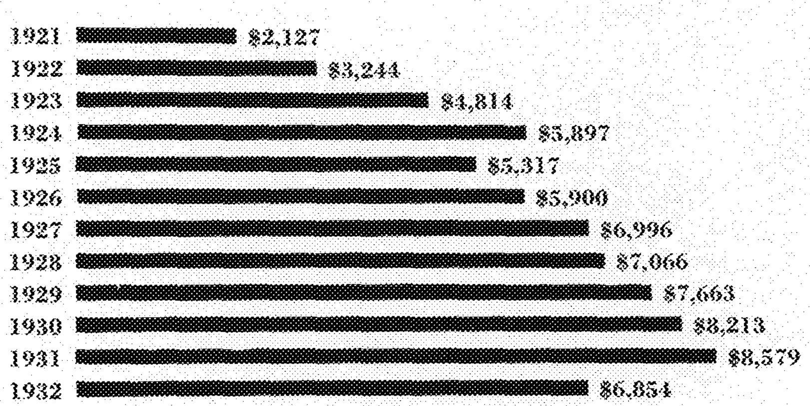
Anyone from any of the Colleges in the University is eligible to membership in the store but only those registered in the College of Engineering and Architecture and the School of Chemistry have a voice in its management. A fee of five dollars is required of each member which is used to supply the store with its working or operating capital. The deposit is returned at graduation or upon leaving school and while a member of the store a dividend is issued every fall to the member based on the total purchases made by that member and the operating profit. For every year of its existence with the exception of the first the dividend rate has been 16⅔ per cent.

The body determining the financial policies and the operation of the store is a Board of Directors, whose membership consists of one elected representative from each college in the technical school, three faculty members and the manager. The personnel of the Board this year is:

Clarence E. Lund, Mechanical
Edward A. Hamerski, Civil Engineering
Paul L. Erickson, Electrical Engineering
C. Herbert Starkey, School of Architecture
Malcolm Hope, School of Chemistry

Under the able direction of Harold D. Smith, who has managed the store since 1925, it has grown to a business of enviable size and reputation. Many innovations have been made in its service to its members. The aim of the Book-store is to supply to students the utmost in service with the greatest economy, but still maintaining a quality of merchandise that will give the greatest amount of satisfaction to the users.

ANNUAL DIVIDENDS TO MEMBERS



MODERN STAGECRAFT

THEODOR SEBERN
Stage Technician, University Theatre

THE ball of revolutionary stagecraft in the modern playhouse is still rolling. Looking back over its path we are confident that it has taught us a serviceable lesson: that the written play is only complete and expressive when it is actually staged with the script, acting, and background knit closely together, affording a harmonious appeal.

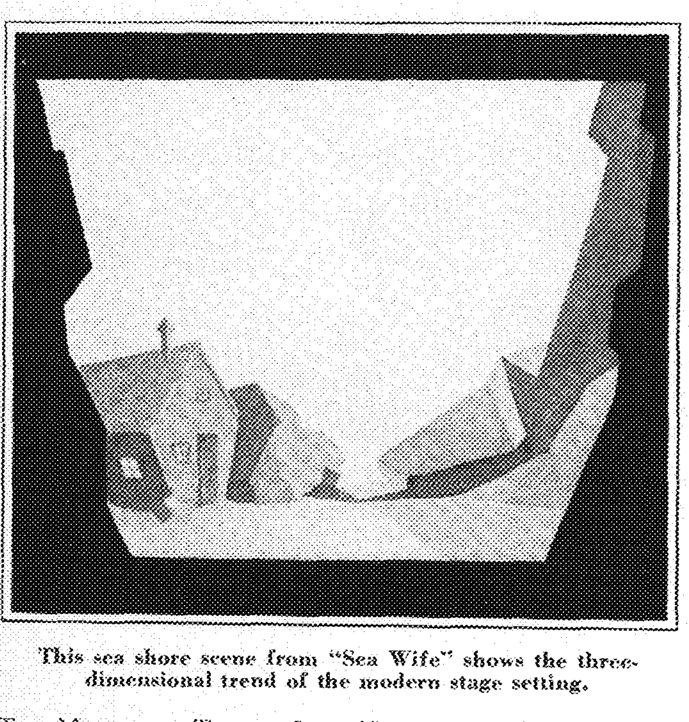
The designing for the play is in a sense a separate craft: but it exists only for the sake of the larger art—just as the picture frame art may be said to exist for a painting. Today's stage "artist" in the modern school is abandoning the idea that the stage setting is something entirely distinct from the play, and instead of designing a set with innumerable points of interest and counter attractions to the acting, he is concentrating his efforts toward a unified effect.

Now, as a result, his work is characterized by seriousness, dignity and unity, and by a single harmonious setting for the mood of the play. His background is unobtrusive, rather than conspicuous for its ugliness or beauty.

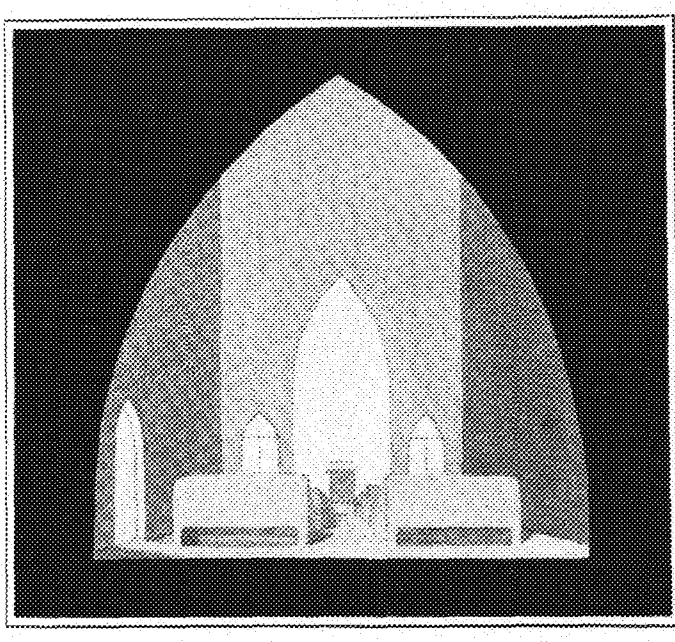
With our modern stage decoration then, we are tending toward a more complete organization of that cube which is the stage toward an architectonic setting, which, by its three-dimensional quality, assures a plastic unity between the actor and the background.

Simple Designs Favored

The new stagecraft exists in the attempt to fit the method of presentation perfectly to the play. This new craftsmanship is based on the firm foundation of the two fundamental principles: that the setting must be an integral part of the presentation and in harmony with its essential spirit; and that it must be unobtrusive in order to concentrate the attention on the action. That is the theory in a nutshell. The practice is to enhance by suggestion rather than by naturalistic delineation, by simple design rather than multiplicity of detail, by reticence rather than by lavishness.



This sea shore scene from "Sea Wife" shows the three-dimensional trend of the modern stage setting.



Superstition, ironic reverence, grotesquery of characters—all are suggested by this church setting from "Sea Wife."

Leave Details to Imagination

Approaching this theory from another angle, we can say that the old method was to leave nothing to the imaginative powers of the audience, while the new method is to leave everything possible to the imagination; the old method was to create a material illusion by multiplication of naturalistic detail; the new method is to create imaginative illusion by simplification and symbolic suggestion.

"Sea Wife" Settings Are Suggestive

As an example of the simplicity that lends background to the action without obtruding, notice the designs for "Sea Wife" by Maxwell Anderson. These are the first designs to be made for this play which will have its world premiere at the Music Auditorium December 6-10 under the auspices of the University Theatre. The scene by the sea merely suggests the grotesquery of the characters and the action motivated by superstition. The church scene carries out this idea to a less extent bringing into the situation an ironic reverence in contrast to the hypocrisy of the characters in the situation.

Quiet Beauty Is Unobtrusive

The new artists of our theatres have learned that there is nothing so unobtrusive as quiet beauty and perfect taste. Naturally, then, their settings are almost invariably beautiful in an unassuming way. The matter of taste is nothing more than good sense of proportion and simplicity of line and mass. To suggest a feeling of completeness with the greatest economy, to conceive the picture in large unbroken masses, thus emphasizing the actors—that is the finest solution to the problem. A good stage designer can with a few lines and masses achieve a sense of richness and pattern where another would with the same materials gain nothing more than a barren, cold, and harsh arrangement.

(Continued on Page 53)

EVERHART PERCY HARDING

1870-1932

THE many friends, former students and faculty associates of Everhart P. Harding were grieved to learn of his death on October 10, 1932. He had been with the University of Minnesota as student and faculty member for more than forty years, and leaves behind him a record of unselfish and conscientious service in many capacities. With the exception of a leave of absence from 1899 to 1901, and sabbatical furloughs of a half year in 1921 and a full year in 1930-31, he had served continuously on the teaching staff since 1894.

DR. Harding was born August 15, 1870 at Waseca, Minnesota. He attended the public schools in Waseca, graduating from the high school in 1888. After teaching district school in southern Minnesota for a time, he entered the University of Minnesota, obtaining the Bachelor's degree in 1894, and the Master's degree in 1895. He served as Assistant in chemistry from 1894 to 1896, and as Instructor from 1896 to 1899. The next two years were spent in graduate study under the direction of Professor Theodor Curtius at the University of Heidelberg, Germany, where he obtained the Ph.D. degree in 1900. Returning to America he served as Lecturer at the University of Minnesota until 1907, as Assistant Professor until 1918, and as Associate Professor until his retirement in 1931. Dr. Harding had been in ill health since early fall of 1929, and was obliged to give up his school work during the fall quarter of that year, and again during the school year 1930-31. He was retired as Associate Professor Emeritus in September, 1931.

DR. Harding's undergraduate activities prove that it is possible to be an excellent student and a star athlete at the same time. Old-timers well recall Harding's prowess as right guard on Minnesota football teams of the seasons from 1891 to 1897. He served as Captain of the "Giants of the North" in 1894, and was picked several times as All-Western guard. He also held the high hurdle record in intramural sports. However, he found sufficient time to devote to his studies to qualify for membership in Phi Beta Kappa in his junior year. He always retained an active interest in athletics, especially football, and many of his friends recall his picturesque accounts of the thrilling plays of the "nineties" and later seasons. After his playing days were over, he served for many years as faculty representative on the Athletic Board of Control, as Auditor of the Athletic Association, and as a member of the Senate Committee on Intramural Sports. His interest in sports was not confined to football as attested by the fact that even a few years ago he played many of the younger generation on even terms at tennis, squash and golf. He loved to hunt and fish and often hied away with gun or rod in pursuit of these sports.

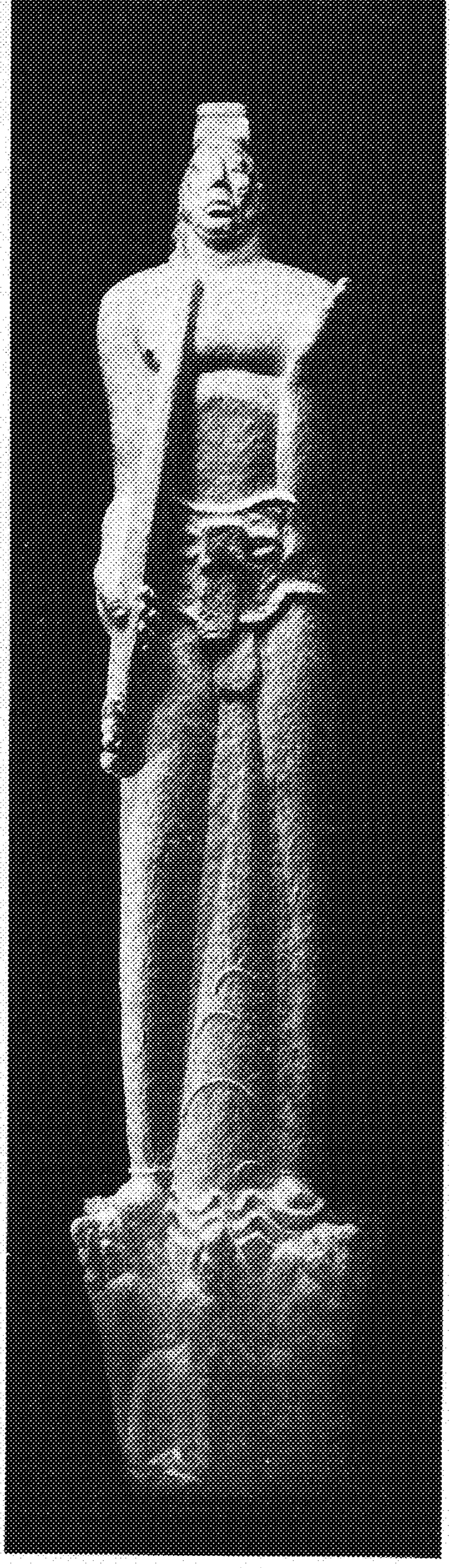
MOST of his students remember him best as a teacher or in some cases as Chairman of the Students' Work Committee of the School of Chemistry. A painstaking laboratory worker himself, he also demanded careful work of his students. In his classes in Gas and Fuel Analysis, a favorite expression of the students was, "You guess and Doc fools." Yet, in spite of Dr. Harding's requirements for conscientious work, he was a favorite with most of his students. Former students returning to the campus, always made it a point to call upon Dr. Harding among the first of the people visited, and if for some reason, failed to find him, were disappointed. As time went on, friendships ripened, and former students and colleagues understood and appreciated the man for the true friend that he was.

During his connection with the University, Dr. Harding was frequently called upon to act in a referee or consulting capacity upon problems affecting many industries in the state. For a number of years he was Expert Chemist for the State of Minnesota in many suspected poison cases, and served in an advisory capacity in formulating methods of testing and the regulation of the sale and distribution of food materials, illuminating gas, petroleum products and water supplies for both state and municipalities.

DR. Harding's scientific attainments were recognized by his election to the many honor societies and technical organizations. He was a member of Phi Beta Kappa, Sigma Xi, Phi Lambda Upsilon, the American Chemical Society, the Society for the Promotion of Engineering Education, the American Association of University Professors, and a Fellow in the American Association for the Advancement of Science. His interest in particular fields of science was indicated by his membership in the Gas and Fuel, Petroleum and Chemical Education Sections of the American Chemical Society. He belonged to Phi Delta Theta and Alpha Chi Sigma, social and professional fraternities. He was a Master Mason, belonging to University Lodge No. 316 A.F. and M.

Dr. Harding is survived by his widow, Mrs. Bertha Harding; by three children, George, 9 years old; Helen, 7 years old, and Louise, 5 years old; and by a sister, Mrs. E. Phelps of Waseca, Minnesota.

A MONUMENT TO PEACE



Rising up from the Concourse of St. Paul's new Courthouse will be this statue, the Indian's conception of the God of Peace.

A STATUE is to be erected in the concourse of the new St. Paul Court House which will, in all probability, be the subject of much discussion. It is interesting to note that, though the competition was for a war memorial, the best design submitted, one by Carl Milles, the great Swedish sculptor, was a monument to peace. Another contradiction, according to Prof. S. Chatwood Burton of the architectural faculty, is that, while likely to be the greatest piece of work done in this country in modern times, it will be the least understood and the most hated.

THE accompanying photograph of a preliminary model gives some idea of the design. From five Indians smoking peace pipes arises their conception of the God of Peace. Elongated legs and very simplified drapery create the atmosphere of concept and of ideal, while the thick neck and strong, simple chest denote tremendous power. While studying the statue one must remember that it portrays a concept, not a person—that peace cannot come until it is more powerful than war and can force itself upon us—that it is the atmosphere created which is important in any work, rather than the statue itself.

THIS monument, though unique in design, will be still more unique in rendering. It will be 35 feet high, of white onyx or, more probably, opaque glass, and illumined from the inside. For background it will have the black marble walls of the concourse. Technical difficulties arose from the size and lighting, for it will be necessary to cast the statue in drums. A great deal of experimenting was necessary before a material was found which would cement the drums together and yet not deflect the light rays coming from the interior.

CARL MILLES has undertaken no mean task in erecting this memorial, for no statue of any great size has ever before been attempted in glass.

WITH OUR ARCHITECTS

IN spite of the stairs which seem to present a sort of mental as well as physical barrier, we architects invite the co-inhabitants of our building to witness some of the very pleasing problems that have been completed during the first part of the quarter, and are now tacked up along the third floor hallway.

The first problem of the interior architects, "An Open Lounge in the Pompeian Spirit," brought forth many vivid and gaudy renderings in which Pompeian red, yellows, and blues predominated. Alice Linsmayer received first mention on this problem, while Lilie Stromback and Ella Stucky were awarded mentions. All of the rooms submitted were beautiful in the fineness of their detail and the choice of wall treatment.

A group of architecture students and alumnae recently heard Professor Arnal tell of his trip around the Mediterranean. The presence of graduates from as far back as 1922 indicates the esteem held for Mr. Arnal by all of his students.

Just Ramblin'

Light and shade—the definition of modern art. Light as cast by brilliant light on a clear cut block of stone—light as seen in velvety dulled tones of black and white in a photograph—light cast on the smooth petals of calla lilies in a black vase reflected against mirrors.

Black and white, light and shade, the essence of modernity. Dominoes—the clear outline of a beautiful white building against a jet black sky—silver and jet—all the most striking contrasts bring out the modern that is beautiful.

The MINNESOTA TECHNO-LOG

UNIVERSITY OF MINNESOTA

THE RED CROSS—JOIN!!

TO the colleges of the country the Red Cross looks for its trained leadership. The real importance of enrolling college students as members is not merely to obtain memberships from among a particular group but to spread a knowledge of the aims and objects of the Red Cross and to arouse the lasting interest of the young men and women who are soon to become actors in the public life of their communities.

As readers of news events, college students know that the Red Cross has been active everywhere in the past year in promoting its general peace-time activities and especially in relief work. It now may be worth while to speak of the part taken by Red Cross in alleviating misery due to disasters and to economic causes.

By act of Congress, the Red Cross has charge of the distribution of a total of eighty-five million bushels of government wheat to the needy, handling its conversion into flour and its shipping and distribution.

DURING the year the Red Cross responded to the call of 62 disasters. Chief among these was the $2,266,000 relief program in six of the Northwestern States, giving aid to 266,000 sufferers. The Red Cross also handled the relief and rehabilitation of 2,906 families suffering from the March tornadoes in Alabama, Georgia, Tennessee and Kentucky.

In considering this relief work, one should not lose sight of the steady service given by the Red Cross in other lines. Among these services is the teaching of first aid and life-saving, which has been given at many colleges over the country as supplemental to athletic work.

Let it be remembered that the Red Cross annual Roll Call opened on Armistice Day, November 11, and ends on Thanksgiving Day, November 24.

RELIGION FOR ENGINEERS

IN a rectifier, the filter smooths out the bumps of the rectified wave of current, leaving practically a pure direct current wave form. So, too, in life, a religion smooths out the peaks and valleys of life, and keeps our life on an even keel. In our times of despondency, when friends have forsaken us, no work is available, and there is no material thing that urges us to live, religion spurs us on with the hope that this life is only an intermediary step, and that our real life will come only if we bear up in this world. And again, when prosperity hits us, religion tempers our exhiliaration, and keeps us within the bounds of propriety.

RELIGION, then, is an electrical filter, smoothing out the bumps of life for us. We engineers must not pass it by because of its associated rituals and formalities—we need not look up scientific data which might prove that there is no hereafter. Science applied to religion brings only discord and discontent to the mind, for religion is intended for the spiritual rather than the material side of life.

THERE is an inherent tendency in man to look forward always, to the future. Even if we have all that we can possibly ever need, we are not satisfied, and if we can taste little of the luxuries of life in this world, then we look forward to happiness in another life after death.

Engineers, do not despise the galaxy of religions which differ from each other chiefly in matters of ritual. And do not make religion your master as so many do. Choose rather the middle path, partaking of the ceremonies of faith only enough to bring you mental comfort, for peace of the mind is the real objective of all faiths.

ENGLISH FOR ENGINEERS

LAST month's English Page brought forth several favorable comments, so this month we go along on the same plan: a poem, a theme, and a literary selection.

"SEA Fever" is an unforgetable poem, great in its strength and living in its music.

THIS month's theme, "The Mechanics of a Pair of Pliers" is one which was turned in as a regular assignment, and shows a very unusual handling of a commonplace subject.

OUR selection this month is from "Tristram Shandy," one of the first novels, and one which has never since been duplicated in originality or disperseness.

SEA FEVER

I must go down to the sea again, to the lonely sea and the sky,
And all I ask is a tall ship and a star to steer her by:
And the wheel's kick and the wind's song and the white sail's shaking,
And a gray mist on the sea's face, and a gray dawn breaking.

I must go down to the sea again, for the call of the running tide
Is a wild call and a clear call that may not be denied:
And all I ask is a windy day with the white clouds flying,
And the flung spray and the blown spume, and the sea-gulls crying.

I must go down to the sea again, to the vagrant gypsy life,
To the gull's way and the whale's way where the wind's like a whetted knife:
And all I ask is a merry yarn from a laughing fellow rover,
And a quiet sleep and a sweet dream when the long trick's over.

—JOHN MASEFIELD.

FROM TRISTRAM SHANDY

Book IV—Chapter 20

WHAT a rate have I gone on at, curvetting and frisking it away, two up and two down for four volumes together, without looking once behind, or even on one side of me, to see whom I trod upon!—I'll tread upon no one—quoth I to myself when I mounted—I'll take a good rattling gallop; but I'll not hurt the poorest jack-ass upon the road.—So off I set—up one lane—down another, through this turnpike—over that, as if the arch-jockey of jockeys had got behind me.

NOW ride at this rate with what good intention and resolution you may—'tis a million to one you'll do some one a mischief, if not yourself—He's flung—he's off—he's lost his hat—he's down—he'll break his neck—see!—if he has not galloped full among the scaffolding of the undertaking critics!—he'll knock his brains out against some of their posts—he's bounced out!—look—he's now riding like a mad-cap full tilt through a whole crowd of painters, fiddlers, poets, biographers, physicians, lawyers, logicians, players, schoolmen, churchmen, statesmen, soldiers, casuists, connoisseurs, prelates, popes, and engineers—Don't fear, said I—I'll not hurt the poorest jack-ass upon the king's highway—BUT your horse throws dirt; see you've splashed a bishop—I hope in God, 'twas only Ernulphus, said I.—But you have squirted full in the faces of Mess. Le Moyne, De Romigny, and De Marcilly, doctors of the Sorbonne.—That was last year, replied I.—But you have trod this moment upon a king.—Kings have had times on't, said I, to be trod upon by such people as me.

You have done it, replied my accuser.

I deny it, quoth I, and so have got off, and here am I standing with my bridle in one hand, and with my cap in the other, to tell my story.—And what is it? You shall hear in the next chapter.

—*Laurence Sterne.*

THE MECHANICS OF A PAIR OF PLIERS

IN considering any mechanical appliance there are two things we think of first, its history, and the principles involved. A pair of common pliers is found to have a very interesting history.

Among the first implements discovered and used by the Chinese were the chop-sticks. These were, and are now, only extensions to the fingers to use for picking up food and other small objects. The first ones were merely small twigs or pieces of bamboo, but as the use of more precious materials developed it became necessary to put a small chain across between the tops of the two sticks to keep the pair from becoming separated.

IT was at about this time that Marco Polo came back to Venice from the court of Kublai Khan and wrote his famous "Book of Marco Polo." He was very much impressed by the use the Chinese made of the chop-sticks, and devoted several pages of his "Book" to the description of them. Marco Polo demonstrated this device to his friend Rustichello, who, being a man of great imagination, at once seized on the idea of joining rigidly the upper ends of the sticks, thus making them easier to manipulate. Thus was the first pair of tweezers made. A few years later an unknown silver-smith of Florence improved the pattern by joining the two legs in the shape of an X by a pivot at the center; and from this the modern pliers have come.

The principles involved in the development of the present pliers has been always the same, i.e. that of the lever. The lever itself is almost prehistoric; in the oldest hieroglyphs there is evidence that the lever was known and used, but until after Marco Polo's report the principle had not been applied to the task of grasping objects.

IN the use of chop-sticks, one stick is held firmly against the first joint of the second finger underneath the second joint of the thumb, the other is held along side of the first two joints of the index finger under the ball of the thumb

(*Continued on Page 55*)

AROUND THE CAMPUS

Dean Receives Medal

Dean Leland recently received a medal and certificate for participation in the defense of Verdun in the World War. He commanded the 303 combat regiment of engineers of the 78th division in the St. Mihiel drive in 1918. After the armistice, Dean Leland was transferred to command the 314 regiment of engineers of the 89th division for the march into Germany with the army of occupation.

Since the organization of the 88th division in 1922, Dean Leland has been colonel commanding the 313 engineers combat regiment of that division which has headquarters in Minneapolis.

E. E. Students Operate Radio and Television

Radio and television activities are going full blast over at the electrical engineering building at the University of Minnesota this year. WLB, the University broadcasting station, is on the air with interesting programs nearly every day, with Bill Gibson and Burton Powell taking tricks at the "mike." WLB divides time with KFMX, WRHM, and WCAL on a frequency of 1250 kilocycles. The transmitter, remotely controlled from the studios in the Electrical Engineering Building, is located over on the other side of University Farm. The two towers supporting the antenna each carry a red signal light to stave off any stray aeronautical engineers who may be coming along on one of their first solo flights

French, German, and Spanish lessons, talks on international affairs, sports broadcasts and reviews, a farm hour and a music appreciation hour given in conjunction with WCCO, dramatics, and organ music are only a few of the entertaining and instructive programs now being broadcast. Efficient chief engineer Fred Shidel is head operator with Vir James assisting him at the plugs. Construction engineers and control operators are L. Clements, A. Newhouse, L. G. Swendsen, and J. M. Wilson.

Captain R. W. Minckler of the Signal Corps is the faculty director of W9YC-W9XI, the University amateur short wave and experimental station, and its consulting engineers are Carl Swanson, W9JT, graduate fellow, and L. G. Swendsen, W9BYA, also doing graduate work. Kenneth C. Kirkland, W9EPD-ITV, is the student manager of the following members of the operating staff: W. C. Boese, W9HOT; L. R. Clements, W9BLG-VE4BT; Martin Fox, W9GVM; A. B. Hallaway, W9HBT; Carl Henrici, W9JHG; Robert Hinkle, W9EHK; John J. Huey, W9HZG-JFJ; David Kearns, W9FFY; C. F. Norton, W9ELA; Robert E. Neuman, W9IKO; Myron Smith, W9IUD; Richard St. Amant, W9GZQ; S. H. Teresi, W9GGA; and J. M. Wilson, W9CIX. The station is on the air every day sending messages by code, and "chewing the fat" with some of the thousands of other amateur stations.

Television is not to be outdone, however, as television enthusiasts Bob Campbell and Max Risley are receiving and transmitting pictures by wire, and are receiving television broadcasts from Chicago in a research lab at the E. E. building.

Newly Organized Flying Club Elects Officers

Thirty aeronautical engineering students have recently organized the University of Minnesota Flying club. The club was organized by the students to promote aviation activity and interest in the Northwest and to obtain flight training.

Officers of the club are: Thurman C. Erickson, president; Harold Anderson, secretary; William Collins, treasurer; Lennert Proebstle, assistant treasurer; Robert Lacy, field manager; and Jean Barnhill, social secretary. John D. Ackerman, head of the Aeronautical Engineering department, Howard W. Barlow, and Charles Boehnlein, instructors in Aeronautical Engineering, are the club advisors.

All members have enrolled in a special course of flight instruction at Wold-Chamberlain field, under direction of Elmer Hinch, chief flight instructor of the Northland Aviation School. Each member will receive a number of hours dual flying with Mr. Hinch as well as a number of hours solo flying. The training planes used are of the latest design for student instruction.

Cellulose from Poplars

New uses for aspen, commonly called poplar, may be discovered as the result of research about to be undertaken in the department of chemical engineering at the University of Minnesota by Dr. Wallace A. Cornell, working under Dr. Montonna of the department of chemical engineering and Drs. Gortner and Schmitz of the college of agriculture. The specific purpose of the research is to determine whether or not alpha cellulose, that is, the purest and most resistant form of cellulose, can be produced from the wood of poplar trees. Alpha cellulose is used in the production of rayon, high explosives, and lacquers.

If the research proves successful, vast amounts of waste forest land in the northern part of the state may become productive because of the ease with which poplar grows in this region.

Molten Metal Spraying Shown in M. E. Building

A spray metal demonstration was given in the mechanical engineering building October 27th. Metal in the form commonly used in welding work was introduced into a metal tip and melted by an oxy-acetylene flame. The molten metal, forced into a blast of air, was given a velocity of 35,000 feet per second. The terrific air velocity broke the molten metal up into fine parts and also cooled the metal as it impinged upon the surface to be covered. The spray tip was held about 6 inches from the surface. If the distance between the tip and the surface is greater, the metal freezes and if closer, the surface is heated.

Such a process as this is used chiefly for applying a protective covering to bridge members and inside surfaces of tanks.

Alloys and the more common base metals are used in this work. The method is applicable to the covering of practically every kind of material including wood, paper, and glass, but smooth surfaces must be sandblasted. After spraying with metal by the above method, the surface is slightly rough and upon first inspection looks similar to polychrome.

« « « SLIP STIX » » »

strange as it seems

An incident has been related to your frothing scrivener that Electricals may relish. In an E. E. lab a D.C. motor went dead and the instructor was called. He advised, "We'll have to give her a kick." Whereupon a lad whom we shall designate at "Tau Bete Sam," swung a mighty hoof and delivered one sudden thud to said motor, which had about as much effect as a whip on a street car.

Some people think college is a snap. Evidently they never heard of the Engineering College.

that library

Did you ever notice what happens in a library full of engineers? Look. Over there are two of them giggling over some quip like a couple of grade school girls over their first beau. And there is one working on his sliderule like a puppy on an old shoe. Several are indulging in that most tedious pastime called study. Oh, oh, would you believe it? See that one reading his paper and rubbing his nose? But the favorite sport is being indulged in by only one. He's sprawled over his notebook — sound asleep.

try a shotgun

An instructor in the Chemical Engineering department frequently puts his class at ease by telling them some queer anecdote relative to contemporary scientists. One morning he appeared before his class and set down on the desk no less than a genuine ticking alarm clock. He explained the bells were not working so well in the building that day. But, we might ask, what are alarm clocks used for generally, especially in the early hours of the forenoon?

successful engineers

Engineers may not look any more prosperous than the next man, but they are just as apt to be "touched" by the unemployed nickel collectors. One of the latest approaches goes something like this, "Pardon me, buddy, but could you part with a dime for a professional beggar?" To which your old sliderule operator was tempted to reply in the words of a clever man, "You try the other side of the street pal. I'm working this side."

A professor of Military Science lecturing to his class on observation, told of a group he once had who came into the room when the final exam was written on the board. They discussed various problems and had their books open for half an hour before they were told to close their books and answer the questions on the board. The Major said not one of the boys had noticed the questions and looked up the answers.

That's what *he* thinks.

or

It is said that when this d'pr'ss'n lifts television on telephones will be as common as tin cans in a June Bride's back yard. Imagine answering your telephone in the midst of a bath.

add similes

Cards from friends are generally favorably received. And then some are as acceptable as flat feet on the night of the J. B. An Architect, who cancelled out the first day of school to go South, writes, "How is the weather up there? Down here it's too hot to run fast. Even the jack rabbits are walking." Such a reminder on a day when our nose was running like a candidate for the class president. And the same day our radiator froze too.

why?

What ho—and a couple of picks. We just saw a freshman coming out of the Dean's office with a look on his face like a young man who has sat down on a piece of fly paper. Thinking something unusual (like getting a "D" or an "F") had happened, we asked, "Weren't the grades so hot, old top?"

"Naw," came back the yearling, "I just happened to think that I can't jump over streetcars," and he stumped away looking much happier for having let off a little steam.

school spirits

Do you talk a good game of bridge? Some talk a good game of football. One weekly mirthquaker always turns up with his hip pocket full of fun and good cheer. At the Homecoming game when Minnesota was within their opponent's 15 yard line and were penalized 15 yards, he piped up in a cackling voice, "Thash fine boysh. It'll look all the more spectacular from there. Just a little line plunge now."—naturally, with only 25 yards to go and fourth down. And such a pushover as Northwestern, too.

Military fraternities, getting their fall pledging under way, concoct many peculiar tasks for their prodigies. Perhaps the height of irony was displayed in the agreement of two actives to trade swats, and then recruited two pledges to absorb the biff and sting.

or what physics prof?

What professor in the School of Chemistry comes to class in the morning smoking a cigar and leaves his weed on the top of a locker outside the door till class is over, and then chastises his class for coming in the room smoking cigarettes?

depression again

What honorary fraternity, giving a smoker to prospective members, had a musician on the program whose stipend for the entertainment was $1.50, and then could scrape together only $1.35 to fulfill their financial obligation?

Do you know, gentle reader, that the next time we appear for you, Santa will be mending his pants and polishing his sled? Remember, there are only 38 shopping days till Christmas.

We're going out now and do our shopping early.

And let's not eat up any angle worms today.

HERE AND THERE WITH OUR ALUMNI

Architecture

'32—Clarice Berg recently received a scholarship from the Cambridge School of Domestic Architecture for Women in Boston, Massachusetts, and now is seeking further honors in architectural designing. Clarice, who is staying at 33 Garden East, Cambridge, Massachusetts, was architectural editor on the Minnesota Techno-Log staff for two years, and turned out many fine stories.

'29—Paul W. Jones has returned for a visit, bringing with him a group of his students to show them the instructive points of interest about the Twin Cities. Paul is teaching Architecture at North Dakota Agricultural College.

'32—Cheffe Marx, Interior Architect, is at present teaching kindergarten in Kenosha, Wisconsin. Cheffe, as you recall, was queen on Saint Pat's Day last Spring.

Aeronautical Engineering

'21—Kenneth Haugen is leading an exciting and interesting life, being stationed with the Pacific fleet for flight duty.

'31—Henry B. Pittelkow and Ray Odell A.E. '32, have a large assignment, both being in the traffic department of the Northwest Airways of St. Paul and are covering the district between Winnipeg, St. Paul, and San Francisco.

'31—Theodore Brouillette is an engineer with the Aluminum Industries, Inc. of St. Cloud, Minnesota. His present home address is Route No. 1, Ely, Minnesota.

'32—Prescott H. Newman is taking advanced flight training with the United States Marine Corps.

Chemical Engineering

'20—Arthur E. Stoppel (Ph.D.—1925) was formerly Assistant Professor of Technological Chemistry in the Technological Division of the School of Chemistry, but because of the discontinuance of this division, he has been transferred to the Department of Chemical Engineering where part of the work in Technological Chemistry is now given. It would have been tough on ye chemical engineers to have lost such a Prof as Doc Stoppel.

'28—Robert A. Gerlicher received his M.S. this year at Massachusetts Institute of Technology and is now doing Chemical Engineering work with the B. F. Goodrich Rubber Company at Akron, Ohio. It seems that Bob has finally weakened; he tied the fatal knot with Miss Catherine Hewlett on July 23 last.

'32—George Flanagan, Winfield Foster, Harold Graves, George Hama, Julius Katz, Lloyd Kempe, Cecil March, Robert McAdam, George Michaelson, Earl V. Peterson, F. L. Reither, Paul Salo, and George Taft are all taking advantage of "job depression" by training themselves to be still better chemical engineers. These industrious members of the Class of 1932 are all aiming for higher degrees over at the School of Chemistry.

Chemistry

'28—Ernest B. Sandell, who received his Ph.D. this year, is taking up his duties as instructor of Analytical Chemistry in the School of Chemistry this fall.

'32—B. Moskovitz, G. E. Noponen, and H. C. Yutzy are all successfully holding down assistantships in the School of Chemistry this year.

Civil Engineering

'23—George C. Schaller has for the past four years been operating a quantity survey bureau at 701 Builders Exchange Bldg., in St. Paul. He now has two fine boys, five and two and one-half years old and they keep him so busy that lately he hasn't had much time for golf. George's home address is in St. Paul, at 2182 Stanford Ave.

'30—Erwin G. Hill is now with the State Highway Department District Office in Elgin, Illinois. He has seen quite a bit of other Minnesota engineers and writes the following:

"There are several other Minnesota men at our office: Kenneth Johnson '28, George Luckman '27, and George Sprehn '24. I have been in the office for over two years and find the work quite interesting. I have played quite a bit of golf lately; taking part in several large tournaments but missing on all the prizes. Have heard from Harold Clausen '30—He was married about a year ago, and is living in Oakland, Calif. He is working for the U. S. Bureau of Public Roads."

Electrical Engineering

'21—Sander R. Hogan tells us that he is manger of the Sacramento Valley Walnut Growers' Association of Live Oak, Calif.

'27—Lloyd V. Berkner is advancing steadily with the U. S. Bureau of Standards, and is now an Associate Radio Engineer. He says the work is full of interesting things and he likes his position quite well. Letters to him should be mailed to 3901 Connecticut Ave., Washington, D. C.

'19—J. R. Heinemann is still with the Federal and Marine Department of the General Electric Company at Schenectady, New York.

Mechanical Engineering

'30—Ellwood L. Johnson was one of the staunch Minnesota "Threshers" who returned to their Alma Mater to help turn back the Purple Invaders of Northwestern. From information gathered from his friends we hear that he is working for the Morrell Packing Co. at Sioux Falls, South Dakota.

'31—Howard Giese was seen by many of his friends and former classmates during the recent Homecoming celebration. Mr. J. V. Martenis of the M. E. Department, informs us that Mr. Giese is gaining fame as a heating and ventilating engineer at Mitchell, South Dakota.

'32—Robert Cerny is at Harvard this year working for his master's degree under a scholarship which was awarded him this fall. He is rooming with Milton Bergstedt in a very chic apartment. Bob no doubt still thinks that beer is a good

antidote for design. While attending the University of Minnesota he was art editor for the Techno-Log in 1931-32. His cover design of that year recently won first place in the competition sponsored by Engineering College Magazines Associated at the Iowa City convention.

Desert air *is wet*

. . . by comparison!

Making telephone equipment presents many an interesting problem to the engineers of Western Electric—manufacturer for the Bell System.

A case in point is the drying of telephone cable before putting on the protective lead sheath. This step is of utmost importance, for the tiny copper wires cannot carry your voice properly unless their paper insulation is thoroughly dried. To this end, Western Electric engineers devised special drying ovens in which the air is *thirty times dryer* than desert air!

The same ingenuity and thoroughness go into every step of making cable, telephones, switchboards and many other kinds of telephone equipment. The dependable apparatus that results is one reason why Bell System service is dependable.

BELL SYSTEM

A NATION-WIDE SYSTEM OF INTER-CONNECTING TELEPHONES

AROUND THE CAMPUS

Receives Baker Award

The annual J. T. Baker award in analytical chemistry for the eastern half of the United States was made this year to Vernon A. Stenger, graduate student in the school of chemistry. This award is made on the basis of outstanding research in analytical chemistry and is given each year to two chemists, one from the eastern and one from the western half of the United States.

A.S.C.E. News

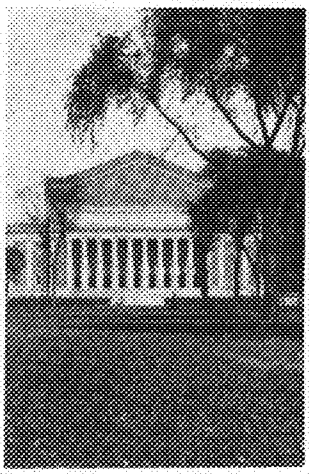
At an informal meeting of the A.S.C.E. held Wednesday, October 19, in the Minnesota Union, Mr. O. Mattison, president of the Minneapolis Bridge Company and a graduate of the engineering college, gave an interesting talk in which he emphasized the outstanding values and advantages in the business world of personality and human understanding over knowledge of engineering theory.

Mr. Legard, a former member of the faculty, now associated with the Minneapolis Bridge Company, talked on the durability of concrete as determined by research and experiments on old and modern concrete structures.

Officers of the A.S.C.E. were elected last spring at the last meeting of the school year. J. M. Nelson was chosen as president; Roy Oltman, vice president; Paul Wagtskjold, treasurer; and Lewis Martin, secretary.

Ninety new members have joined the society this year, and it is the wish of the officers that any men who have not already joined will do so without delay, not only to gain the advantages of the society but also to become better acquainted with their fellows in the civil engineering college.

Dr. Straub, guest speaker at the year's second meeting, has spent the last few years in Europe as travelling fellow for the A. S. C. E., studying and investigating the use of hydraulics both in practical construction and in theoretical aspects. His talk was illustrated by slides showing projects under construction in Holland, Dantzig, and other parts of Europe. Dr. Straub also gave an interesting description of the customs of the people of the countries he visited and of the life of the university students in those countries.



Northrop Auditorium

Student Develops New Nitrate Determination

A new method for the determination of nitrates has recently been developed in the school of chemistry by Benjamin Moskovitz working in co-operation with Drs. Kolthoff and Sandell. With this new method it is possible to determine the percentage of nitrates in fifteen to twenty minutes as compared with two to four hours by older methods. The determination consists essentially in boiling a mixture of the sample and a known excess of ferrous solution in a strongly acidic solution in the presence of ammonium molybdate which serves as a catalyst.

Part of the ferrous solution reduces the nitrate ion to nitric oxide and the remaining excess ferrous solution is titrated with potassium dichromate using diphenylamine sulphonic acid as an indicator. This indicator also was developed at the University of Minnesota by Drs. Kolthoff and Sarver. The determination is carried out under an atmosphere of carbon dioxide in an ordinary Erlenmeyer flask. Using as a sample twenty to two hundred and fifty milligrams of potassium nitrate a maximum error of .3% results, while with amounts as small as three to four milligrams the error reaches 2%.

Office Force Get Eats

The office force of the School of Chemistry wishes to express its appreciation to the "eats" committee of the student branch of the American Institute of Chemical Engineers for the apple bobbing and cidar party held on October 20th, the morning after the smoker. The only complaint voiced was to the effect that only one-half as many sugsugared as unsugared doughnuts were left by the sugar-loving chemists.

Rowley Returns from Western Lecture Trip

Professor Frank B. Rowley, national president of the American Society of Heating and Ventilating Engineers, has recently returned from a tour of the various local chapters of the society on the West Coast. He addressed the groups on a variety of subjects dealing chiefly with his experimental work which has been conducted at the University of Minnesota for the past several years.

Professor Rowley has been actively engaged here for some time in the conducting of research work regarding the heat transmission of building materials. About 96 different wall constructions have been tested by the special apparatus designed by Professor Rowley. This device is of considerable value in the work being carried on, and has been adopted as the standard method of testing by the society. Practically all insulating materials on the market have also been tested here at some time or other. The result of this extensive research has been to gather sufficient information on insulating and composite materials so that it is now possible to calculate the thermoresistance of practically any type of construction without going through the laborious and painstaking method of actual testing. The work at Minnesota is financed jointly by the American Society of Heating and Ventilating Engineers and the University. Four graduate fellows are assisting with the work.

Other chapters of the society located in the east were visited by Professor Rowley on a similar tour made last spring. His recent trip which included practically all of the universities in the west completes his contacts with all of the society's local chapters.

MODERN STAGECRAFT

(Continued from Page 43)

The other requirement of the perfect setting is that it shall be in the mood of the play—in other words, strike the keynote of the play.

By proper scale, by the correct proportions, by correct combinations of line, mass, and color, any atmosphere that is desired can be created in the eyes of the audience. Let me explain: straight lines suggest severity, curved lines grace. Thus long, straight, vertical lines create a feeling of majesty and nobility. Accentuated horizontal lines suggest repose. So the whole span of pictorial composition is applied to the picture that is designed. It is suggestive rather than delineative, decorative rather than graphic.

Lighting Effects Give Atmosphere

By lighting, too, which is often called "the fourth dimension" on the stage, we suggest the atmosphere of the play. Few people realize the value of lighting for dramatic purposes. Strange as it might seem, it is this branch of the theatre which holds the place of most importance in our present time. Along with the suppression of extraneous detail came the dependence upon light for the expression of atmosphere. It has been only in the last ten or fifteen years that a new means of illumination for the stage has been developed, the invention of the high wattage lamp and its successive adaptations for stage use made possible a medium far different from that of the traditional stage. It is in this new system that we find a reciprocal relationship between the technical and artistic progress.

Perhaps it is in this field of lighting that there is more of interest to the engineer. There are such devices as the Richter-Weil Diapositive Projector; Hagemann's device for projecting scenery; Geyling, Kann, and Planer's machine for projection using the Gekape process; and Thomas Wilfred's Clavilux or color organ from which he decomposes light into its spectral colors, projecting them into a seemingly innate, half-crystalline, half-nebulous rhythmic movement.

An article explaining these devices and more on the subject of lighting will appear in a later issue.

▾ ▾ ▾

OUR BOOK REVIEW

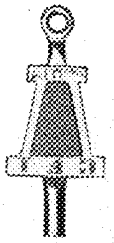
"Air Conditioning for Comfort"

With the public becoming increasingly conscious of the beneficial effects of air conditioning in home and office, it has become necessary for the engineer, be he a mechanical, electrical, chemical or any other, to inform himself at least on the basic principles of air conditioning. Such information, with special emphasis given to home and small office problems, has just recently been put into an easily available form in a book, *"Air Conditioning for Comfort,"* by Mr. Samuel R. Lewis, past president of the American Society of Heating and Ventilating Engineers.

This book touches upon every type of equipment now available, including methods of humidification, dehumidification, cooling, air filtering, etc. Chemical processes for extracting moisture, and use of refrigerants are adequately covered.

WITH OUR SOCIETIES

Tau Beta Pi



The fall election for Tau Beta Pi, scholastic society, is now under way and the qualifications of possible initiates are being checked.

Minnesota has one of the largest chapters of this society. The number of bids to be given out this quarter will be eighteen of which three will be juniors and fifteen, seniors. Since the chapter does not take all those students who are eligible, the standard is especially high and membership is a distinguished honor.

The initiates to the chapter will feel the benefit of instructions given in a model initiation at the national convention recently held at the University of Maryland. Archie Japs, president of the local chapter, attended the formal dance and banquet at the University of Maryland, had a trip through the Bureau of Standards, went through the Smithsonian Institute, and attended the reception given by President Hoover.

A. S. M. E.

The local student chapter of the American Society of Mechanical Engineers was recently honored by a visit from Mr. W. L. Abbott, past president of the A.S.M.E.

In the afternoon Mr. Abbott, chief operation engineer for the Commonwealth Edison Company, spoke before a large assemblage of engineers, present and future, in the Main Engineering auditorium.

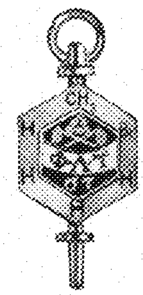
Norbert Mengelkock was appointed chairman of the program committee and George Graetz placed in charge of inspection trips to local industrial plants. A large number of mechanical engineers participated in the trip arranged by Mr. Graetz on Friday afternoon, November 4, when the Milwaukee Railroad shops were inspected.

Officers for this year include N. E. Carlson, president; Frank Ventura, vice president; Norbert Mengelkock, treasurer; and Russell W. Johnson, secretary. It is the purpose of the society to meet once a month, combining a technical discussion or talk with an interesting program, and to make at least two inspection trips each quarter.

Pi Tau Sigma

With the Minnesota Gamma chapter of Pi Tau Sigma, honorary mechanical engineering fraternity, being represented by Don Leslie, president of the local chapter, and by Associate Professor John V. Martenis, supreme secretary, the national convention is scheduled to get under way today at Urbana, Illinois, under the auspices of the University of Illinois chapter.

Phi Lambda Upsilon

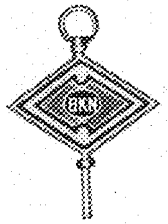


Phi Lambda Upsilon, honorary fraternity made up of students of chemistry, chemical engineering, biochemistry, and pharmacy, announces the results of the fall election. The new officers are as follows: president, H. M. Davis; vice president, S. I. Aronoksky; corresponding secretary, D. L. Fuller; recording secretary, H. P. Roe; alumni secretary, K. Goldmark; and counselor, Dr. E. B. Sandell.

A. I. Ch. E.

Attention, chemists and chemical engineers! There is an organization in the school of chemistry that will provide you with some of the finest technical training and information that it is possible to obtain in any extra-curricular activity. We refer to the student branch of the American Institute of Chemical Engineers. This organization, sponsored by the exclusive national organization of the same name, is made up of both graduates and undergraduates of the school of chemistry and most of the members of the chemical engineering faculty. The purpose of the organizaton is to inculcate in its members those qualities of character and mind so desirable in the technical man. To this end the society provides outstanding speakers on technical subjects and conducts student discussions in which some student is charged with the responsibility of studying a scientific subject and presenting this subject to the society for open discussion.

Eta Kappa Nu



Five seniors and seven juniors were selected for membership in Eta Kappa Nu at a dinner meeting held at the Minnesota Union on October 26. The first step in the initiation of the new men, which consisted of a six hour written examination, was held on November 2, and the informal initiation was conducted amidst mysterious electrical engineering apparatus on November 9.

James Stoddart and Paul Erickson were appointed to the committee on social events, and their first duty is to arrange a welcoming party for the initiates.

Robert Haxby, Fred Bauman and Jerry Shepherd were assigned to the banquet committee, and will take care of all the details of the formal initiation and the annual fall banquet of Eta Kappa Nu.

A. I. E. E.

A student talk by Everett Miller featured a meeting of the student branch of the American Institute of Electrical Engineers held in the Music Auditorium on the evening of November 17. Mr. Miller told about Western Electric sound equipment and illustrated the various pieces of apparatus with two reels of film.

Committees appointed for the school year include: Meetings and Papers—John Hancock, chairman, John Hyvarinen, and Kenneth Gregerson; Membership—Adolph Kupka, chairman, James Stoddart, George Krauch; Publicity—William Shepherd, chairman, Everett Miller, Robert Marshall, Earl Diekhoff.

A film portraying "Romance of Glassblowing" will be presented in the Main Engineering auditorium during convocation hour December 8. Mr. A. Tylor, lighting consultant of the Macbeth Evans Glass Co. of Chicago, will supplement the film with a lecture covering modern methods of making cut glass, lighting fixtures, and other glass products. This meeting will be open to all engineering students.

ST. PAUL'S NEW CITY HALL

(*Continued from Page 37*)

ernistic with straight mouldings, no carvings and large unbroken surfaces. Many unusual specimens of wood are used, including wood from every continent on the globe. Veneers are approximately 1/20 of an inch thick and therefore lend themselves well to a repetition of graining and booking. In many instances the booking is repeated around the entire room giving a most unusual effect in color and design. Woods used include practically all of our domestic ornamental woods as walnut, mahogany, quarter sawed birch, oak, maple, butternut, etc. Some of the imported woods are Mexican, African, and Honduras mahoganys, Indo China and Brazilian Rose Wood, Australian Black Wood, Teak from India, Indian Laurel, Prima Vera from Mexico, Ebony from India, Tasmanian Oak, English Oak, Austrian Oak and many others. There will be combined in this building a finer and larger variety of ornamental woods than has heretofore been attempted in modern design. Acoustical material of varying sound-absorbing qualities will be applied to practically all the ceilings in the Court Rooms and offices.

The building will be serviced with six passenger elevators located in the center of the tower section. Each elevator will be equipped with a seventy-five horse power alternating current generator and a seventy-five horse power direct current motor, located on the twenty-first floor. The elevators are the latest in design with certain mechanical features built especially for this job. They will have a speed of 900 feet per minute and will be the fastest operating elevators in the Twin Cities. Each elevator will be fully automatic in operation and equipped with a complete schedule system. This system regulates the interval between the starting of each car, thereby assuring the best possible service to the public. Each car is provided with an electric clock, a complete air circulating system, and a telephone system. One elevator will be especially built to take prisoners from the county jail to the criminal court on the eighth floor.

The heating equipment is the latest type of high vacuum system operating on a maximum vacuum of eighteen inches. The combination of a Marsh Compensating system of steam temperature control and a Johnson heat regulating system, makes a highly efficient heating installation. The Marsh Compensating system operates on the principle that the higher the vacuum the lower the temperature of the steam. The system will be required to supply steam to 50,000 square feet of radiation. A central steam generating plant will be located some distance from the structure and steam will be supplied through a ten-inch main. All steam pipes 2½ inches and over have welded joints. All water piping and steam returns are of copper tubing with soldered joints. Two water tanks on the twentieth floor, a high pressure tank and a 100 horse power fire pump located in the basement will provide fire protection for the building. Washed air will be supplied to rooms requiring ventilation.

The building was designed by Ellerbe and Company, Saint Paul, and Holabird and Root, Chicago, Illinois, Associated Architects. Foley Brothers, Incorporated, Saint Paul, were General Contractors for the building.

A FRESHMAN THEME

(*Continued from Page 47*)

and follows the movements of the finger. Probably Kublai Kahn did not know that the leverage principle was involved here, but it was, the leverage exerted by the finger being extended through the stick to grasp and pick up food and small objects. Here the tool was only an extension of the natural lever in the finger. In Rustichello's tweezers, however, the lever became self-contained so that instead of extending the leverage of the finger it received a force from the fingers and was moved by them to accomplish the work intended. The lever, though, still belonged to the same general type, the force applied at the middle, the fulcrum at one end, and the work done at the other end. The mechanical advantages of the tweezers is evidently limited since the point of application of the force must be nearer the fulcrum than the work is. Herein lies the great superiority of the silver-smith's refinement; the work arm may be shortened and the force arm lengthened with the fulcrum between them so that a mechanical advantage of ten or fifteen might be obtained easily, as against that of the tweezers which must always be less than unity.

E. C. M. A. CONVENTION NOTES

The twelfth annual convention of Engineering College Magazines Associated, which was held in Iowa City, Iowa, on October 27th to 29th, was attended by three delegates from the Minnesota Techno-Log: Laddy Markus, editor; Thomas Rogers, business manager; and Parker Lowell, chairman of the Techno-Log board. The editor's diary supplied the following rambling comment on the convention, on the delegates, and on Iowan customs.

OFF for Iowa City on Tuesday, October 25th — a swell day, with a clear sky and a breath of Indian summer. Fill the gas tank, check the oil, and step on 'er. Paved roads all the way, but oh, how narrow! Timing plug decides to fall out, and car gets sprayed with oil. A cork stops the flow—a Ford garage in Rochester finishes the repairs. Breakfast at a hot dog establishment, and big, strong cigars for the business manager. First one not so bad, but that second one just about smoked out the editor.

Stop for dinner at a hotel in Decorah, Iowa—phonograph music free.

Off again, through the corn fields and over the rivers. Iowa must have more rivers than Minnesota has lakes—but it's heaven for the civil engineers—they are kept busy building them. Cedar Rapids, and a funny little street car that has neither head nor tail. Twenty miles more, and Iowa City is in view.

At last, in front of the Memorial Union. In we go to register and get little badges pinned on our coats. Then to our lodgings—the swellest fraternity house on the campus—high on the bluffs above the Iowa river.

Up at 7:30—too late for breakfast—feed ourselves in the kitchen. Pack into the car and head for "Old Capitol," where Dean of Engineering gives welcome. Nice little building, built around 1842—not safe to say anything against it to an Iowan.

CONVENTION travels to Iowa Memorial Union and gets down to business. Annual reports read and cussed—publisher's representative jumped on for not getting enough national advertising. Almost noon, so back to the Old Capitol steps to watch the little birdie. Luncheon in the Union—back to the meeting again, with not a minute to write to the girl friend back home. Committees appointed to do the work of the convention—Rogers on nominating committee—Markus made chairman of railroad fare pro-rating committee.

Local advertising discussed—everyone has ideas. Minnesota has most local ads

—everyone listens to Rogers telling how he got them. St. Pat's Approved Service cards praised by everyone. Committees get five minutes to try to meet—then back to the house to clean up for the banquet.

A SWELL feed—cocktails—fancy programs—classy entertainment. TECHNO-LOG editor very unhappy at end—called on him for first after-dinner speech. Editor exchanges experiences with the other delegates, while Tom and Parker inspect the sororities and the nurses' homes. Get to bed about one, and up again at seven. Convention gets pretty hot—everyone wants to talk at once. Circulation, student articles, illustrations, editorials, alumni news, humor—all discussed. Tom and Parker show the gang how Minnesota sells ads. Parker is Greek restaurant owner—Tom is our advertising salesman. Greek objects to advertising—strenuously objects to parting with money. Tom pulls out his rod, and stops argument by three shots. Greek falls down, and that's why we haven't an ad from the Greek restaurant down the avenue. Now a bit of seriousness, while Tom runs through all his selling arguments in getting a page ad contract from a clothing store of which Parker is the owner. Convention gives big hand for the skit—Tom heads for town to get back the two bucks he deposited for the gun.

Friday night — convention dance — with dates secured for all by the host, the Iowa Transit. A wonderful ballroom is the lounge room of the Union when the rugs are taken up.

'Twas something at first sight for Tom and Parker, so they didn't stay long at the dance. Polly Inn drew our business manager, but nobody knows where the chairman of the board spent his evening. The big question—where did Tom get that Phi Mu pin he displayed so proudly? Tough luck—girls had to be in by 12:30. Iowa wasn't such a bad place, after all, was the consensus of the after-midnight bull session at the frat house.

Awards for the year announced—Minnesota wins first place in cover design competition (thanks to Bob Cerny)—third place in alumni news.

OFFICERS of the association elected—last year's chairman resigned after eight years of faithful work—made an honorary chairman for life. Robert Winfrey of Iowa State made new chairman. Committee reports made and approved—convention very successful — adjournment. Each man for himself—Tom to Phi Mu, and Parker to the river bank. Lunch at the Iowa Union cafeteria. Big surprise here—it's cafeteria service, but the waiters carry the trays.

Some queer customs at Iowa—all senior engineers wear leather jackets—all senior lawyers carry canes. Freshmen conspicuous by their green caps.

On the road home again—all take turns keeping 'er around fifty—stop to buy watermelon—call the girl friend from Rochester—home at 11, and Tom's only two hours late for the date made before the convention. Money pretty low—seems as if the engine burned more oil than gasoline. In bed at last—today's Sunday, so no school. Isn't it great to be back again?

A Century of Progress in Engineering

(Continued from Page 41)

buildings is located on the south end of Northerly Island, an artificial island which was built expressly for the fair at a cost of $600,000.

Artificial Lightning

The Electrical building is built in the shape of a circle with the quadrant facing the mainland removed. In the center of this circular court will be erected a huge transformer developing about 5,000,000 volts. High above the transformer a huge discharge of artificial lightning rivalling nature's own will take place periodically. Below the great stroke and leading up to it will be a modern counterpart of Jacob's ladder. This apparatus will consist of two vertical electrodes between which minor flashes of lightning will ascend toward the great flash.

"House of Magic" at Fair

The Geneial Electric Company will move their far-famed "House of Magic" from Schenectady, N. Y. to Chicago for the fair. In this spectacular laboratory they will display the very latest electrical discoveries. Among these will be the new "fever machine," a device enabling man to artificiate nature's own method for combatting disease by raising the body temperature. They also have a display of unusual lighting effects produced with gaseous illumination tubes making use of the new sodium lamp.

Moving picture concerns intend to transplant a section of Hollywood to Northerly Island.

The National Broadcasting Company intends to build a complete broadcasting studio in the Radio building in which will originate numerous special broadcasts throughout the duration of the fair.

With a special appeal to the student of architecture there will be a housing exhibit covering 5 acres consisting of eight modern residences, garages, an apartment dwelling, and a fire station, all supplemented by areas of landscaped ground.

Many Amusements and Rides

Of no little interest to the engineer are the rides and amusements which will provide diversion thrills to the vast crowds. Two, which are destined to be the most popular, are Flying Turns and the Sky Ride. The first is a gravity ride on the order of a roller coaster except that the cars travel on a smooth floor rather than on rails. This floor is built in the form of a long winding trough. When the vehicles round a corner at a high rate of speed they will climb to the steep sides of the trough in many cases executing a ninety degree bank. The Sky Ride consists of two high steel towers, one on the mainland, the other on Northerly Island. Between these towers at a considerable height will be stretched long cables from which will hang rocket cars for transporting passengers back and forth across the lagoon. High speed elevators will operate in the towers to take the people up to the rocket cars.

Technology Lectures Cover Varied Subjects

October 14

The part of the engineer in the organization of a public utility company was discussed by Mr. J. A. Colvin, Superintendent of Generation with the Northern States Power company. Mr. Colvin stated that teamwork, cooperation, and ability to work with others are the requirements for success in any large organization.

October 17

"Do your job from day to day—do not be irritated at the petty annoyances of life—do just a little more work than the fellow next to you—train yourself to learn from observation—to analyze the character of the men whom you meet each day—develop your personality—be original, consulting others only where absolutely necessary—if you want to be successful in the industrial world of today"—thus did Mr. James P. Coleman, general manager of Sherwin Williams Paint company address the students.

October 21

Mr. F. R. Calton of the Standard Oil company traced the steps used by the oil industry in converting crude oil to the finished product, and told of the many by-products resulting from the different distillation processes.

October 24

Mr. B. J. Robertson, Professor of Internal Combustion Engines, traced the progress of the internal combustion engine from the early days of the horseless carriage to the modern high speed airplane engine, showing slides of the various motors of the past. Of especial interest were Henry Ford's first car, the first Wright airplane motor, the revolving cylinder airplane motor, the Packard Diesel aviation motor, and the large industrial Diesel engines. Prof. Robinson presented an interesting picture of the troubles of our first autoists and told of a number of incidents where old Dobbin came to the rescue.

October 31

Three reels of film on lap welded, butt welded, and seamless piping were shown by Mr. Pore of the National Tube company. Actual scenes of blooms being rolled, step by step, into the finished pipe were included, and at the close Mr. Pore showed on a blackboard the steps followed in the piercing of a bloom to form seamless piping.

October 28

Mr. Bayliss and Mr. Pore of the National Tube Co. and the Illinois Steel Co. showed films which traced the steps followed in converting ore deposits into steel ingots. Some of the scenes showed ore being taken out of the open pit iron mines of Minnesota, huge crushers which break up the ore, blast furnaces for melting it down, and fiery Bessemer converters.

November 4

Mr. E. A. Titze of the Crane company told all about the valves and control equipment used in piping systems, and showed a number of slides of the different pieces of equipment put out by his firm.

November 7

Mr. Henry Bellows, president of Northwestern Broadcasting, compared the development of radio broadcasting in this country to that in foreign countries. Starting with Marconi, he went on to tell of radio telegraphy and of the first experimental radio telephony transmitters in this country.

In Europe, governments have had control of radio broadcasting since its beginning, but in this country radio was unrestricted for many years. Stations then broadcasted on any channel they pleased, using the maximum power they could afford, and radio reception was in chaos. Mr. Bellows told of the formation of the radio commission, after the department of commerce had declined the honor of controlling broadcasting, and described his work as one of the five original members of the commission.

« « MENTAL TILTS » »

OUR first Mental Tilts column of the year was a huge success—from the standpoint of the TECHNO-LOG'S bank account—not a single person came in to claim the two dollars offered for the first correct solution of the three puzzles. Our business manager is so anxious to get rid of this two dollars that he has asked Ye Editor to run only two puzzles this time. And so a credit slip good for $2.00 in goods at the Engineers' Bookstore will be given to the first student who turns in to the TECHNO-LOG office the correct solutions to this month's Mental Tilts.

SEEING THINGS

AT a powpow, an inebriated gentleman clambers into a canoe and paddles up a stream for a mile. At this place he drops a cork overboard and continues upstream for an hour; then he turns around and paddles downstream. He reaches his starting point the same time the cork does which leads him to believe that he is seeing things.

What is the rate of the man in still water and what is the rate of the stream?

TRY THIS WITH A FOOTBALL

A MAN throws a ball 40 feet into the air vertically; two seconds later he throws a second ball upwards and strikes the first ball squarely. What is the initial velocity of the second ball if the first rises to a height of 40 feet above the man again after the collision? The impact is perfectly elastic.

Answers to Last Month's Mental Tilts

GOLD DUST

The weary miners could divide their "dirt" equally in several ways. One method is as follows:

Step	*24 ounce box*	*5 ounce box*	*11 ounce box*	*13 ounce box*
1	24	0	0	0
2	11	0	0	13
3	11	5	0	8
4	11	5	8	0
5	0	5	8	11
6	0	3	8	13
7	3	0	8	13
8	3	5	8	8
9	8	0	8	8

THE FARMER AND HIS STOCK

The farmer bought eleven horses, nineteen cows, twenty-eight sheep and twenty-two pigs. This is the only solution to the problem if the farmer buys a positive integral number of each animal.

HEADS YOU WIN

Believe is or not, an infinite amount of money must be charged.

The probability of tossing heads is one-half. Hence this chance is worth one-half of one dollar. The probability of tossing first a tail and then a head is one-fourth. Hence this chance is worth one-fourth of two dollars or fifty cents.

A table of worth against probability would thus go:

Tosses	*Probability*	*Payment*	*Value*
Heads	½	$1	½x$1=$.50
Tails once, then heads	¼	$2	¼x$2=$.30
Three tails, then one head	1/16	$8	1/16x$8=$.50
n tails, then one head	$(\frac{1}{2})^{n+1}$	$\$2^n$	$(\frac{1}{2})^{n+1}\text{x}\$2^n=\$.50$

The sum of all the probabilities is one, meaning it is certain that one of the possible events will happen. The sum of the values of the individual possibilities or events is an infinite amount, hence the house should charge an infinite amount to guarantee that it will break even.

An interesting discussion of this problem can be found in the book "Probability and Its Engineering Uses," by T. C. Fry.

WCCO

(*Continued from Page 39*)

matically allow only three-fourths normal plate voltage to be applied at first to the power tubes for protection thereof when starting up with cool tubes. A time delay operated contactor shorts these resistors a few seconds after the power is thrown on and the station is then operating at normal power.

Water Cooling System

The cooling system for the water cooled tubes is of excellent design and has proved to be particularly effective. Two hundred gallons of the purest water obtainable is kept flowing at the rate of one hundred gallons per minute throughout the system by either of two pumps. Brass pipe and fittings are used throughout to reduce corrosive effects and hence leakage to a minimum. The cooling of this water is accomplished by four forty-two inch fans which blow through four radiators similar to but much larger than automobile radiators. The cooling air comes direct from outside the building through three built-in louvres in one side of the building. Each louvre occupies a total area of about forty square feet. After passing through the radiators, the air passes into an air shaft which extends through the building up to a pent house on the roof. The air escapes through louvres on all sides of this pent house.

Lights Signal Trouble

Trouble developing in any one of the six large rectifier tubes or any one of the eight 35 kilowatt tubes might be difficult to determine or isolate were it not for the signal system provided. Relays in each of the above tube plate circuits are connected with corresponding indicating lights on the power panel so that an overload of a breakdown in any tube causes the corresponding light to go out and also the plate supply to be disconnected. If the overload is only momentary, the high voltage can again be applied and the signal light reset. If permanent, the trouble can be investigated in the tube or tube circuit in which trouble has been registered. Also by making note of the temporary trouble indications explained above, repetition for any one tube may foretell some future permanent failure. The station staff can therefore sometimes locate trouble before it becomes of sufficient magnitude to interrupt the broadcast, necessitating changes and adjustments during the broadcasting hours.

Safety Precautions

The interlocking protective circuits are rather elaborate and are quite complete. Before an operator can enter the cages surrounding the main transmitter, the power panel, the dummy antenna, the coupling equipment in the coupling house, or the transformer room, a safety wheel must be turned which withdraws a bolt from the gate and gate frame, opens the power control holding coils and grounds the high voltage busses. Also it is impossible to open any of the windows on the panels in the transmitter or power units without first turning the safety wheels on the cage gates. It is therefore impossible for anyone to throw on the power when someone is working within the cages or through the panel windows.

Similar protective door switches are placed in the doors to the bias and filament control cabinets in the basement. This prevents applying plate voltage if and when either or both filament or bias

A 50 KILOWATT TRANSMITTER

supplies are off since the doors cannot be closed until the control switches are "in." In the power panel units are holding coils also which prevent application of the high voltage until the filament and bias voltages are up to normal.

Interesting Points

Some of the incidental interesting points about his installation are given herewith.

Second harmonic radiation from the transmitter is reduced to 70 DB below the fundamental by the use of series resonant LC circuits, one each such circuit being connected from each set of three paralleled plates in the six tube push-pull output power stage, to ground.

The transmitter delivers approximately twenty-nine amperes into the sixty ohm antenna, unmodulated. With 100% modulation, this power rises to 200,000 watts. Since the 35 watt tubes will handle easily some 45 kilowatts each momentarily and the regulation of the power supply is better than one-half of one per cent, there is plenty in reserve to take care of the modulation peaks.

A special motor driven blower is mounted below the large rectifier tubes whose output is piped to blow directly on the base of the tubes. At the spots where the air strikes the tubes, drops of condensed mercury can be seen on the glass. This cooling maintains the proper mercury vapor pressure within the tube, reduces the number of flashovers and breakdowns and lengthens tube life.

Keep Complete Spares

It is interesting to note that one hundred per cent spares of all tubes is maintained and the majority of other parts which may become defective in service are kept on hand in duplicate to insure a minimum of interruptions of the broadcast. This duplication is carried to the speech input and associate equipment as well. It is also interesting to note that the only batteries in the station are the C batteries in the speech input amplifier. Filament and plate supply is furnished by eliminators which are in duplicate, and all controls are actuated by alternating current or rectifiers or rectified alternating current.

The total average power drawn by the installation is 265 kilowatts or greater than that of the entire town of Anoka which has a population of 5,000. This is in decided contrast with the load of only 30 kilowatts taken by the old 5,000 watt station.

Will Broadcast Overtones

The quality of output of the transmitter considering everything from the studio to the output on the air is decidedly better than the average radio receiver is capable of reproducing.

A staff of seven operators operate and maintain the present transmitter, there being two on duty while the station is on the air and one on duty during the night for making such checks or adjustments as may be required. The entire installation is cleaned and checked for possible loose connections or misadjustments of equipment completely every week, and all relay equipment is thoroughly inspected and contacts adjusted once a month to insure continuity of operation of the station. All possible readings of the indicating instruments—some fifty in all—are taken three times daily to give complete knowledge of the operating condition of all the parts.

Minnesota

Member Engineering College
Magazines Associated.

DECEMBER, 1932
Vol. XIII No. 3

NON TECHNICAL NUMBER

15c

Imported Silk Lined Holiday Ties

$1

Gorgeous imported French moires — the kind the shops along the Rue de la Paix sell for many, many times this price — sumptuous woven silks from Switzerland, Austria, Italy — they're all hand-tailored

CAMPUS STORE

MAURICE L ROTHSCHILD & CO

Palace Clothing House

DECEMBER, 1932
VOLUME XIII, NUMBER 3

Minnesota Techno-Log

37 • ELECTRICAL BUILDING • • • U of M

Published monthly from October to June inclusive, by the students of the College of Engineering and Architecture, the School of Chemistry of the University of Minnesota

THIS MONTH

THE EDITOR SAYS

Today the Techno-Log is out—today the staff pushes aside the typewriters, kicks out the politicians, and settles down for some real work. But oh! How we would like to just throw our feet up on the desk—lean far back in the good old chair—light up the old p . . . (no—we couldn't do that, for no one smokes in room 37)—but anyway, just forget about school and copy and deadlines and the howls of our printer—and sit and dream. And worst of all, we haven't studied for so long we've just about forgotten how. Those long reports—those seminar speeches—those dratted finals—and we don't like to study. Ah—me! Such is the life of an engineer!

It's quite a surprise to see the Techno-Log out so early in the month—isn't it? Well, here's the very sad reason—finals are only a week distant. To you students who have kept up with your assignments faithfully each day, this means nothing, but to the members of the staff who have put so much time into work on the Techno-Log that their studies have been a bit neglected, finals mean danger. With the last issue of the year 1932 out of the way, the staff can once more turn to their books, and think again of scholastic averages.

MEMBERS OF THE ENGINEERING COLLEGE MAGAZINES ASSOCIATED

Chairman: ROBLEY WINFREY, Engineering Hall, Iowa State College, Ames, Iowa

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Iowa Engineer	Michigan Technic	The Pennsylvania Triangle	Wisconsin Engineer
	Minnesota Techno-Log	Purdue Engineer	

Entered as second-class matter April 9, 1925, at the post office at Minneapolis, Minnesota, under the Act of March 3, 1879. Office, 37 Electrical Building, University of Minnesota. Telephone, Dinsmore 2760. Contents copyrighted and permission must be secured for re-publication. Subscription rate, $1.50 a year. Single copies, 25 cents. Advertising rates upon application. Alumni Directory, 50 cents.

ST. MARK'S CHURCH
A pencil drawing by
RUSSELL WILLIAMS

Six Years Out---And Now!

PAUL NELSON, '26 E. E.

in which an engineer asks himself some pointed questions

EVERY time I look back on those four years at the College of Engineering, and I think how I spent valuable hours swinging a hammer in the forge shop and graduated without knowing the difference between an invoice and a statement, the proper way to hold a knife and fork, or some of the rudiments of making good investments, I get damn upset about it.

In other words, I firmly believe that one of the reasons why the engineering profession is as it is (and you know what I mean) lies in the fact that an attempt is made at specialization in too many phases of work—purely technical—during the four years of undergraduate work, and that a lot of plain good common sense subjects needed to fit the average fellow for the art of living and getting along are entirely missing.

Be a Gentleman First—Then an Engineer!

To be specific, study at a technical college, to my way of thinking, should first train the student to be a gentleman and then an engineer.

Give a good fundamental training in mathematics and all the rest, show the student where he can find information about the branch of work that interests him the most, and that's enough as far as the technical end goes. Require plenty of English (though many will simply hate it), perhaps one foreign language, economics, business law, accounting, something about investments and insurance, and even a course in table manners.

But, this will all take more than four years. What if it does? Isn't it better to learn essentials while in school a couple of years longer than to go through life struggling with the subjects I have mentioned, perhaps never really to master them?

Every day that I get groggy after lunch and wish that I had played handball that noon, I am reminded of the importance of exercise. And, that reminds me of sports and how important a part of university work I think it is to acquire a certain proficiency in tennis, handball, squash racquets, or the like—or at least to have developed a liking for some sport which can be easily followed almost any place one might go. At least, give sensible sports more emphasis for the student engineer.

I wish that I had played more back in those days. I would if I had been made to. So, why not make play a required part of a course in engineering? Yes, why not?

As a class, engineers cannot "sell" themselves. Acquiring a little social polish in conversation and manners, which constitutes the background of a broad education, would do a lot for technical men, so many of whom go through life all tied up in a knot mentally, and with their hands in their pockets socially.

Of course, there were a lot of excellent features about the engineering course which I experienced. It taught me how to work hard, developed a sort of analytical attack for the solution of most any problem, and brought me in contact with some real educators. However, this doesn't purport to be a back-slapping article, so we'll take those things for granted.

I'm quite dubious about the value of any fraternity, social or professional. I have observed very few instances where the contacts result from such affiliations really meant much—not even in the instance of selling life insurance or bonds.

Of the two types, I believe the professional fraternity is of most value. However, there is a tendency for get-togethers of professional men to be all shop-talk. Assuming the attitude again of a know-it-all, I suggest strongly that such meetings be of a cultural nature or else of the *beer-bust* type.

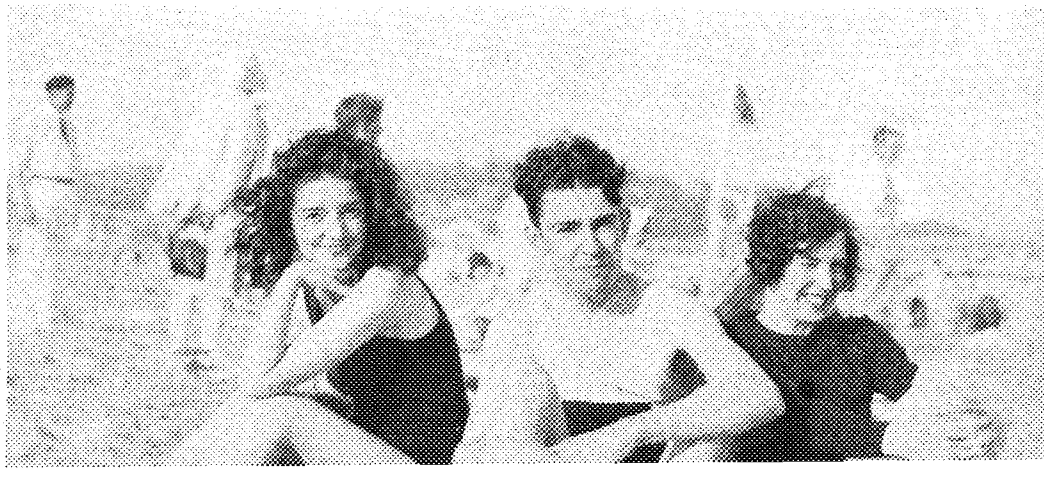
Beer-busts and similar stag affairs are valuable, for they lessen the tension of everyday life, promote congeniality, and result in a lot of silly acting by people who would not otherwise do so. This in itself is a mighty fine thing . . . once in a while.

Connected with a great many large social fraternities is a lot of *honey* that a great many men get sick and tired of after a while. I have observed that the ardor connected with a lot of meaningless Greek symbols starts to wear off about three or four years away from the campus, just as an alumnus progresses to a point where College Humor, rolled socks, and anything more than an arm band at football games gives him a pain in the stommick.

While I do not want to be misunderstood, still I think

[*Please turn to page 96*]

Paul Nelson and his fair companions enjoy life on the beach at Deauville.



Between the lines--

LEON ARCHIBALD

BACK in the days before the Canadian Northern lost its identity in the Canadian National system one of its important branches, the Maryfield extension, ran into a jam one day which is not listed as an obstacle common to railway construction. And perhaps the way in which the difficulty was overcome was just as unorthodox as the obstruction itself.

Along the right-of-way just before it dips into the Souris Valley lived a German homesteader by the name of Hoffmeister. In sinking his well Hoffmeister came across a sizeable deposit of gravel, and since this is a scarce commodity on the prairie, the C. N. entered at once into negotiations with the homesteader for a supply of this highly desirable surfacing material.

The right-of-way agent bought the fifteen acre gravel area of the homestead for six thousand dollars giving Hoffmeister the Company's check for this amount. A few days later a spur track had been run into the deposit and two steam shovels installed. An "extra" gang of two hundred and fifty men came out from Winnipeg under a capable foreman and surfacing began. Everything ran smoothly for three days when on the morning of the fourth the conductor of the gravel train reported trouble to the foreman of the surfacing outfit.

It seems that during the night Hoffmeister had built a barbed wire fence across the spur track into the pit and had ordered the train crew to keep out. The crew was a trifle hard boiled and since a few strands of wire didn't amount to much, the German was told where he might head in if he felt chilly, and the train proceeded on its way for a load.

While they were out on the track plowing off, Hoffmeister fixed up the fence again and on its return the train crew found him comfortably seated by the fence in a chair with a double barrelled shotgun across his knees. In addition to the gun the ugliest looking bull dog in ten counties was lying between his feet.

"What's all this?" demanded the conductor.

"You knock down mine fence again und I shoodt," replied Hoffmeister.

"Don't waste shells. Let me at 'em," snarled the bull advancing belligerently.

The German then explained that he had not been paid his land. All he had received was a piece of paper with s writing and figures on it. What he wanted and, he aver what he was going to have before another load of gravel the pit, was money—the real thing. The conductor, engi fireman and brakeman argued, threatened and swore minously, but Hoffmeister stood his ground.

"Take a run for it," suggested the conductor, "I think he dast to shoot."

With one hand on the throttle and the other on the ai engineer took up slack but as the sentry cocked his barrel the air brake won easily.

"You take her, Con," the engineer invited. "I never fond of buckshot," he added.

The trainmen then went into executive session from w they emerged unanimously against testing Hoffmeis marksmanship. They decided, instead, to put the matte to Johnson, the foreman of the "extra" gang. They ag it was his funeral, not theirs.

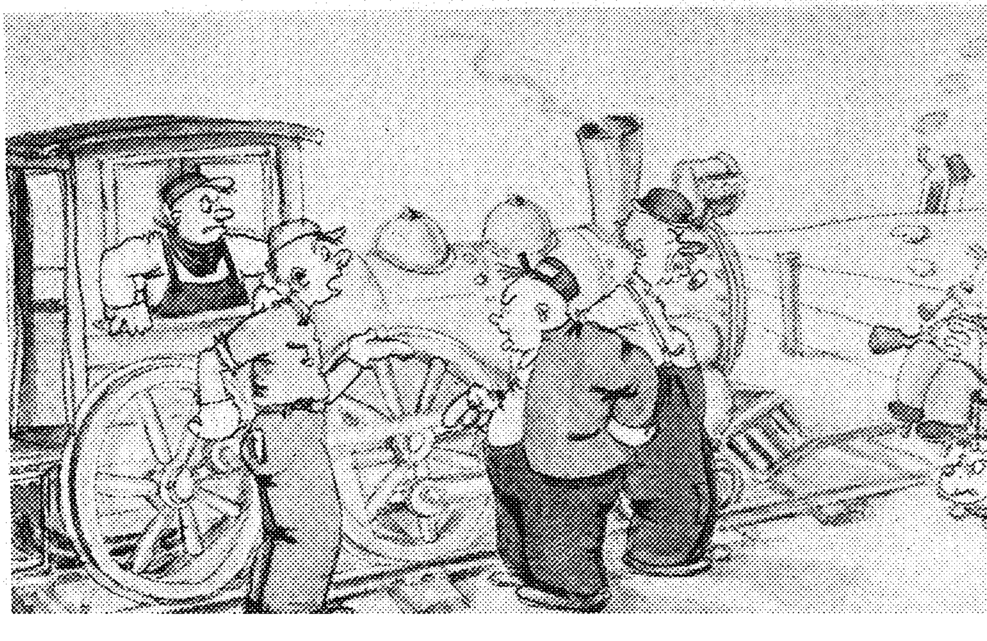
Johnson held a fruity consultation with the hostile h steader at a distance deemed to be safe with a few yard good measure but failed completely to change the sta his mind. Hoffmeister wanted cash while the bulldog wa action. That, apparently, was all there was to it.

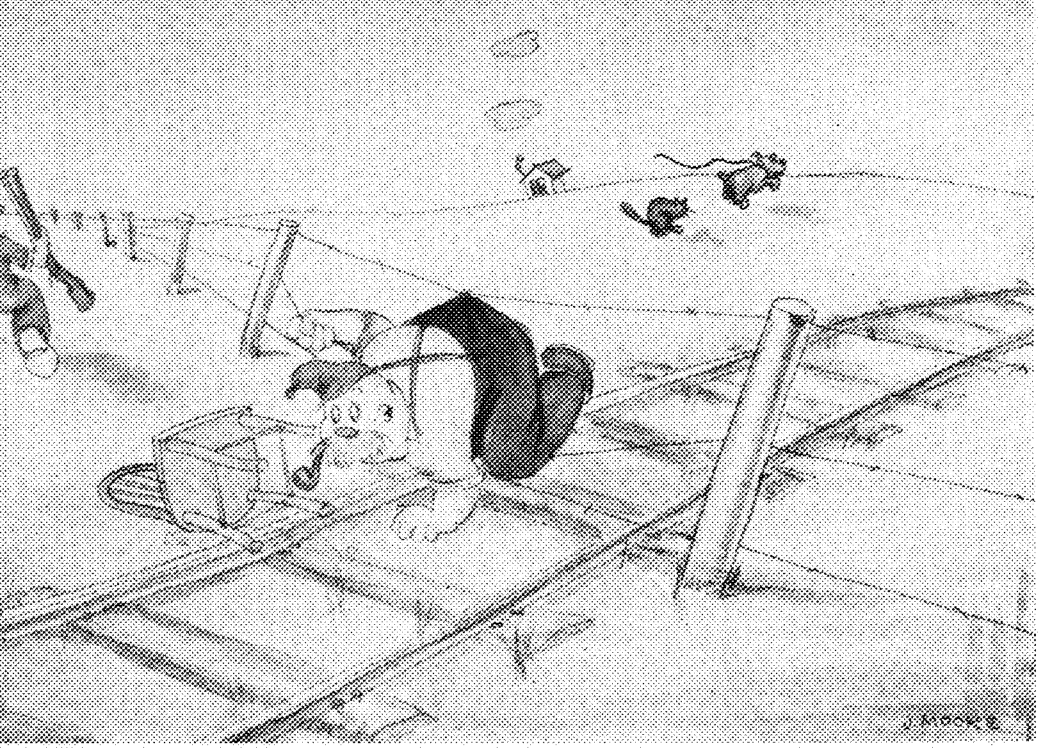
The nearest available cash was back at headquarte Winnipeg three or four hundred miles away, which at could not reach the scene of hostilities in much less than days. In the meantime two or three hundred men tog with a lot of expensive equipment would be idle. Joh needed no reminder of how all this would appeal to the struction superintendent when he heard of it. The mere thoughts of the aftermath made him shiver.

"And all this because a fool Dutchman don't know what a check is!" stormed

first of a series adventures of ci in camp and on

Hoffmeister, barbed wire, a bulldog, and a shotgun mean trouble for this gang of civils.





A highly indignant tommy relieves the situation, and Canadian Pacific rolls on.

by one who has spent years surveying in Canada

the foreman as he reached the boarding camp.

"What's the trouble?" asked the waterboy, who a few years later distinguished himself by talking back to a regimental sergeant major. "And say, Mr. Johnson, when do I get that assistant time-keeper's job?" he added, purely as a matter of habit.

"Boy," fumed the foreman, "you ask me that fool question again and I'll take you all apart and see what makes you go. Git me that telephone outfit and git it quick!" he ordered.

The telephone was cut in and a message dictated to the nearest operator for headquarters. Before reaching Winnipeg that dispatch was handled about five times and as many times toned down, but upon arrival it still retained enough of its original flavor to cause an assistant secretary to reach quickly for her smelling salts.

Meanwhile the waterboy was losing no time on his way to the front to get his information first hand. Here he found the German making preparations for what might prove to be a lengthy siege. His wife had brought out a supply of food and to guard against a surprise attack should he fall asleep, the bulldog's chain had been fastened around one of the picket's ankles.

The boy studied the situation and suddenly discovered what he felt to be a serious flaw in the German's defenses. He pondered the matter for a moment and then exploded in a burst of mirth. The dispenser of lukewarm, alkaline liquid refreshment hurried back to camp and found Johnson.

"If I move Hoffmeister, do I get me that assistant time-keeper's job?" he asked of the foreman.

"You—you—you keep away from that crazy Dutchman," exploded Johnson. "I got troubles enough without you throwing in any funerals!"

"Do I?" persisted the waterboy.

"Git out of here!" roared the harassed foreman as he reached for something to throw.

"I'll trade you Hoffmeister's gun for that job—what d'ye say?"

"Git! And mind I told you to keep away from that Dutch lunatic."

"All right, boss," the youngster replied as he got ready to dodge a tie plate, "but this afternoon I start workin' for the timekeeper."

The graduating custodian of the water pail found a gunny-sack and climbed aboard the cook car. In a minute or two he reappeared and was off up the track carrying something which bulked largely in the bag swung over his shoulder. As he reached the pit spur he sidled up along the gravel train keeping it between him and the guard, while every so often he thumped the contents of the sack on the ground. The engine was within a few yards of Hoffmeister's strategic position, and the boy reached it without disclosing his presence even to the watchful bulldog. A peek around the pilot revealed that his earlier hopes had materialized—Hoffmeister was dozing.

The waterboy untied the bag and then gave its freight two or three additional thumps on the ground together with a couple of vigorous kicks which produced a blood curdling yowl of protest.

"Now, Jim, do your stuff," he said as he dumped an enormous, thoroughly mad yellow tom-cat onto the ground.

I don't know which saw the other first—the bulldog or the cat, but in the twinkling of an eye they were both messed up with each other, Hoffmeister and the new fence.

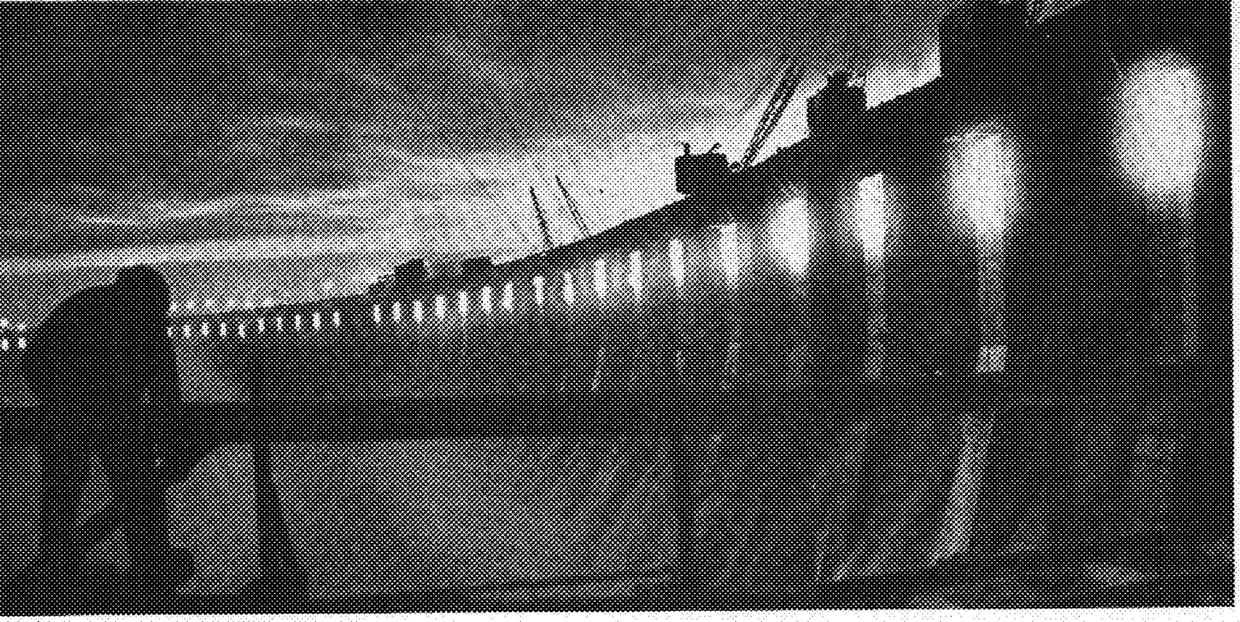
The German dropped the shot gun and thereby improved his chances considerably of coming out of the fracas alive. The waterboy pounced upon the weapon and was off for camp like a flash leaving Jim to shift for himself, a job the cat seemed quite equal to.

"Here's the Dutchman's gun; now you birds get up there and tamp ties," the youngster said to Johnson as he climbed into the foreman's car, "and I'll be up there after dinner to collect them time cards. How about it?"

"You win, boy," Johnson affirmed, grinning, "but how'd you do it?"

"Jim'll be back in a minute, ask him—I'm busy."

--of a surveyor's notebook



dneprostroy at sunset

Courtesy—Amtorg Trading Corporation

DNEPROSTROY - -

A MEMORIAL to American engineering skill and ingenuity, and a symbol of the progress of the Soviet Union stands Dneprostroy, Russia's newest bid for world wide recognition. Dneprostroy is the world's largest hydro-electric development, and is the stepping stone for the opening of a huge new industrial area in Southern Russia.

The project is located on the Dnieper River 200 miles from the Black sea, in the southwestern part of Russia. When the entire project has been developed, it will consist of an industrial center housing 16 million people, and rivaling in richness the great Mississippi valley of our own country.

In addition to providing an annual yearly output of 2,500,000,000 kilowatt hours of electrical energy, the dam and sluice provide a means by which ocean going ships can pass the formerly impassable rapids of the Dnieper. The dam was built at the foot of the series of rapids which extended up the river for a distance of 100 kilometers. These rapids had previously been an impassable barrier to large boats plying on the river. However, the level of the river at the dam was raised 125 feet, and the resulting backwater completely removed the rapids as a menace to navigation.

A sluice with three locks was built around the dam to permit navigation to pass. The entire sluice is five-eighths of a mile in length, and each of the locks has a lift of 41 feet, making a total lift of 123 feet. Boats are towed through the canal by electrically driven engines. The opening of this portion of the Dnieper to transportation is the last step in the building of a waterway to connect the Baltic and Black Seas. It is expected that as a result of this opening of a 1,300-mile inland waterway, more than two million tons of grain, oil, lumber, and other products of the Dnieper valley will pass through Dneprostroy annually.

Of equally great significance is the fact that the water held back by the dam will be used to irrigate hundreds of thousand of acres of surrounding steppe, and thus open an almost limitless area of rich farming land.

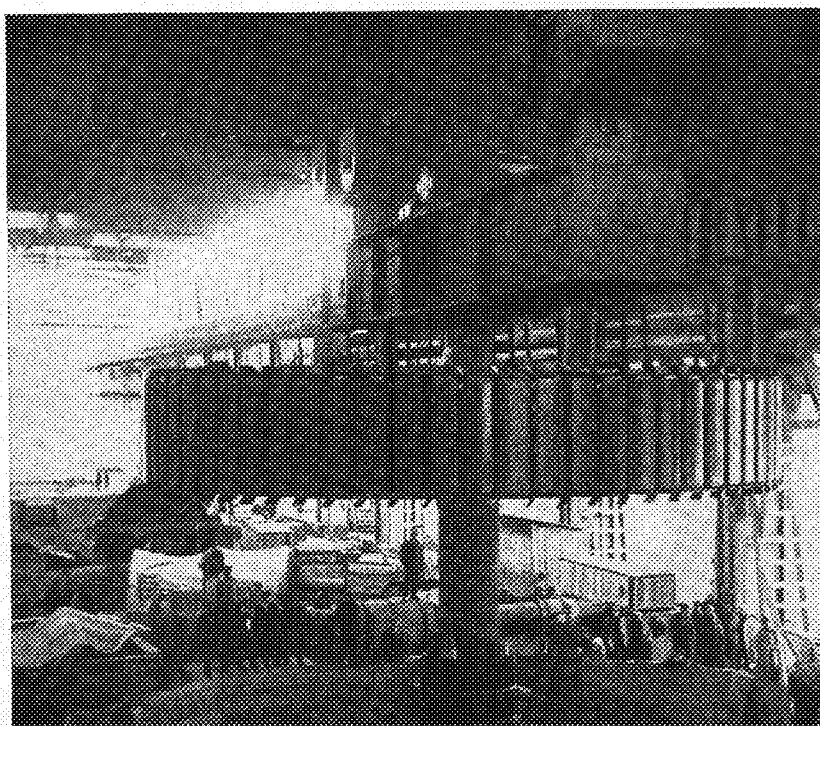
Near the site of the dam and power plant is being built a socialist city including many blocks of apartments, schools, hospitals, theaters, clubs, and other public buildings in addition to the industrial buildings. This city will house 100,000 inhabitants. yearly output of 1,250,000 tons, a coke and chemical plant which will produce 1,400,000 tons of coke annually, a ferro-alloys plant producing ferro-manganese, ferro-silicon, ferro-chrome, and ferro-tungsten, an aluminum plant which will manufacture aluminum by a new process invented by Soviet engineers, and many other industries.

Work on the hydro-electric development was begun in May, 1927, more than five years ago, and it is expected that the plant will be operating at its ultimate capacity sometime in 1933. Although the chief construction engineer on the project was a famous Soviet engineer, A. V. Winter, a great deal of credit for the successful and rapid completion of the job is given to the American and German engineers who assisted with the work.

Outstanding among the American engineers was Hugh L. Cooper, more commonly known as Colonel Cooper, who was the chief consulting engineer for the

the first of the nine rotors being lowered to its resting place

Courtesy—General Electric Co



entire project. His practical experience in the damming of large rivers made it possible for him to foresee many of the difficulties which would be encountered, and to provide for them in advance. Perhaps the greatest accomplishment of the American engineers on the project was adapting the unskilled Russian laborers to modern construction methods. This was done very rapidly and efficiently by the establishment of schools for training the laborers.

An interesting although surprising fact in connection with the schools was that the women were the best students and learned their duties most readily. Consequently when the actual work was begun, many of the important posts were filled by women. They held such jobs as instrument workers, forewomen, concrete mixers and placers, common laborers, and switch tenders.

The hydro-electric project consists of a dam, powerhouse, and sluice. The dam is of the type commonly used in America on large jobs, and was first used in this country on the McCall's Ferry work in 1906. It consists of a series of piers with provisions to pass the flood waters between the piers. The dam has a total length of 2,500 feet, and spans the entire river. It is 170 feet high, and raises the level of the river 120 feet. The flood control system consists of 17 crest gates each with a span of 13 yards. In addition to the gates, the piers support cranes which raise and lower the gates and also a highway bridge.

At the right hand end of the dam is the powerhouse bulkhead which is 800 feet long and is integral with the dam. As there are heavy flows of ice on the Dnieper in the spring of the year, special provision was made to protect the powerhouse from them. A series of long sweeps mounted on the piers which carry the highway from the right hand bank to the dam proper prevent the ice from coming in contact with the powerhouse bulkhead. In order to prevent damage from ice gathering around the piers of the dam, and on the tops of the crest gates, arrangements have been made so that compressed air can be forced out to eliminate the ice.

Some idea of the immense size of the structure can be gained from a consideration of the quantities of various items in the basic considerations. The dam contains 968,000 cubic yards of concrete, making it the largest concrete dam ever constructed. On the complete job there are 1,500,000 cubic yards of concrete. Before this could be laid 2,300,000 cubic yards of rock were excavated, 4,400,000 cubic yards of earth were removed, and 4,200,000 cubic yards of earth and debris dredged from the river bed.

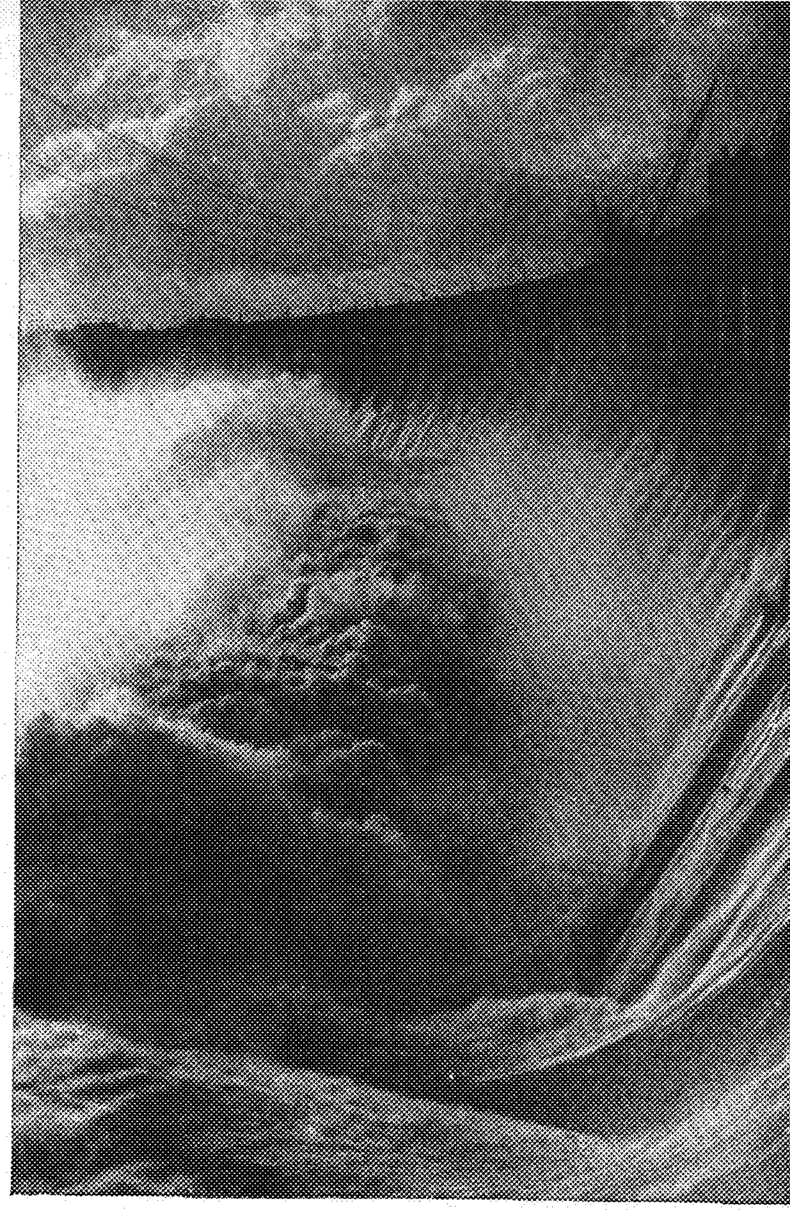
In the powerhouse are located the world's largest hydraulic turbines and electric generators. The nine hydraulic turbines will each develop 84,000 horsepower under a hydraulic head of 116.5 feet, and more than 100,000 horse power under the maximum head of 123 feet. They were built and are being installed by the Newport News Shipping and Dry Dock company. Five of the generators, each of which is rated at 77,500 kilovolts, were built in America by the General Electric company.

This plant is by far the largest in the world in generating capacity. Under normal load the capacity is 756,000 horse power, and at peak load it is 900,000 horse power. This is almost half again as much as the Muscle Shoals plant which is the largest in America. Low water in the Dnieper during a good portion of the year, make it impossible to operate more than three of the nine turbines during the entire year. During the times of low water the hydraulic turbines will be supplemented by steam plants with a total capacity of 200,000 horse power.

During a few months of the year there will be a maximum head, and at this time more electricity will be generated than can be used by the regular customers. At this time the ferro-alloys plant and several of the other industrial activities will flourish, and utilize the excess current. The operation of these plants will take a large number of laborers for a short period of the year. These laborers will be used to run the farms the remainder of the year.

The Pennsylvania Triangle, November, 1932, has the following interesting description of the generator units: "The total weight of each generator, excluding the water wheel, is approximately 1,760,000 pounds, the maximum diameter 42 feet, and the overall height 40.5 feet, with 17.5 feet

[Please turn to page 95]



Courtesy—General Electric Company

flood waters roar their defiance to concrete and steel

- - WORLD'S GREATEST DAM

By N. LEVINSOHN, Mines, and RALPH MONSON, C. E. '34

while the moon goes over the campus

RODERICK WM. SILER

I AM here sitting at the typewriter trying to think up something to say in this article, and for the life of me I can't think of anything just at this moment but Kate Smith. Do you know Kate? I saw her not long ago at the State in Minneapolis in a show called "The Big Broadcast." I suppose some will say immediately, so that is what profs think about when they're off duty: movie actresses. But please remember that Kate is a radio star, not a movie star. And Kate is, putting it mildly, a rather large woman. What chiefly interests me in Miss Smith is the fact that she is said to be responsible for a song, "When the Moon Comes Over the Mountain," which each evening at about this time sweeps over this continent, from Atlantic to Pacific, from Baffin Bay to the Panama Canal. It must be hard for a young man in college today to realize that up to a dozen years ago—to November 2, 1920, to be exact—there was no broadcasting station stirring up the night air over this country. KDKA of Pittsburgh was this first station, I believe. I do not remember the name of the announcer—though I am certain it wasn't Smith—but the subject of this first radio effort was the returns of the presidential election of that year. Radio took itself very seriously in the beginning. And this starts me off on a philosophizing strain, which is supposed to be the strain profs are particularly addicted to.

Here is what I am thinking of: the difference between the environment of college men in these days and of those of my time. Can you imagine an existence in which there were no radios or movies? That is, an earthly existence? I sometimes think that if a man behaves himself in this world he may be rewarded with such an existence in the hereafter. But we will let that pass. Probably most of you would not agree with me in this hope. In the old college days we were practically without automobiles. There were autos then, to be sure, but in nothing like their present abundance. Fords had not at that time aged sufficiently for college men to use, so that very few of us ever had contact with a car except to occasionally help push one up a hill. The question then arises, very naturally, as to what we did with our spare time, having no radios, movies or autos. Well, of course, we studied. We were a generation of students. We worked and studied from eight A. M. until ten P. M., when we went to bed. If you have any doubt of this statement you might ask some other old timer. Old timers are very loyal to one another when it comes to substantiating a statement like this. Those of you whose fathers went to college might inquire there. As a matter of fact, the one generation I know of that worked and studied harder than mine was my father's. More than once while I was in college my father has told me that when he got his schooling they worked and studied harder than I was doing, which would make their hours from about six A. M. until eleven P. M. And then to bed. And my father always added that his father worked and studied harder than he did. And then to bed, I imagine. I have not relied entirely on my own data, however, but have inquired among fellow old timers, and they all tell me that they worked and studied harder than do their sons, and that their fathers worked and studied even harder than that. This all indicates something very interesting, you will notice, a phenomenon which forms a sort of arithmetical progression, with great-great grandfather working and studying twenty-four hours a day and his descendants in the not very far future tapering off to a score which promises to be pretty close to zero.

And yet, despite the great changes that have come over the world in recent years, there are portions of this continent where life seems to go on much as it did generations ago. This was impressed on me the last summer in traveling through the Canadian province of Quebec. Quebec is distinctly foreign to an American. French is the language spoken, and if you are contemplating a visit to Quebec polish up your French. I jumped from Minneapolis to the Soo in two days; from the Canadian Soo to North Bay, Ontario, in one day; from North Bay to Ottawa, the Canadian capital, in one day; and then, after a short run, into Montreal, Quebec. The Canadian roads by this route are gravel, usually good, sometimes a bit bumpy, but always providing scenery in abundance. You follow the Mattawa River on the way from North Bay to Ottawa, and this river is a beauty—broad, clear and placid. But when one talks of rivers the St. Lawrence comes very nearly being the greatest of all. In rivers it is hard to equal the St. Lawrence and, I believe, impossible to surpass it.

a professor comments on campus affairs in general

I have, at one time or another, followed the St. Lawrence from its beginning to its mouth, and I have never discovered a stretch of it without beauty and interest. It is remarkable among rivers in that it begins its career a full sized stream, coming out of Lake Ontario of a width and

a deep highway for our ocean steamers is the st lawrence

depth capable of providing passage for large steamers. That is one thing that makes the St. Lawrence always interesting: the shipping on it. From Kingston at Lake Ontario to Montreal this shipping is made up chiefly of freighters, long, low boats with funnels in rear, the sort of craft we find taking care of the commerce of the Great Lakes; but also there are excursion steamers, with triple decks, which bring Canadian and American travelers from the interior out to see the Thousand Islands, Montreal, Quebec, and get a sniff of the sea. From Montreal on, the river widens into the Gulf of St. Lawrence, and then into the Atlantic, and along all this stretch deep sea ships appear, so that it is rearely that one, looking from St. Lawrence shores, cannot see a freighter or great liner.

The St. Lawrence has of course had its tragedies. I ran across a sad reminder of one of these while driving along the south shore not far from a town called Rimouski. It must be about two hundred miles beyond Quebec. I passed a small burial ground at the side of the road, and stopping to see what it was found the graves of more than sixty of the unidentified dead from the steamship Empress of Ireland, sunk off this point on the night of May 29, 1914. Almost twenty years ago. The Empress of Ireland was rammed by a Danish collier, the Storstad, while a dense fog hung over the river, and went down with the loss of over a thousand lives. It is very impressive standing by this little burial ground on a dark day looking out over the misty expanse of the river. I met an Englishman a number of years ago who told me he had been on the Empress of Ireland at the time of the collision, and that when he managed to get on deck from his cabin the ship was heeled over at such an angle that he practically slid into the water. He was not much of a swimmer yet managed to keep afloat until picked up. There is much fog on the St. Lawrence, even in summer, but it seems to me that this adds something to the peculiar appeal of the river—that is, if one in on shore.

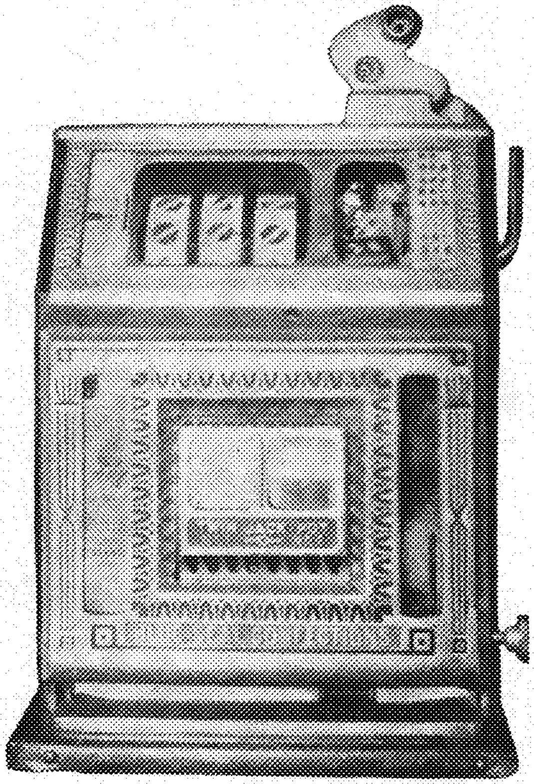
While I am speaking of wrecks I am reminded that some years ago I passed through a Quebec town named Beloeil where occurred a fearful railroad wreck almost seventy years ago. The exact time was two o'clock of the morning of June 30, 1864. The Grand Trunk then had a crossing at this town over the Richelieu River, a branch of the St. Lawrence. There was a canal along the river, and over the canal was a draw, from the tracks of which to the water was a drop of almost fifty feet. Coming from the east was an emigrant train carrying about 500 people, mostly Germans, and made up of thirteen cars. The engine-driver (the engineer was so called at that time) had never been over the road before, it seems, and though danger signals were being shown he ignored them. The result was that he carried the train into the open draw while a tug was going through with a tow of barges. The entire train went through, falling on one of the barges and the coaches piling up on top of one another. This was one of the worst wrecks in railroad history, a hundred people perishing in it.

If one starts from Quebec to circle the Gaspe Peninsula of the province he will have to buy gas for a thousand miles before he gets back to the city. It is worth it. As one goes on, the St. Lawrence widens out into the Gulf of St. Lawrence, then the Atlantic appears, then the Baie des Chaleurs on the south side of the peninsula; and from here one can cut back across the base of the peninsula, along the valley of the Matapedia River, returning down the St. Lawrence to the city of Quebec. On this drive there is a constant succession of coast villages, most of them decidedly picturesque, each dominated by the tall steeple of a handsome church. Quebec is predominantly Catholic, and on Sundays, rain or shine, one will find any number of people trudging along the roads or driving in old fashioned buggies to church. A Quebec village is usually strung along the main automobile highway, the street narrows and twists, there appear on it carts, buggies, animals of various sorts, old people and sometimes very young ones. No chance for speed here. The houses are set close together, all have porches, and on these porches the inhabitants seem to find time to sit and chat and observe the procession. Life in Quebec has always struck me as deliberate, peaceful and comfortable. What will happen when autos replace the buggies would be interesting to argue.

A Frenchman, Jacques Cartier, is credited with being the discoverer of the St. Lawrence in 1534, forty-two years after Columbus first saw the Bahamas. He made three voyages to the river, met with a good deal of danger and hardship, but in spite of that died in his bed, in France, in 1557. I have at hand a translation of the accounts of his voyages as given by himself or his aides. Here is an excerpt from one describing the St. Lawrence region:

[*Please turn to page 94*]

on sundays in quebec one may find any number of villagers trudging along the narrow streets to their quaint churches



Courtesy—Scientific American

you can't beat 'em

By A. H. PECK

Reprinted through courtesy of Scientific American

OF the many clever devices which have been created for the purpose of separating the gullible from their money, probably the most widely distributed and simplest to operate is the so-called "slot machine" of the general type illustrated here. These are to be found in more or less open operation throughout the country in small stores, barber shops, restaurants and—*s-h-h-h-h*—speakeasies, and are variously designed to be played with nickels, dimes, quarters, and half dollars. At least one manufacturer of these devices puts out models for foreign trade, operable with foreign coins.

For those who are not familiar with the method of playing these slot machines, the following description will serve to make more lucid the description of the internal functioning of the apparatus, and of how the machine takes your money and gives you little or nothing in return. As you stand before the machine, you will find near the top a slot into which may be dropped a coin of the proper denomination. At the right-hand side is a lever. Behind a glass plate are three wheels placed edgewise toward the player and each bearing pictorial representations of various fruits interspersed with occasional bars. One of the fruits is, very aptly, a lemon. In most of the machines is a "jack-pot" consisting of a small glass-covered receptacle in which may be found a varying number of coins or metal disks (slugs). The following description will be concerned only with one of these "jack-pot" machines.

You drop a coin in the slot, pull the lever, and the three wheels whirl around. Soon they come to a stop, one at a time, and lined up just behind the glass plate will be seen three fruits or bars, one on each wheel. If you are lucky and have "hit" the proper combination, there will be a slight pause, a click from the interior of the machine, and a number of coins or slugs will be delivered to the opening at the base of the machine. Since you played with a coin, it is now possible for you to receive a package of mints—but only if you twist the proper knob or push the proper button. The machine does not act automatically as a vending machine, the machines, in the words of a Supreme Court Justice, "being operated under the guise of selling candies primarily for gambling purposes." And, by the way, the candies that the writer has obtained from machines of this sort were of the cheapest, most unpalatable kind.

But we are not concerned here with either the legal aspects of gambling or non-gambling with these machines or with the moral side of the question. The intent of the machines is self-evident, and the most interesting phases are the internal mechanism and the method by which the machine takes your money and hands you out something—or nothing.

Through the cooperation of Hon. Edward P. Mulrooney, Police Commissioner, New York City, we have been able to obtain the accompanying series of photographs which show the interior of a slot machine. This is of the jack-pot type, and it is this jack-pot that serves as the greatest drawing card or come-on for prospective players. Comfortably filled with coins or slugs, it stands as an invitation and incentive to keep on playing until you "hit" it and the contents are delivered. But how often can it be "hit"? On one machine which the writer investigated, the mechanism was set so that it was impossible to line up the three bars—the symbolic combination which is necessary to open the jack-pot. In another and fairer machine, there was one chance in 1,000, mathematically calculated. In other words, on a nickel machine, you might play 50 dollars' worth of nickels before you get the jack-pot, although in the meantime you would undoubtedly obtain other combinations that would pay two, four, eight, twelve, or sixteen coins or slugs.

TAKEN as a whole, however, the percentage which the machine pays is on the order of 70 per cent, and may range from about 65 to 75 per cent. Thus, if you play consistently, the machine will retain at least 25 per cent of your money. Of course, as in all gambling devices, if you are lucky enough to make a strike on the first one or two plays, and then stop, you will be ahead of the game. But to stop is not human nature, and it is the human trait of wanting something for nothing upon which these machines—and all other gambling devices—are based.

Now, let's take a look inside one of these machines. The back is securely fastened with a high-grade lock to guard against theft. When this rear panel is removed, the first thing one notices is the mechanical complexity of the interior. However, when studied, it becomes apparent that most of the works is for the purpose of protecting the machine from being cheated. It is evident that if any cheating is to be done, it is to be one-sided—and that one side is not to be the customer's.

As the mechanism is traced down, it becomes relatively simple. First there is the unit that allows the lever to be pulled only after the coin or slug is inserted. Then there are the chutes through which the coin or slug is delivered to either the coin chute or "pay-out" tube (from which winnings are delivered when a lucky combination shows up), or to the jack-pot, or to the coin box. Once it gets in the latter it is gone from circulation until the owner of a key opens the back of the machine and collects.

The three wheels are prominent parts of the mechanism, and next to them

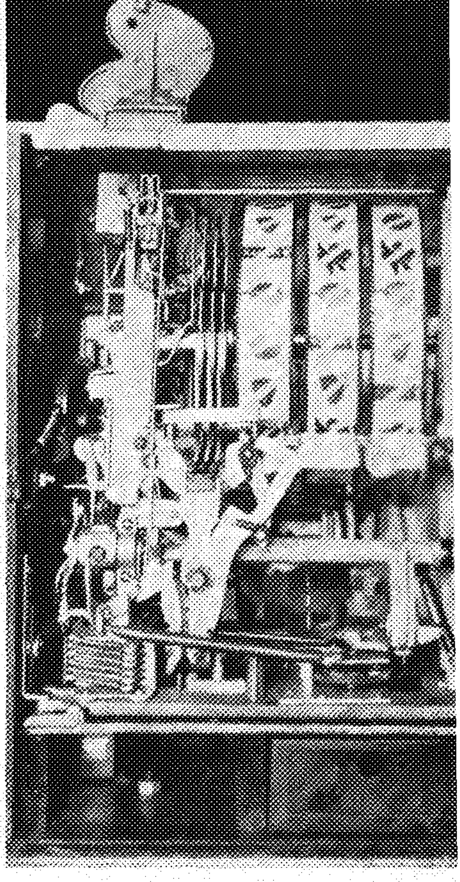
slot machines are always made to pay dividends to owners

and on the same shafts are three metal disks, one corresponding to each wheel. In the edges of the disks are notches by which they are held in position until the machine is operated and by which they are locked at the completion of each play. In their faces are series of holes. Beside these disks is a group of spring-operated levers so placed that when the disks come to rest at the completion of a play they will, if the proper combination is obtained, drop into certain combinations of holes. These levers actuate another set of levers which in turn operate a metering device at the bottom of the machine, through which is delivered the number of slugs or coins called for by the combination. If the jack-pot is called for, all the levers of the first set fall into holes and the jack-pot operating mechanism is released.

When the operating lever is pulled by the player (or should we say victim?), a spring is wound up and then released to operate a small clock-work. This timing device delays the functioning of the coin-metering mechanism until after the wheels and their corresponding disks have come to rest.

When a slot machine is received from the factory and is to be placed in operation, it must first be loaded. This means that the "pay-out" tube must be filled with either coins or slugs, according to whether the machine is for "vending" or gambling. This is done by pulling out a lever in the back of the mechanism and feeding in the coins or slugs through the slot at the top. When this tube is filled, the device is ready for use. Coins or slugs now played will be distributed between the jack-pot and the money box. In a "vending" machine, all coins go into the money box and slugs into the jack-pot or pay-out tube. In gambling machines, a distribution is made. When a lucky combination is hit, the player is paid from the pay-off tube, and subsequent plays must once more fill up this tube before the jack-pot or the money box again receive their share.

Now comes the question of whether or not these machines can be "rigged" or "fixed" so as to pay a greater percentage to the owner or lessee. It is obvious from the percentages given above that such a procedure is unnecessary, but such is the greed of some people that they cannot be satisfied even with a sure thing, and they must contrive to make it more sure. It is possible to manipulate the mechanism of these machines so that the three bars calling for the jack-pot can never line up. But then steady customers would become suspicious if the same well-filled jack-pot were always on display. So, it is possible to "dump" the jack-pot.



Rear view of slot machine mechanism. The delayed action device is in the lower right corner.

Courtesy—Scientific American

At the back of the mechanism near the bottom plate will be seen a series of levers, one above the other. If these levers are held by the finger while a coin is inserted in the regular playing slot, and the operating lever is pulled, the jack-pot and part of the contents of the pay-out tube will be delivered regardless of the combination which is shown on the wheels. This may be done at some time when no outsiders are present, by the holder of the key to the rear panel. Then the one in charge of the machine has only to spread the word carelessly that "Jack Smith hit the jack-pot just a few moments ago," and confidence in the machine returns and the coins continue to roll in.

Another example of how the public can be misled is found in the fact that all of the symbols on the wheels are not used. On one machine with 20 characters, two on the first wheel could never line up with the window. All on the second wheel were "good," but three on the third were "dead." It is obvious that merely five "dead" characters have a tremendous adverse influence on the chances in favor of the player. On another machine, half of the characters were "dead" on each wheel.

It is obvious that police suppression will not stop the slot-machine racket any more than it can stop the sale of liquor or the commission of crime. If, on the other hand, people will realize that they can not beat the machines, and will refuse to be fleeced of their money, the machines will gradually disappear as they become unprofitable. If you like to see the wheels go 'round, read silly "fortunes," and have a machine collect a toll of at least 25 per cent of the money that you put into it, go on and play. But take our word for it, backed by our own studies, and those of the New York Police Department, that in the long run "You Can't Beat 'Em"

Courtesy—Scientific American

Front of mechanism, with the case removed. Long curved tube leads to money box; short one to jack pot. Back of money box tube is pay-out tube to metering device.

The MINNESOTA TECHNO-LOG

UNIVERSITY OF MINNESOTA

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ARE WE GOING TOO FAR?

IN accordance with our policy of giving our readers what we think they want, you have probably noticed a lack of technical articles in the first two issues of this year. We have received many compliments on the articles of general interest which have appeared in these two issues, so this month we are going a step further, and changing our entire make-up. There will always be at least one good solid technical article in our magazine, for you know this *is* a technical magazine. We intend, however, to inject a bit of human interest, of excitement, and of humor into each article.

The modern practice of placing illustrations out to edge of the pages has attracted the editor's eye for many a month, but it was only a few weeks ago that he got up courage enough to carry out such a radical change. This month's make-up is merely an experiment, and we will go back to our former more dignified make-up again next month, unless we are absolutely sure that our readers prefer the new form.

Won't you jot down your criticisms of this issue on a sheet of paper and drop them in the box just outside of the Techno-Log office? Or better still, come right in and tell us what you like to see next in your magazine. And faculty members, won't you address your criticisms to us through the campus mail, so we can do our best to please you, too?

TO OUR STAFF

THIS issue we take our hats off to the business staff and to James Moore. Our business staff is small, but it is composed of real workers—men who have worked many hours to obtain local advertising, with the result that the Minnesota Techno-Log has more local advertising than any other engineering college magazine in this country. Likewise we have been able to put out a 32-page issue each month, while the other magazines have been having a hard time to get out 12, 16, and 24-page issues.

Jim is our newly discovered cartoonist—and he has spent many hours of thought and work upon the sketches which you see scattered throughout this issue. You'll be seeing more of Jim's work in our future issues. With the excellent art staff which we now have, there is no reason why we can't put out the best illustrated magazine in E. C. M. A. this year.

And we must not forget to thank every one of the forty members of our staff for the hours they spent in getting material for this Christmas issue. You have all worked hard, and if it were at all possible, we would certainly like to mention every one of you now.

ELECTRONICS SCORES AGAIN

SIX years ago photoelectric cells were scientific curiosities; three years ago these tiny tubes were first used in television experimental sets; but today there is not an industry in which uses can not be found for these delicate light sensitive tubes. Perhaps the most remarkable of the newer uses for photoelectric cells is in the printing and engraving industry. It was just two months ago that Walter Hewey demonstrated his photoelectric engraver, an ingenious machine which can make half-tone engravings of the kind used in this magazine in a few minutes without using an acid, and which can put out three-color plates within half an hour instead of the usual thirty heretofore required.

Everywhere photoelectric cells are being used for automatic control and for safety apparatus. Accurate matches of color of inks and papers is now possible; transmission of photographs is being done daily over wire and radio; illumination engineers everywhere are turning to photo-cells to solve their problems—in fact every successful engineer of tomorrow will have to be well acquainted with this new field of electronics.

TECHNO-LOGS FOR FRATERNITIES

EACH fraternity on this campus has been placed on our circulation lists to receive complimentary copies of the MINNESOTA TECHNO-LOG this year. We are doing this to show the rest of the campus that we engineers are human beings—men who can forget for the time the technicalities of an engineering education—men who do appreciate the finer things in life.

The mailing of these complimentary copies involves a great deal of additional expense and work for our staff. All we ask of the house managers in return is that they place them on their library tables where all may see them. We would very much like to see these copies placed in the fraternity files for reference as each new issue is received, for the magazines contain much valuable data, such as alumni addresses and officers of student societies.

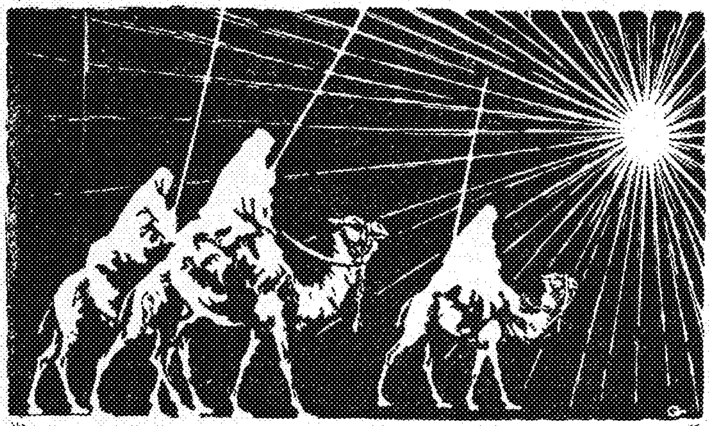
COMMON SENSE

AN incident in the construction of the great Dnieper hydro-electric plant described in this issue exemplifies the absolute necessity of common sense even to the exclusion of theoretical methods. In 1926 the Soviet government engaged an American firm to investigate and report on the feasibility of the Dnieper project. The American company reported that the project was practical both from an engineering and from an economic standpoint.

Contracts were soon made with the American company for complete details and consultation services for the construction. However, about the same time, plans worked out in great theoretical detail, and seemingly perfect to the nth degree, were submitted by a German firm. The Soviet officials were so impressed with the theory of the Germans that they were unable to decide whether to let the Germans do the job or the Americans.

An agreement was finally reached in which both groups and both plans were to be used, one starting from each side of the river. As soon as one plan proved itself superior to the other it was to be used and the other discarded. The American consultant, Hugh L. Cooper, was a man of wide experience in the hydro-electric field. He used theory only in so far as he knew that it was applicable to his work, and from that point on he relied on his past experience and his COMMON SENSE to carry him through.

It is sufficient to say that it took only a few months to prove that the American scheme was superior, and in fact, that the German scheme was absolutely impossible of completion under the circumstances.



To Our Readers

the members of the techno-log staff wish

you the best of luck in finals

a very merry christmas

a happy new year

'n we'll be seein' ya next year

1932 GREETS 1936

"FEELING blue?" asked the grad of four months' standing. "Everything's new and strange, isn't it? I myself know how it feels. At my job in the electrical works I'm a freshman over again—like you, a little frog in a big puddle.

"Not so easy, getting on to the ropes. Makes a fellow impatient for the time to pass. You're anxious to get the upper hand over your work, you want to make the team, you want to clean up in general.

"Well, it can't be done all at once. But getting off to a good start is half the game. Just pick out what you want the most and go after it hard.

"Tackle your obstacles—pretty tough now but after you've downed these you'll find the going easier. Look on each week as a yard line you are crossing.

"See how every gain, every problem you get the best of, is important—not for itself but because it is a necessary part of the bigger drive that gets you down the field. Just keep plugging, with your heart in the game, and you'll make your touchdown.

"Pretty good advice, isn't it? Guess I'll take it myself."

WE EXTEND OUR SYMPATHIES

THE staff of the MINNESOTA TECHNO-LOG extends its sympathy and best wishes for a speedy recovery to Franklin W. Springer, Professor of Electrical Engineering, who has been ill during the past summer and is now confined at his home at 127 Orlin Avenue, Minneapolis.

Professor Springer is feeling much better now, and it is the earnest hope of the students and faculty that he will soon be back with us, as hearty and cheerful as ever. We miss those long talks on everything ranging from campus politics to transient electrical phenomena—that willing advice on problems which stump us in our daily routine of work.

A POET'S ADVICE

"To carry on after repeated failure—that is worth while. To fight on, one more battle, not the last, the best. Men should aim high, to attain success through failure."

Robert Browning was a great poet, he was also a sound philosopher. Toward the closing years of his life he wrote:

"What I aspired to be,
And was not, comforts me."

It is better to aim high and to fail, than to seek for nothing and obtain it.

LOW-DOWN-SKI-ON-U-MAH-SKI

By OSCAR QUACKENBUSH FEGAS, Q. E. D. '111

Many years ago, Oscar Quackenbush Fegas, engineer pre-eminent, and famed TECHNO-LOG punster, liked his puns better than his buns. For which he was transported to the Cannibal Island as a patient and captive by a number of honorable gentlemen from Pillsbury Hall.

The cannibal chief fed Oscar on yolks and jokes, but alas, Oscar was incurable, and could not be fattened. He told the black chief and his subjects so many whoppers they all died after splitting their sides with laughter. Thus did Oscar at last break away from the bonds of captivity to return once more to his special desk in Ye Log office, which has been kept dusted in readiness for him all these years.

Oscar Quackenbush Fegas returns to his Alma Mater

Can this be poetry?

Just as colleagues burst into song
We say, "Surely we cannot go wrong,
If we depart from the realms of good fun
To give you just old fashioned Skum."

To make a non-technical mag.
(We feared that truly, we'd sag)
But after sinking so low, we'd only begun
Because it was just pure old fashioned Skum.

Oh, loud are the wailings of sorrow,
And we'll surely be bawled out tomorrow,
So let us say, "it was all in fun"—
Now that we've had our revenge on Skum.

Jones Hall

It is rumored the professors in this building of lost ambitions have become quite accustomed to the students looking at their watches during lectures. But they still think it a mark of distinct discourtesy for the boys and girls to hold the timepieces up to their ears to see if the tickers have stopped running.

Try it

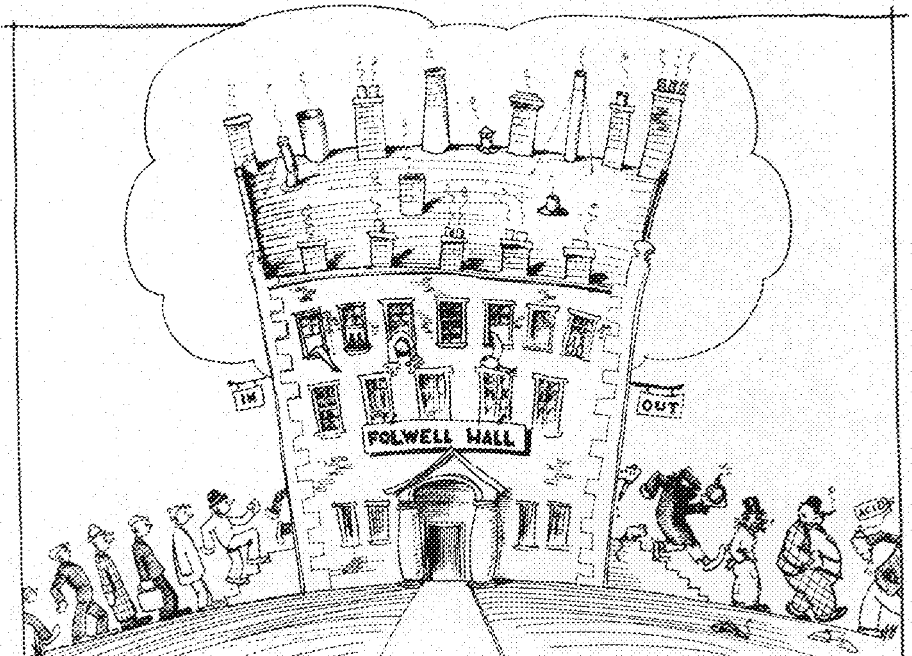
In an eastern university students are allowed to use their books, notes and consult each other in quizzes. And the instructors defy the boys to pass the tests.

We know a school much nearer where books and notes wouldn't do much good either.

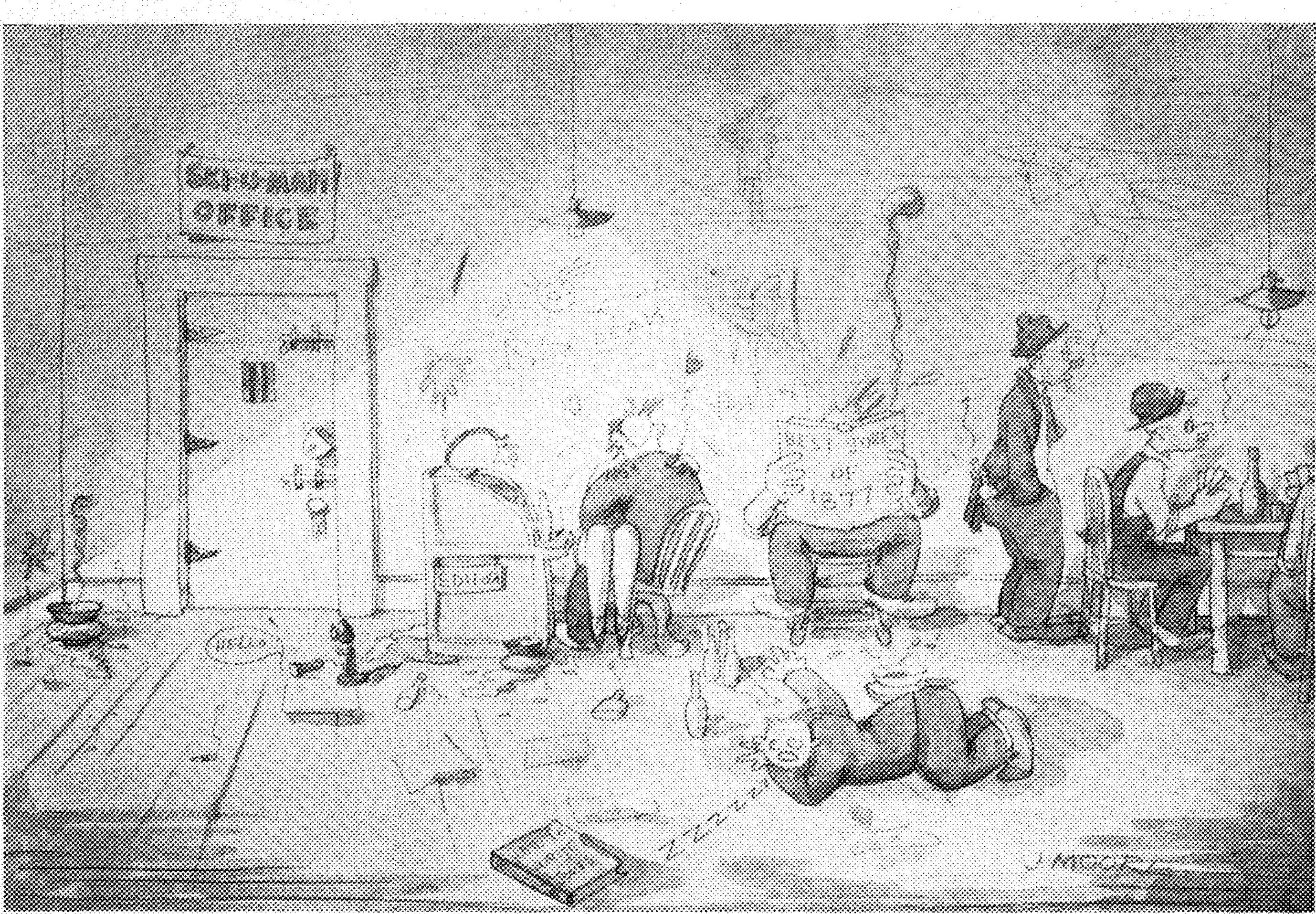
Folwell

Sly, farsighted gentlemen who dispense knowledge of literature et al in ye old University avenue structure sometimes peer into the future. One such member of the male sex said to his class, "We better all look out for the wolf. Before long we may all lose our jobs. Maybe we go back to the soil yet. Has anybody got a little piece of farm land?"

Voice in rear, "Yes, but I'm hanging on to it."



The school of lost ambition



The campus skum shop--on the dead line

The Mystery of S. L. A.

or

Should Lunatics "Ascape?"

By Muh Hat 'M Gondi

A play in three acts or scenes, and you ain't scene nothing yet. (The play is reversed in the order of acts for obvious reasons.)

Cast (entirely unnecessary)

ACT III

OSSY: Hi, bean old dean, I mean old bean.

DEAN (*assuming the defensive*): Climb upon my desk, Sonny Boy.

OSSY: I want to take life easy, deany. What can you do about it? (*In a sly whisper.*)

DEAN: Would you like to study?

OSSY: Hell, no! I said *EASY*.

DEAN: I got just what you want.

ACT II

(1 second later)

OSSY: I heard of the collitch of Sla(y).

DEAN (*Just an old hotcha*): What! With no snow? Heh! Heh! Heh! (*His villain's laugh—like it?*)

OSSY: Ha, ha. That's very good. But I think I like Art.

DEAN: Then you never met Henry. Tsk. Tsk.

OSSY: Deany, ol' boy, ol' toad, ol' slop, you simply slay me.

ACT I

(1-20 second later)

DEAN (*Pulling a gun*). Not a bad idea. (*Shoots Oswald through the brain. Pardon. The head.*)

The demise of the hero in Act I explains why it comes last. Otherwise there would be no play. And then what have you? Nothing — absolutely nothing. Consider what you have now. If it's not pink tooth brush, think how lucky you are.

Advice to humorists

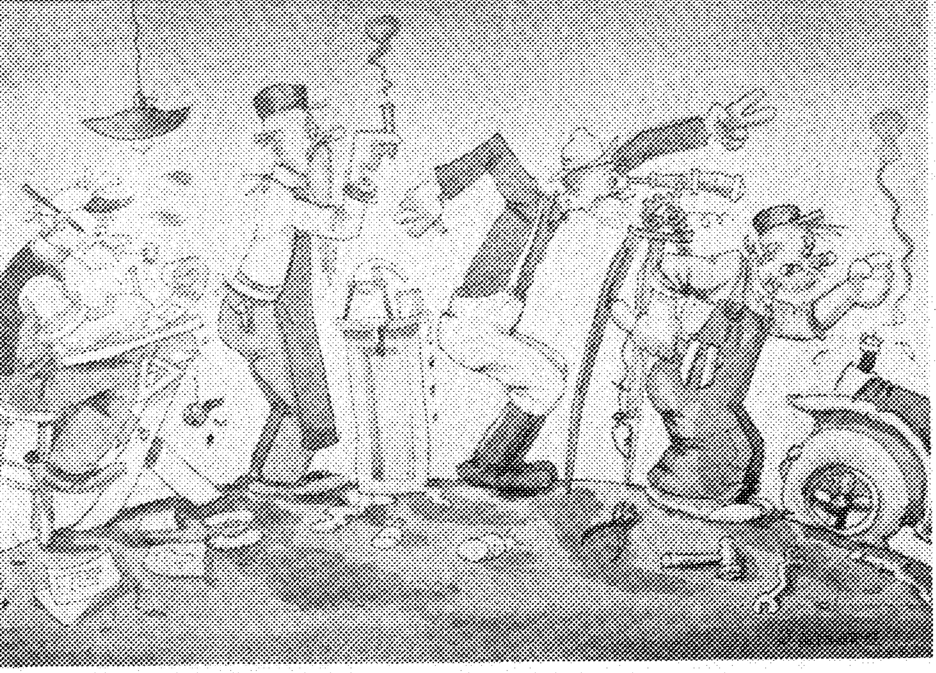
Consider the fish. If he didn't open his mouth he wouldn't get caught.

Squelched

In a certain room in the basement of Pillsbury Hall a collection was being taken for foreign missions. One desk sitter grumbled a hearty negative response to the hat passer. But was he stunned at the reply: "Oh, you better take out a quarter. It's for the heathens."

Burton

What prominent member of the rifle team was up before his History instructor endeavoring to answer a question, and finally blurted out, "Well, aah, gimme a clue, will yuh?"



ALUMNI

What Are You Doing?

Aeronautical Engineering

'32—VILLABONE E. SOREJANA has recently departed for the Philippine Islands to engage in air transportation there.

'32—A good bit of the class of 1932 comes back to the University for post graduate work. ALBERT E. BAAK, KELYTH G. JONES, and LESTER GUSTAFSON are the ones seeking more aeronautical education.

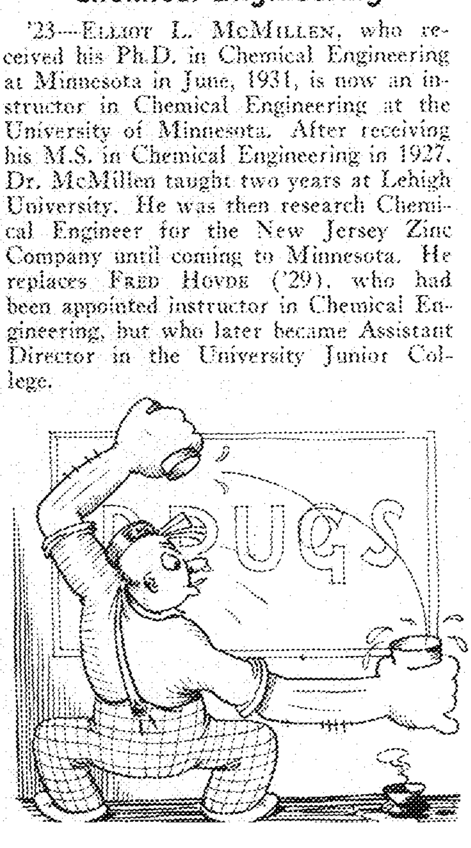
Architecture

'28—DEAN HOWARD AFFLECK has strayed quite a ways from the engineering fold for he writes from Oakland, California that he is interning at the Highland Hospital there.

'32—GORDON WALL is nother Minnesota graduate taking advanced work in Architecture at Harvard University. He is staying with Milton Bergstedt, '31, and Bob Cerny, '32.

Chemical Engineering

'23—ELLIOT L. MCMILLEN, who received his Ph.D. in Chemical Engineering at Minnesota in June, 1931, is now an instructor in Chemical Engineering at the University of Minnesota. After receiving his M.S. in Chemical Engineering in 1927, Dr. McMillen taught two years at Lehigh University. He was then research Chemical Engineer for the New Jersey Zinc Company until coming to Minnesota. He replaces FRED HOVDE ('29), who had been appointed instructor in Chemical Engineering, but who later became Assistant Director in the University Junior College.



'26—KENNETH KOBE, who received his Ph.D. in 1930 and now teaches in the chemistry department in the University of Washington in Seattle was a visitor in Minnesota in July, and among other things was married to Geneva Holm of Minneapolis; all of which proves something or the other about our Minnesota girls. Dr. and Mrs. Kobe will reside in Seattle, and mail may be sent to Dr. Kobe in care of the Chemistry department, University of Washington, Seattle.

'27—L. WALLACE CORNELL received his Ph.D. this year at the University of Minnesota. Doctor Cornell is at present engaged in a special research project on the utilization of aspen wood at the School of Chemistry.

'30—RAY F. WINDUS is over in Minneapolis with CARROLL CLARK ('29) working as a chemical engineer for McLaughlin-Gormley-King and Company.

'30—LEONARD D. SCOTT received his M.S. in Chemical Engineering at the University of Minnesota in 1931. He is now working as a chemical engineer with the Kellogg Company, Battle Creek, Mich. Talking about beating the depression, Len put in a new recovery system in the plant, saving the company a lot of money, and consequently received a raise in salary.

'31—NORTEN O. MIDTLIEN is at present engaged in doing chemical engineering work for the Minneapolis Gas Light Company in Minneapolis.

'31—WILLIAM R. PETERSON has been hunting ducks and a job this fall. Don't give up the ship, Willie!

'32—GEORGE CLARK is working for the Pillsbury Milling Co., Minneapolis. We feel sorry for George when he has to brush the flour off of his suit after a hard day's work.

Electrical Engineering

'32—GERALD P. UTTLEY is Chief Engineer of the Kerker Drug Company here in Minneapolis. He is in complete charge of maintenance of the electrical equipment, and his specialties, the sandwich toaster, the stamp machine, and the weighing machine, are always in good working order. His latest operation was the complete rejuvenation of the malted milk motors and they are now one hundred per cent efficient.

Civil Engineering

'05—ROYDEN R. BROCKWAY is chief draftsman for the bridge engineer's office of the Northern Pacific Railway at St. Paul. His home address is 616 6th St. S. E., Minneapolis, Minn.

'05—FRANKLIN R. MCMILLAN has recently been appointed as a member of the Board of Concrete Experts which is in charge of the specifications for cement to be used in the Hoover Dam. This board is formulating the plans for the cement and concrete research which must be made before the specifications are made up. Mr. McMillan is ordinarily occupied with managing the research department for the Portland Cement Association. His address is 33 W. Grand Ave., Chicago, Ill.

'21—LIEF SVERDRUP, in conjunction with Prof. J. I. Parcel of our Structural Engineering Department here at the University, was the consulting engineer for the Wood Brothers Construction Company of St. Louis, Missouri, in the construction of a new bridge over the Mississippi River between Moline, Illinois, and Arsenal Island. This bridge is 2,033 feet long and had a total cost of $209,500. Mr. Sverdrup still lives at 7401 Arlington Drive, St. Louis.

'25—W. C. BROSE is salesman for the Borchert-Ingersoll Corp. of St. Paul. He is living at 4125 McCollough St., Duluth, Minn.

'28—RALPH P. JOHNSON has been spending a rather busy time since his graduation four years ago. He first spent about a year with contractors working on the Pennsylvania Railroad throughout Illinois, Michigan, Indiana, and Ohio. Then in 1930, he came back to St. Paul with the U. S. Engineers, and on March 18, 1931 married Miss Frieda Bergman. Ralph Jr. arrived on Jan. 25, of this year and is now able to say "Da Da" much to Ralph Senior's satisfaction. Ralph's home address is still in St. Paul, at 2041 Juliet St.

'29—STANTON E. WALLIN has recently been appointed County Surveyor of Carver County and has set up an office in Watertown, Minnesota as Private Surveyor and Civil Engineer. From his graduation in '29 up to July of this year Stanton has been working with the Bucyrus-Erie Company, manufacturing power shovels. His present address is Watertown, Minn.

Electrical Engineering

'24—F. R. Kappel now Transmission and Protection Engineer for the Minnesota area of the Northwestern Bell Telephone Company, recently discussed telephonic communication before Mechanical Technology students, and showed with slides the extent to which the world is criss-crossed today by telephone lines. Mr. Kappel can be reached in Minneapolis at 4715 York Avenue South or at his office in the Northwestern Bell Telephone Building.

'27—Myer Engler is with the Cook County Highway Dept., 221 No. La Salle St., Chicago, Ill. He fills the position of Junior Civil Engineer. 846 Montrose Ave., Chicago, Ill., is his home address.

'31—MORRIS NEWMAN wrote an interesting letter to Professor Springer recently. We reprint parts of it below:

"Until lately my work was with lightning surges in transmission lines, and also laboratory investigations using a 2,000,000 volt surge generator. So far I've survived (naturally, or rather-obviously!) and though beginning work with much higher potentials have still managed to retain respect for even 220 volts.

"I'm also working a little in connection with AC-DC-AC, conversion and transmission systems, with methods of producing very high D.C. and surge potentials for research work with breakdown phenomena, and with the surge protection of transformers. It is admittedly a wide range and certainly keeps me more than busy, but there is here an excellent technical literature collection. (I do so much reading of English technical work that there is not much danger of my forgetting it in spite of not too good memory.) There has unfortunately been none too much connection between theory and practice, at least at this Institute of Research, and co-ordination of the two appeals to me as a very interesting field to work in. At any rate I'm in charge at present of an interconnecting theoretical group specially created to more closely tie up practice with theoretical development."

Best regards are also transmitted from Basil Maine, '21 E, and Everet Ostlund, '23 M.E., who are at present working at the Leningrad Institute with Mr. Newman. Mr. Newman and Mr. Ostlund enjoyed an extended trip through the U. S. S. R. last summer, and their adventures will be the interesting subject of a later letter.

Chemical Engineering

'29—Carroll A. Clark is now engaged in ridding humanity of insects. He is a chemical engineer with the McLaughlin-Gormley-King Co., Minneapolis, in charge of their pyrethrum insecticide extraction plant.

Mechanical Engineering

'23—Elmer Eige, Chief of the Manufacturing Design Division of the Western Electric Company, comes through with a bit of encouraging news. He reports that he is still on the job in spite of some very drastic, as well as necessary, cuts in his division. Mr. Eige maintains his residence at Berwyn, Illinois.

'24—L. P. Grobel is still working in the Engineering Research Section of the Research Laboratory of the General Electric Company. He may be reached through the company in Schenectady, N. Y.

'32—Clifford Anderson, former president of the student chapter of the American Society of Mechanical Engineers at the University of Minnesota, is back taking graduate work in Mechanical Engineering.

'32—Forton Christoffer is back taking graduate work at the School of Mines. As you remember, Forton was a very active member of the mechanical engineering school last year. We wish him much success in his new field.

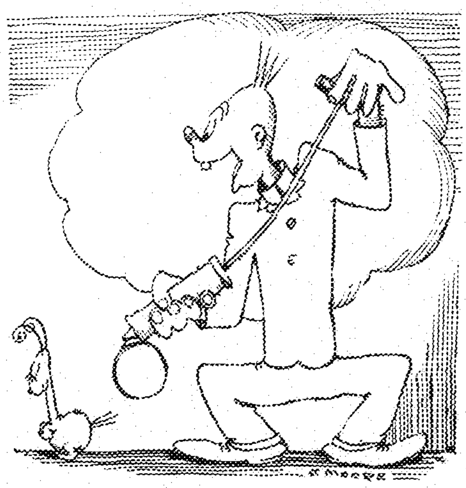
'32—Neil J. McDonald is back again taking graduate work in Mechanical Engineering. He is majoring in the field of gasoline engine design.

Dean Leland Speaks at Alumni Gathering

A group of alumni of Engineering, Architecture, and Chemistry who are located in Washington, D. C., gave an informal dinner November 16 in honor of Dean O. M. Leland, who was in Washington to attend the annual convention of the Association of Land-Grant Colleges and Universities.

The following alumni were present:

Nathan A. Cohen, '06 EE
S. H. Ingberg, '09 CE
Ernest J. Jones, '20 Ch.E
F. C. Kracek, '20 Ch.E.
C. C. Fifield, Ex.'24
Russell Backstrom, '25 ME
L. R. Hafstad, '26 EE



Paul Bliven, '27 ME
J. Edwin Coates, '27 ME
Richard R. Trexler, '27 ME
Fred S. Anderson, '29 CE
David Erickson, '29 CE
Walter W. Anderson, '29 CE
Fred M. Hakenjos, '29 ME
William H. Norley, '29 ME
Erling B. Saxhaug, '29 EE
Robert K. Zeese, '30 CE
Milford A. Juten, '32 ME
K. J. Albrecht, '25 ME

Engineers Desire Graduate Training

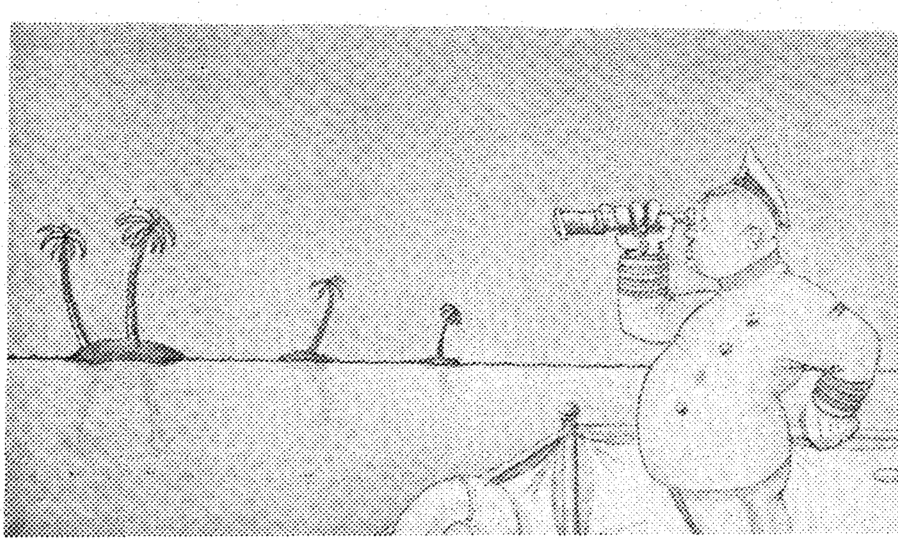
One of the outstanding features of the present depression is that more engineering graduates are coming back to school for post-graduate courses. This year, the drop in enrollment for the undergraduate courses has been nearly compensated for by the number of last year's seniors who have come back to work for their Doctor's and Master's degrees.

The following is a table showing, first, the number of men who have returned to the different colleges, and, in the the second column, the number who graduated last June.

Electrical Engineering	36	43
Mechanical Engineering	22	34
School of Chemistry	62	8
Chemical Engineering	30	32
School of Architecture	8	30
Civil Engineering	12	21
Aeronautical Engineering	0	15

The most spectacular return of alumni occurred in the Chemistry department, with nearly one hundred graduate students in the department.

'11—C. G. Mattison has for some time been Commanding officer of the S. S. Pathfinder which is surveying for charts of the Philippine Islands. He writes that he intends to remain in the Philippines for at least another year before returning to the United States. His present home address is 860—F. B. Harrison, Pasay, Risal, P.I. He may also be reached in care of the Geodetic Survey, Marula, P.I.



Music and Engineering

CLAYTON EBERT, M. E. '33

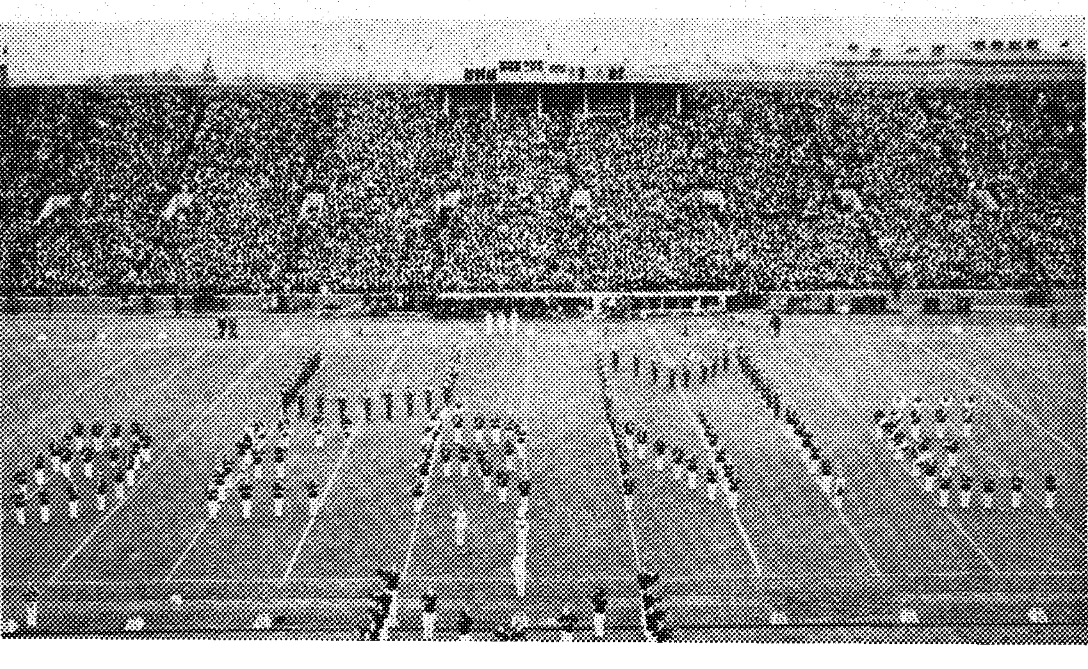
Hats off! Along the street there comes
A blare of bugles—a ruffle of drums
A flash of color beneath the sky,
Hats off! Our band is marching by!

THE sharp staccato report of a pistol closes the first half of a great Homecoming game: the Northwestern and Minnesota teams scramble to their dressing rooms for a few minutes of rest; the spectators relax for the first time since the game began. Suddenly, far down in the bowl of the stadium, a swirling mass of uniforms congeals into a solid, geometrical block. There is a flash of sunlight on shining metal as a figure in spotless white twirls a baton. The stadium re-echoes to the strains of a powerful march and the University of Minnesota band, in a high-stepping, spirited cadence, rolls onto the field for six minutes of those intricate and colorful maneuvers which add so much zest and pageantry to the university football season. In rapid succession tribute is paid to Homecoming Day, to Northwestern and Hanley, to Minnesota and Bierman. Then, with an accordian-like formation, the band steps off the field to the strains of Sousa's stirring "Minnesota March." The drum-major's baton spins and glitters, suddenly flashes high over the goal posts, whirls rapidly downward, and is caught to the cheering accompaniment of a crowd which has enjoyed the whole spectacle immensely.

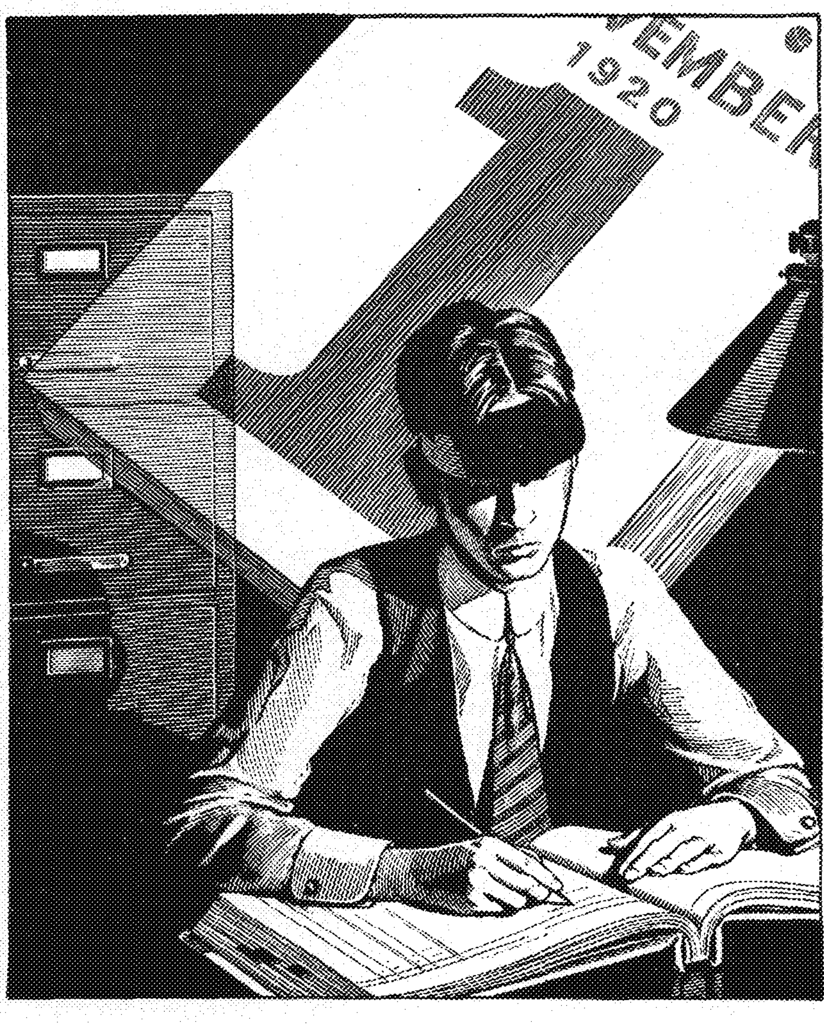
No doubt many of these spectators, students and alumni, have wondered just who make up this great organization. Were someone to make the statement that engineering students compose one-third of the band—that it contains more engineers than students of any other one college in the university—the statement would be accepted with considerable skepticism. Yet such a statement is the truth, for of the fourteen colleges with students in the band this year, engineering has the largest representation. This predominance of engineers seems at first glance very strange, especially when one realizes that the engineering school is by no means the largest on the campus. Yet this situation is not uncommon, for there was one year, not long ago, when engineers composed sixty per cent of the band's membership. It commonly has been observed that prominent engineers and scientists throughout the country are more often than not musicians of some ability. It seems the natural tendency of the man of engineering or scientific ability to find his hobby and cultural enjoyment in music. His ability to play a musical instrument, regardless of his skill, seems to provide the link between the exacting problems of his profession and the relaxed enjoyment of his cultural life. Music acts as the relief valve on the boiler of his cares and worries. It would seem then, that Minnesota's student engineers are following a normal course.

To the freshman engineer marching for the first time with the band, the morale of the organization is a revelation. He is immediately impressed with the spirit of fellowship, of sacrifice, of service. He finds that nearly one hundred per cent of the old members have come back to school four days earlier, in order that the band may present a good appearance at the first game of the season; he finds a friendly group—a group which welcomes the newcomers and enjoys their company. As the year rolls by, he appreciates this spirit more and more. He absorbs it himself and joins the others in long hours of practice, oftentimes monotonous occasionally most uncomfortable. Some days are hot, some so cold that the valves of his instrument freeze. Occasionally he marches about in the mud and rain, yet through it all he jokes and jests with his fellows, making light of many a disagreeable situation.

The College of Engineering can feel justly proud of its important contribution to the band, for it is doubtful if there is another organization on the campus which stands so ready to serve the university. At football and basketball games, for Homecoming Day, the Ag Royal, and dozens of other occasions, the band contributes its part. When that most important event, Engineers' Day, arrives, the band takes its traditional post, leading the big parade in its annual march about the campus.



the 1932 marching band thrills the minnesota and northwestern fans at the homecoming game



It *haunted* clerks for generations

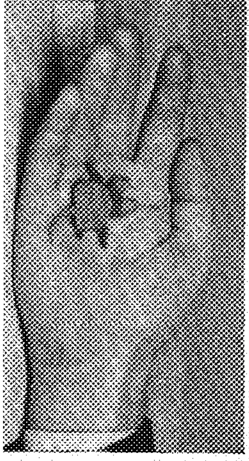
"The first of the month" used to be a time of feverish activity for ledger clerks. But the Bell System accounting staff — breaking away from tradition — simplified the keeping of accounts and rendering of monthly statements to customers.

They applied a modern system of *rotation billing* to the telephone business which now spreads this work evenly throughout the month. In co-operation with manufacturers, they devised special typewriters and bookkeeping machines. Thus they did away with inefficient rush and achieved greater accuracy, speed and neatness.

This is but one example of a point of view found throughout the Bell System. Even long accepted routine is constantly studied — it's always worth looking for the more efficient way!

BELL SYSTEM

A NATION-WIDE SYSTEM OF INTER-CONNECTING TELEPHONES



NEW FIELDS IN ENGINEERING

X-Rays Probe Turtle

A TWO-HEADED turtle was recently taken to the Research Laboratory of the General Electric Company by F. B. Cliffe, chief statistician of the company, whose nine-year-old daughter, Norwood, found it near a small lake at Schenectady. The turtle, of the snapping variety, was born September 24, along with more than a dozen normal brothers and sisters. It was taken to the laboratory so that x-ray photographs could be obtained of the unusual reptile and because turtles are a particular hobby of Dr. W. R. Whitney, director of the laboratory. The radiographs revealed that the turtle has a division in its spinal column, so that its two heads terminate the ends of a Y spine. Whether the turtle has two mouths to feed one stomach is yet to be determined, but it is considered probable that such is the case; as yet the turtle is a bit bashful, and has not been seen to feed.

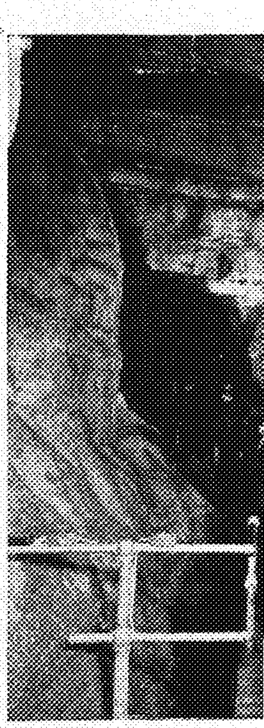
The freak's two heads, four legs and tail are normal in appearance, but its shell is wider than usual, humped in the middle, slightly pointed on the front end, and indented over the tail. The two heads behave normally, and it is apparent that they react independently. Each seems to control the two legs on its side of the body, for at times the turtle attempts to travel in different directions at the same time. At other times one head may be under water while the other is above, or the turtle may be sleeping with one head while wide awake on the other side. The right-hand head is slightly larger than the other, but it has not been noticed that either predominates in reaching decisions.

Ordinarily a turtle walks with alternate leg motions—the front and rear left legs forward together. The two-headed turtle has been seen to walk this way some of the time, but more frequently and with more success it progresses by moving its front legs forward at the same time.

Lights Enhance Cavern Beauty

THAT the scenic wonders of the Howe Caverns might look their best, a modern electric light plant was installed. To carry out the program of lighting the research and engineering resources of the Westinghouse Lamp Company were employed with the result that every foot of the mile and a half pathway below the earth is illuminated. Engineering ingenuity solved this difficult lighting problem without disturbing in any degree any of the natural formations.

In the Caverns is a unique system of concrete and gravel walks. The visitor no longer has to protect himself with rubber coat or boots but steps from his automobile into the Caverns Lodge which resembles a fashionable country club, takes the elevator down and then walks along dry paths framed by an iron guard rail.



There are many points of interest that hold the attention of the visitor to the Caverns; for instance, a section known as the "Rocky Mountains" formed by gigantic rock and stalamites which have been forming for centuries; another large room size section which is known as "Temple of Titan," and all through this underground wonderland are natural formations which resemble the wonders of the world.

Throughout the Caverns runs a stream of water known as the "River Sty," and terminates at a lake upon which the visitor is taken for a novel boat ride replete with scenic wonders.

If weight is a factor consider DOWMETAL

WORLD'S LIGHTEST STRUCTURAL METAL

SAND CASTINGS · DIE CASTINGS · SHEET · EXTRUDED

BARS, RODS AND SHAPES · SCREW MACHINE STOCK

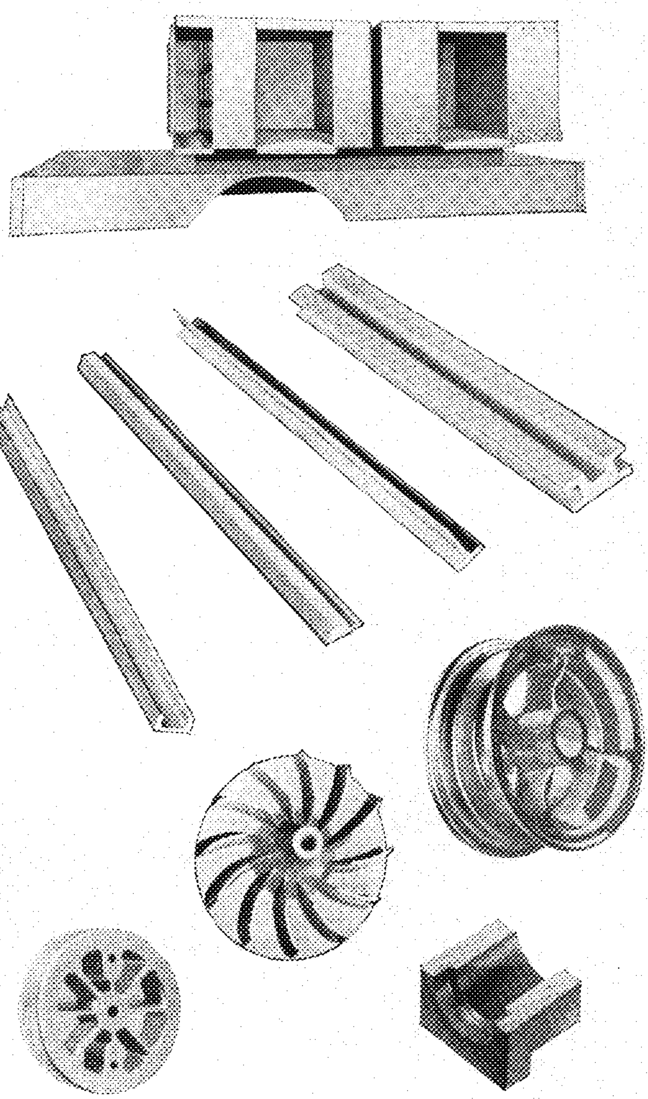
Manufacturers who have never been able to use metal in their products because of too much weight can now gain desirable added strength and ease of fabrication by using Dowmetal.

In many non-metallic as well as in fabricated metal products Dowmetal can replace other materials and open new ways to improved products and easier production.

Dowmetal cuts 25 to 30 per cent weight from previous light weight metal castings. It saves 35 per cent weight in die cast parts. Strong, smooth, sound forgings are one fourth to one third lighter. Rolled sheets are surprisingly light and strong.

The excellent machinability of Dowmetal cuts production costs and its light weight saves labor in handling through the shop.

Test its value—learn its advantages—gain sales benefits for your products. Send for the Dowmetal Data Book.

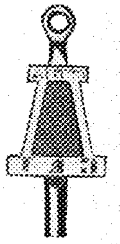


DOWMETAL DIV. THE DOW CHEMICAL COMPANY, MIDLAND, MICHIGAN

fall initiates

initiation news

tau beta pi



Alvin Anderson
Roman Arnoldy
Helmer Brockhoff
Paul Erickson
Walter Gustafson
Myron Hall
John Hancock
Edward Kaiser
Roy King
Adolph Kupka
Jack Lenhart
George Lindquist
William Lundquist
Laddy Markus
Henry Rahn
William Sears
William Shepherd
Bert Wood

THE informal initiation of Tau Beta Pi initiates was held on the evening of Tuesday, November 29, in the Mechanical Engineering Building, and the new men again enjoyed the fragrance of newly cut wood, while they operated in turn the many woodworking machines in Professor Richard's fine pattern shop.

The formal initiation took place at the Curtis Hotel on the evening of December 7. Mr. Frederick Hovde, now assistant director of the University Junior College, gave the main address of the evening.

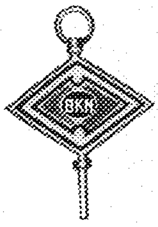
chi epsilo

Alvin Anderson
Philip Kilpatrick
Miles Kersten
John Ripken
Hugo Shogren

CHI EPSILON, honorary civil engineering fraternity, is an organization open to those juniors and seniors who have completed at least one year's work at the University and who are in the upper one-third of their class. The officers of the fraternity this year are: president, John Hubbard; vice-president, George Lindhjem; secretary, Harold Sundstrom; treasurer, Roy Oltman, and transit editor, Jason Yaggy. John Hubbard was selected as the delegate to the national convention this year, which was held at Pennsylvania State College.

The annual banquet, at which the fall pledges were initiated, was held at the Curtis Hotel on the evening of December 1.

eta kappa nu



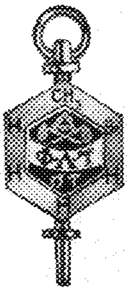
Benjamin Axilrod
Robert Carlson
Morris Cohen
Joseph Getsug
John Hyvarinen
Orville Jensen
Charles Martin
S. Ivar Pearson
Arvid Turnquist

THE fall quarter at Minnesota is near its end, and with it goes many memories of gatherings of Eta Kappa Nu—memories very pleasant to the members, but not so pleasant for the initiates—

The informal initiation which took place in the Electrical Engineering Building on the evening of November 16, held many a thrill, tinged perhaps with a bit of uneasiness, for the pledges. The appearance before the council—the shrill whine of the high tension generator—the "electric chair"—all added to the tenseness of the evening.

The formal initiation, that impressive ceremony before the flickering lights of many candles, will be held at the Curtis Hotel on the night of December 14.

phi lambd upsilo



Ross Gortner, Jr.
Sigmund Jacobs
Hilary Joswick
Gordon Lindner
Russell Nelson
Henry W. Rahn
Frederick D. Schmalz
Stanley Shima

AN annual smoker for men interested in chemistry was held in the Minnesota Union on the evening of November 20. Mr. H. M. Davis, president of the local chapter, introduced prominent men connected with the School of Chemistry. Dean Leland entertained the group with humorous anecdotes. Dr. Gortner, professor of biochemistry and a recognized authority in his field, gave an interesting account of the purpose and history of Phi Lambda Upsilon. Dr. Lind, director of the School of Chemistry and recently appointed editor of the *Journal of Physical Chemistry*, gave a brief talk.

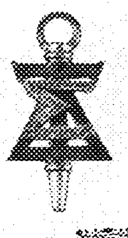
The formal initiation of the candidates took place on the evening of December 10 in the Minnesota Union.

pi tau sigma

Peter Riede
O. P. Prochar
Edward L. Kells

THE formal initiation was held Wednesday evening, November 30, in the Mechanical Engineering building, followed by a banquet at the Leamington hotel. Honorary members attending the banquet included Col. Paul Doty and Professors DuPriest, Shoop, Martenis, and Wilcox. Professor Martenis, newly elected National President, reported on the recent national convention at Urbana; Professor Wilcox contributed a few "vaporizations" on first editions, and the evening closed with several entertaining card tricks by Professor Shoop.

tau sigma delta



The fall-winter election for Tau Sigma Delta is now under way and the qualifications of possible initiates are being considered. Formal pledging will take place early in January.

TAU SIGMA DELTA is an honorary fraternity in architecture and the allied arts. Membership is based on scholarship, character, and interest in departmental activities.

Student officers of the Minnesota chapter are: president, Kenneth Lundberg; secretary, Austin Lange; treasurer, Helmer Brockhoff. The remaining members are Jarl Seppanan, undergraduate, and Dave Anderson, James Brunet, Roy Thorshov, Eino Jyring, graduates.

AROUND THE CAMPUS

Staff Discovers Mistake in University Address Book

Girls, take heart; where there is a bachelor there is hope. The TECHNO-LOG staff, after many days and nights of tireless search, can say at last that Edgar Piret, the school of chemistry's gift to women, is not married, notwithstanding statements to the contrary in the address book. The elusive Mr. Piret in his interview with our correspondent termed the statement ridiculous but added further, "Marriage, though highly desirable, perhaps, has not received any undue consideration from me as yet," though, as Mr. Piret slyly added, "Should the proper circumstances present themselves, I would not hesitate for a moment to take the step."

Dr. Hartig Determines Telephonic Phase Difference

Dr. Henry E. Hartig, Professor of Communication Engineering, has recently developed a method for determining phase relationships between the voltages at different points in a telephone network. His device makes use of the fact that the wave length of an audible sound in air is long enough for fairly accurate measurement. Two ordinary ear phones are connected to the two points between which the phase difference is wanted. A pasteboard tube of variable length with a small opening in its middle, is then placed betwen the two receivers and the length of the tube varied until the sound at the small opening disappears. The tube is then lengthened more until the sound has reappeared and disappeared once more. This is the equivalent of a change of 360° in the phase. Noting this change of length on the tube, the same voltage is now impressed on both receivers and this length is also measured. The difference between this length of the tube and the original length of the tube, divided by the length of tube for 360° gives the difference between the phase positions of the original voltages.

Dr. Ruth Discovers Laws of Filtration

Dr. B. F. Ruth, instructor in Chemical Engineering, has worked for a number of years on the mathematical laws governing the process of filtration. This work, which is on a theoretical basis, is nevertheless highly practical and of great importance to the manufacturer who plans to produce a chemical product. He wishes to know in advance how much equipment he will need for each operation and how much space he must allow for it; without such information very costly mistakes are almost inevitable.

Each of the fundamental processes of chemical manufacture has been worked upon to some extent in an effort to discover the laws that govern it, but, until recent years, very little work had been done upon the all-important processes of filtration, and it had not been possible to ascertain in advance the exact amount of equipment necessary in a given case.

In 1928, Dr. Ruth set about to discover the exact laws of filtration, since the work which had been done previously gave results of limited practical application. It had been supposed that the basic law governing filtration was Poiseuille's law, which states that the rate of filtrate flow is directly proportional to the pressure applied and inversely proportional to the resistance encountered. This predicts that the volume of filtrate during a filtration will vary as the square root of the time. However, it was well known that the early stages of a filtration did not obey this relation. Moreover, a number of different types of equations were required to cover all the cases encountered in practice. By a modification of the square root relation, Dr. Ruth was able to derive an equation which predicted actual performances over the entire filtration range very closely. He was thus able to show that after all the filtration processes do obey Poiseuille's law closely over the entire filtration range.

Not only does Dr. Ruth's modified equation have a simple theoretical basis, but it is entirely general and covers all types of materials commonly filtered, thus simplifying to a great extent the hitherto quite complicated mathematics of the problem. The final result is a formula relating all the variable quantities, such as the volume of filtrate, area of filtering surface, pressure, and viscosity. It is possible by means of several trial filtrations to determine the manner in which resistance of the material varies with pressure. When once the nature of this function has been determined, the action of the sludge in any filter press under any conditions can be calculated.

DO YOU KNOW . . .

. . . **THAT** there exists a course in our college where knowledge can actually be acquired without study or the aid of text books? This course, Mechanical Technology, presents to engineers twice each week men who are experts in their respective fields. This quarter has afforded students the opportunity of hearing several former Minnesota men who have even ventured to expose the human side of life along with the cold, cold facts. Just a few of the points brought out by these men are given below, to show just how interesting a lecture course of this nature can be.

. . . **THAT** one drop of carbolic acid contains the equivalent antiseptic value of $256 worth of Listerine? There you have direct evidence of the power of advertising in putting across a product.

. . . **THAT** the details of the famous Liberty motor were developed in one week? The motor passed the Bureau of Standards in one month, and three months from the time the plans were formulated in the drafting room, the motor was put into production.

. . . **THAT** the effective range of a radio transmitter in miles is approximately equal to the square root of the output in watts? By effective range is meant the distance from the transmitter to the point where the average radio receiver is able to receive clear signals at any time of the day. Mr. Bellows, at one time professor of English at Minnesota, presented this startling information, and incidentally made light of the fact that he had been fired from the mighty halls of this institution.

. . . **THAT** over one hundred million gallons of water are consumed daily in the city of Minneapolis? The Minneapolis water department was organized in 1866 as an auxiliary of the fire department to provide protection to the factories situated along the river bank. Since then it has grown to the proportions where it supplies pure water to an area of sixty square miles through eighty-three miles of pipe mains.

. . . **THAT** a perpetual motion machine cannot be patented unless a working model is submitted? Those things which can be patented comprise any new and useful art, design, or process. A patent is a seventeen year monopoly controlled by a person or a group of persons, which on expiration becomes public property.

. . . **THAT** the civil engineering class of 1908 is the only class in which no honorary degree was obtained. Failure to achieve scholastic heights was not the reason. It seems that the faculty seriously objected to a cow which they found up on the fourth floor of the old Mechanic Arts building (now the Business building). And then there was the incident where this class locked their professor in the class room for four hours just because he gave them an exam they couldn't answer!

« « MENTAL TILTS » »

PROFITING by our sad experience of last month, when the correct solutions were turned in to us by C. W. Janes less than six hours after the issue came out, we have made the Tilts a bit harder this time. We still have a bit of money in the bank, so we say again, "A credit slip good for $2.00 at the Engineers' Bookstore will be given for the first correct solution to all the puzzles."

THE WAYS OF WAYS TO WEIGH

IN the window of a general store in a small town, there hung for many years a cast iron kettle that weighed exactly forty pounds. One day when the chains rusted through the kettle fell and broke into four pieces.

The storekeeper found that by using these pieces in various combinations on a balance scale, he could balance integral number of pounds from one to forty. What was the weight of each of the four pieces?

TRY IT — IT HAPPENS OFTEN

IN a thoroughly shuffled deck of cards, what is the probability that at least one of the four aces in the deck will be side by side with one of the kings. If you don't believe the answer you obtain, try it on your favorite pack of cards.

WAR DEBTS AND HOW TO SETTLE THEM

IF England were permitted to pay their present debt of $4,000,000,000 to the United States in a lump sum at the end of sixty-two and one-half years, instead of paying part of the principal plus interest each year, what would they pay if the interest were compounded continuously at two per cent?

Answers to November Mental Tilts

SEEING THINGS

The rate of the stream is one-half a mile per hour, the inebriated gentleman may row at any speed greater than that of the stream.

TRY THIS WITH A FOOTBALL

The initial velocity of the second football is the same as that of the first, 50.7 ft. sec.

AMONG OUR SOCIETIES

A. I. E. E.

"Manufacture of Small Arms Ammunition" was discussed by Harold Sanderson, E.E. '32, representing the Federal Ammunition Plant of Anoka, Minnesota, at a meeting of the student branch on the evening of December 9th. Laddy Markus, senior electrical engineer, gave an illustrated talk on "Peculiarities of Neon Signs," and showed with experimental tubes just how three or four different colors may be produced in one tube.

Paul Erickson, chairman, made the following announcements:

The Electrical Show is to be held on April 21, 1933. The manager of the show is to be elected out of the Senior Class during the first part of the winter quarter.

The Minnesota Section of the A.I.E.E. is offering two cash prizes of fifteen dollars and ten dollars, respectively, to the two regular or prospective members of the student branch of the A.I.E.E. who present the two best papers on some electrical engineering subject. The deadline for these papers is January 21, 1933. The committee of awards will select the four best papers and the final selection will be made at the combined meeting of the Branch and Section on Feb. 8. All students who are interested are to see the chairman of the Student Branch for more specific rules pertaining to the contest.

A. I. Ch. E.

Mr. A. F. Mellen, filtration engineer of the Minneapolis Water Works Department, addressed the members of the Minnesota Branch of the American Institute of Chemical Engineers at their last meeting on November 22. The speaker discussed the methods and equipment used by the Minneapolis Water Department for purifying the city's water, giving special attention to the technical problems encountered in such a system.

Mr. Mellen is now considering the use of activated carbon for removing all color and taste from the water at all times of the year. The cost of installing complete equipment for using activated carbon would be too great to justify itself, but, by the use of modified methods, he hopes to accomplish the desired result at a moderate cost.

A. S. M. E.

The film, "Fine Arts in Metals," was shown before the student branch of the American Society of Mechanical Engineers at their regular meeting held on Tuesday evening, November 29, in the Engineering building. John W. Hoffman gave a report of the activities of the A.I.E.E. to the mechanical engineering group. After a short business meeting devoted to formulating a new plan for membership, vice-president Frank Ventura declared the meeting adjourned.

The test car of the Skelly Oil Company was on display at the Experimental Engineering building on Saturday, December 3rd.

John V. Martenis, Associate Professor of Machine Design at the University of Minnesota, represented the Minneapolis Branch of the American Society of Mechanical Engineers at their National convention.

An inspection trip through the new telephone building in Minneapolis is also being planned for the early part of next quarter. The national president of the A.I.E.E. is to visit the University of Minnesota Student Branch on April 14, 1933.

A. S. C. E.

Members of the A.S.C.E. recently made an inspection trip through the buildings and tunnels in which the heating equipment of the university is housed. The group learned some interesting facts about the heating system and, incidentally, were given a few points to remember if, as civil engineers, they should ever be called upon to construct steam tunnels such as those which are used in the university heating system.

American Chemical Society

Studies of X-ray diffraction patterns of many liquids indicate that liquids are largely composed of small aggregate patterns of solids and that the molecules of each aggregate are in semi-orderly arrangement, almost as in solids, according to a lecture given to the Minnesota Section of the American Chemical Society at their November meeting in the Chemistry Auditorium on November 7th, by Professor G. W. Stewart, head of the physics department of the University of Iowa. Professor Stewart showed this by comparing the ordinary X-ray diffraction patterns of solids with the patterns he has made of the same substances in the fused condition. The two patterns showed a similarity that would be difficult to explain unless the fused substance has a structure somewhat like that of the solid. Entirely different types of experiments confirm this theory. In the course of his work Professor Stewart has found strong evidence that even gases are partly coalesced into somewhat orderly arrangements at temperatures appreciably above their critical temperatures.

AROUND THE CAMPUS

New Rules Now Govern Trans-Oceanic Flights

The pioneering period in long-distance flying is over, is the opinion of the Department of Commerce. For this reason the Aeronautics Branch has adapted new rulings governing flights to foreign lands. These laws will in no way hamper the flyer but help him by eliminating much red tape.

Under the old policy, the individual in charge of the flight would inform the Department of Commerce of his intentions. The Aeronautics Branch would then examine the licenses of pilot and plane. If these appeared to be in good standing, the State Department would be notified to that effect. The State Department would then be requested by those in charge of flight to obtain the necessary permission from the countries to be visited. When this permission was obtained those in charge were notified, the matter resting in their hands. This procedure was not always followed, resulting in several embarrassing protests to the Government.

With the new rules in effect, however, the procedure is somewhat less involved. When the airworthiness of both airmen and aircraft has been proved, the Department of Commerce asks, through the State Department, permission for foreign entry.

These rules are but the forerunners of a minimum code for all long distance flights. This code, doubtless, will demand a knowledge of blind flying and that the flyer either be an accomplished navigator himself or be accompanied by one.

Pass Along the Glad News

Not even professors of physical chemistry can resist the thrusts of Dan Cupid, for Professor MacDougal of the school of chemistry was married on Wednesday, November twenty-third, to Anne Van Derlip Reichman. Experimental evidence as to whether two can live as cheaply as one has not yet been received at this office.

Dr. Taylor Designs X-Ray Camera

Studies of the packing arrangements of atoms and molecules in solids by examination with X-rays has been intensively prosecuted during the past 20 years. The diffracted X-rays give a characteristic pattern which may be recorded on a photographic film or ionization chamber. The University of Minnesota is excellently equipped to do work of this kind, and the departments of metallography, geology, physics, and chemistry are active in such researches.

Using a special X-ray camera of his own design, Dr. Nelson W. Taylor of the school of chemistry has been able to examine the structure of crystalline substances over a wide range of temperatures, from that of liquid air up to about one-thousand degrees Centigrade. Substances which are liquids or gases at ordinary temperatures may be examined as solids at low temperatures, and measurements made of atomic sizes, atomic arrangements and so forth. Dr. Taylor recently described this camera and some results obtained with it, before the staff and research groups of the departments of physics and chemistry.

Pre-Mortem Ramblings of an Architect

Every quarter about this time there comes a lethargic pre-final period when doings about the campus come to a standstill. . . . Math instructors warn that they will flunk at least a third of the class. . . . Sophomore Architects are worried, they still have six sheets of water-color to hand in. . . . The Juniors have two sketch problems on the program . . . the Seniors, well, there's always Mr. Mann's seminar to worry about . . . but all these things are dwarfed by comparison with such major events as this. A certain architectural prof. is adept at crooning love idylls. Erstwhile Alpha Alpha Gams persuaded him to croon to them at a recent banquet. Present was another architectural prof. not so versatile. Said he, "Singers of love songs, seldom are lovers." Said the crooner, "That may be why you never sing a love song.". . . And then there is that senior Interior Architect's sketch problem, "A Theater Curtain," with several admirable designs for an entrance to a tunnel handed in.

While the moon goes over the campus

[*Continued from page 73*]

"All the countrey on both sides of the river is as faire and plaine as ever was seene. All that countrey is full of sundry sorts of wood and many Vines. There is a great store of Stags, Deere, Beares, and other such like sort of beasts, as Connies, Hares, Marterns, Foxes, Otters, Bevers, Weasels, Badgers, and Rats exceeding great and divers other sortes of wilde beasts. There are also many sortes of birdes, as Cranes, Swannes, Bustards, wild Geese white and gray, Duckes, Thrushes, Blackbirdes, Turtles, wilde Pigeons, Lenites, Finches, Readbreasts, Stares, Nightingales, Sparrowes, and other birdes, even as in France. Also, as we have said before, the river is the plentifullest of fish that ever hath of any man bene seene or heard of, because that from the mouth to the end of it, according to their seasons, you shall finde all sorts of fresh water fish and salt. There are also many Whales, Porposes, Seahorses, and Adhothius, which is a kind of fish we had never seene or heard of before. They are as great as Porposes, as white as any snow, the bodie and head fashioned as a grayhound, they are wont alwaies to abide betwene the fresh and salt water."

What a region that must have been then for hunters and fishermen! Think of throwing out a line and pulling in a Whale or a Porpose. Or a Seahorse! Think of going hunting without having other hunters taking shots at you under the impression that you were a Beare or a Stag or a Ducke.

▼ ▼ ▼

Here is something more from Cartier:

"There groweth also a certain kind of herbe, whereof in Sommer these people make great provision for all the yeere, making great account of it, and onely men use of it, and first they cause it to be dried in the sunne, then weare it about their neckes wrapped in a little beasts skinne made like a little bagge, with a hollow peece of stone or wood like a pipe: then when they please they make pouder of it, and then put it in one of the ends of the said Cornet or pipe, and laying a cole of fire upon it, at the other end sucke so long, that they fill their bodies full of smoke, till that it cometh out of their mouth and nostrils, even as out of the Tonnell of a chimney. They say that this doth keep them warm and in health; they never goe without some of it about them. We ourselves have tried the same smoke, and having put it in our mouthes, it seemed almost as hot as Pepper."

Thus did Cartier have his first smoke. And notice that Indians did not seem to approve of ladies smoking. Of course, they had never seen a Lucky Strike ad.

DNEPROSTROY

[*Continued from page 71*]

standing above the floor of the plant. Fabricated or welded construction was used throughout to eliminate, as far as possible, large castings.

"Due to the shipping limitations the generator stator was made in six parts; punchings and windings of each section being installed before shipping from the United States. On arrival at the site the six sections were assembled and the joint coil entered. Thus considerable time and labor was saved in the construction of the stators on the site. The frame of each stator is built up of steel plates by means of electric welding and weighs 138,000 pounds. Shipping limitations necessitate each of the twelve arms of the stator being shipped separately. The central ring, to which the arms are fastened, is 16 feet in diameter.

"The generator shafts were the heaviest single pieces to be handled. They are 36 feet long, 70 inches in diameter, and 9 inches in thickness, and due to their weight (136,000 pounds each) had to be shipped in special cars and routed in a round-about way from factories to shipping point to insure railroad clearance. Their upper ends support a continuous load of two million pounds.

The mere facts of the immense size of this plant amaze us, and set us to wondering whether or not it can be practical. But not so the Russians—already they have begun constructions on a new and larger plant in Siberia which they expect to be operating within a year.

The natural resources of Soviet Union seem to be limitless in extent. The building of this great hydro-electric plant and the opening of hundreds of miles of inland waterway, have brought to light a valley which within a very few years may be as productive as the great central plains of our own country.

SIX YEARS OUT—AND NOW

[*Continued from page 67*]

that a lot of the fast talk I used to pass out about the value of my fraternity, the grand alumni spirit, and all that is just so much *you-know*.

The value of this fraternity lies chiefly in the social and broadening influence it can have upon its members in their formative years, the upping of scholarship, and whatever it can do in its student-alumni contacts and in helping the senior find out just where he best can get started in the business world.

If I were to endeavor to philosophize about life, I would say that six short years of observation have taught me not to take it all too seriously. Getting all hot and serious about one's job will never do a *Horatio Alger* for you if you haven't learned how to relax and play well when occasion demands.

Learning how to play is just as important as learning how to work. Most Americans, may I grandly generalize, cannot play without making asses of themselves. It's a funny thing, but I have observed in other countries where life doesn't go on at such a mad pace as here that everyone gets almost as much done and certainly has a great deal better time.

AFTER concluding a successful year as editor of the Minnesota Techno-Log in 1925-26, Paul Nelson has had a wide variety of experiences. He was once the Western Vice-Chairman of E.C.M.A.; was associated editor of The Electragist before it merged with another trade paper; was a member of the staff of the School of Journalism here at the University of Minnesota; and has traveled extensively abroad as well as in Mexico and Central America. Paul is now living in Chicago, where he writes radio advertising and works for The Travel Guild, Inc.

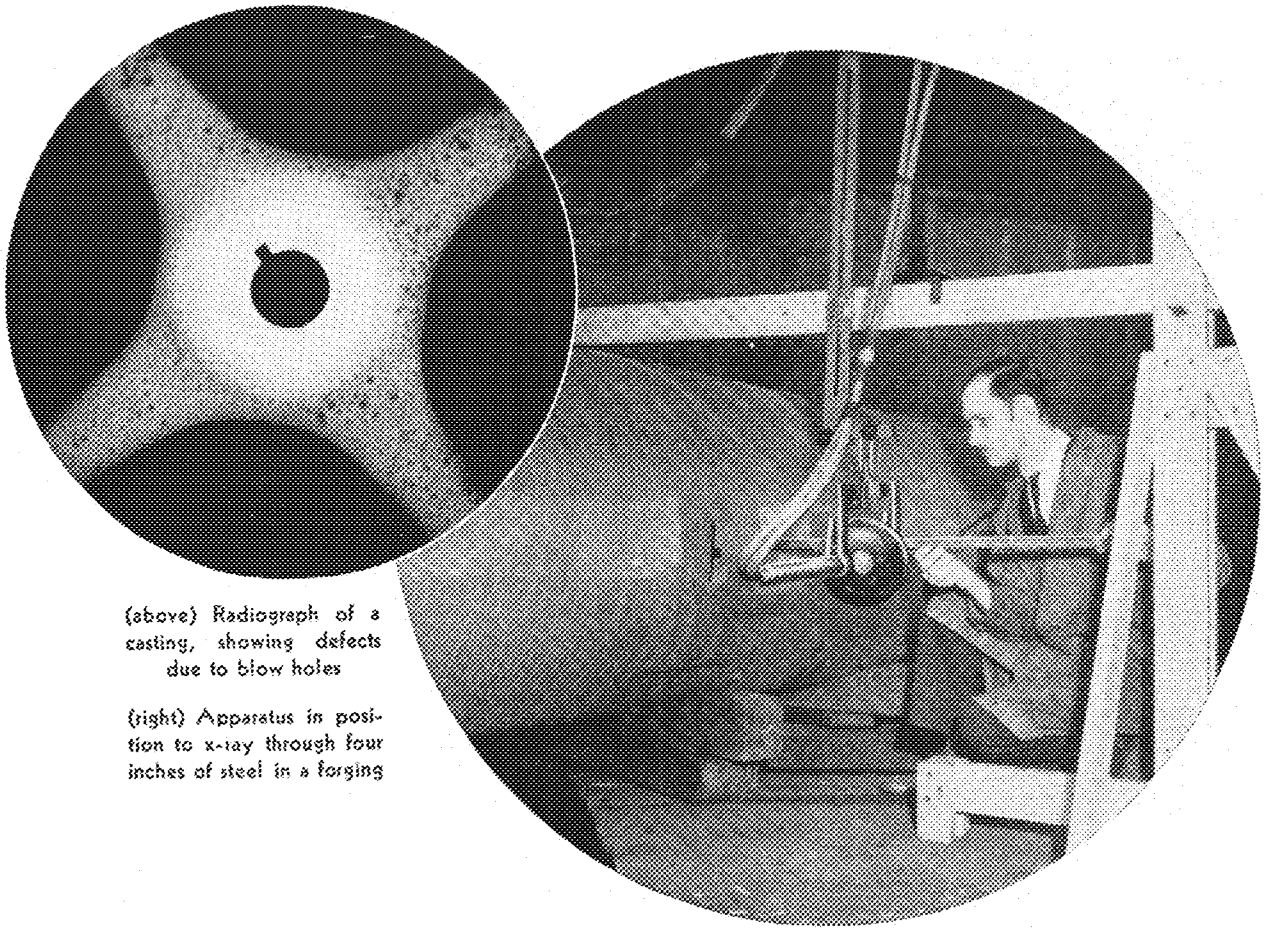
After all, what do we live for? Just to build a machine for others to use and enjoy? To amass a fortune for our relatives to scrap over when we're six feet deep? Or to enjoy a few of the many swell things there are here for us?

Moreover, I'm not for a lot of saving and planning for fun later in life when I probably will be too stiff to dance all night and enjoy it. I'd rather live say 75 per cent in the present and 25 in the future than the reverse, which so many of my friends seem to be doing.

I repeat, forget about what's happened. Live each day—for it never will come again. Plan, of course, for the future, but learn to live now, and the future will be even more glorious.

With our various biological and emotional set-ups I suppose it is hard to generalize about such a thing as marriage. However, I am not married for several reasons (besides not finding anyone who could bear to see me successively over the breakfast table); there is, first of all, the big economic problem, and I believe a certain number of years of bachelor life are a good thing, for they give a young fellow a chance to get around and see what he can best see alone. Also, I believe a young man should have his fling at the world so that later on when he settles he will probably be contented and not itching to get out and cheat and so on—as are so many of my friends who have jumped from the classroom into the harness.

Seeing through steel



(above) Radiograph of a casting, showing defects due to blow holes

(right) Apparatus in position to x-ray through four inches of steel in a forging

WHEN Prof. Röntgen announced his discovery of the x-ray, in 1895, he intimated that medical science would not be the only beneficiary. Since then, General Electric has been a pioneer in the development of the x-ray for industrial as well as medical use. ● As a result, a new science — industrial radiography — enables us to peer at the internal structure of almost any material. Radiography reveals most microscopic defects in metals — blow holes, shrinks, pinhole porosity, cracks, dross inclusions, etc. — without destruction of the specimen. Even four inches of steel is no obstacle to the modern radiographer. ● "Seeing through steel" has become a reality with the new and more powerful x-ray tubes developed by General Electric. These tubes, using as much as 400,000 volts, make possible the most powerful x-rays available to industry. Such developments are largely the accomplishments of college-trained engineers. They are leading the way to even greater progress in the electrical industry and are helping to maintain General Electric's leadership in this field.

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GENERAL ELECTRIC

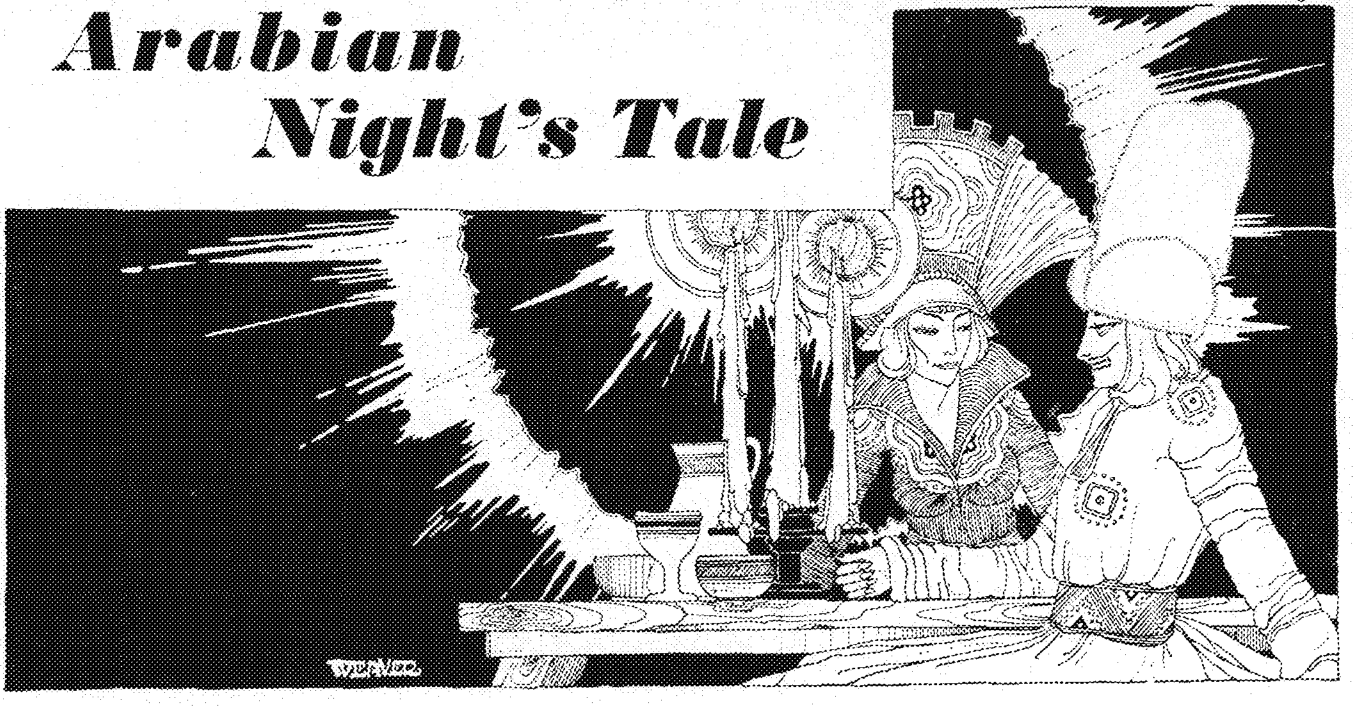
Minnesota

Member Engineering College Magazines Associated.

JANUARY, 1933

Vol. XIII No. 4

Arabian Night's Tale



While Old Araby reeled off tall tales of romance – ancient Cathay built Great Walls, and early Egypt reared the pyramids.

The engineer has never excelled as a tall tale teller, but the story of China's wall and Egypt's pyramids has been continued in mountain puncturing, river harnessing and canyon construction.

Like engineering, printing also has advanced from the papyrus manuscripts of the ancients to the marvelous machinery of the printers of this magazine . . . .

The LUND PRESS, *Inc.*

406 Sixth Ave. S. *Genera 8684* **Minneapolis, Minn.**

JANUARY, 1933
VOLUME XIII, NUMBER 4

Minnesota Techno-Log

37 ELECTRICAL BUILDING . . . U of M

Published monthly from October to June inclusive, by the students of the College of Engineering and Architecture, the School of Chemistry of the University of Minnesota

THIS MONTH

THE EDITOR SAYS

Here we are at the beginning of a new quarter—at a time when everyone makes resolutions to study more than ever before—to surprise the folks at home with a real set of grades this quarter. An excellent idea—in theory if not in practice. Along about the middle of the quarter, when study is beginning to get a bit monotonous, most of us forget the resolution, and along about the end of the quarter we are making up for the time spent on studies by stepping out twice as much as before.

Registration was a bit easier this quarter, wasn't it? That long line of students extending far down the hall was noticeable by its absence, and probation was checked more rapidly by the classifiers.

The administration has again turned its attention to our engineering campus, with the result that we will no longer be able to run over to the electrical building and obtain, for a few cents, all the milk we want. Now we must eat our sandwiches as best we can, whether they are dry or not, and ponder upon the fact that our university allows magazine salesmen of all kinds within its buildings, but objects when someone wishes to perform a real service to engineers by bringing milk to them each noon.

MEMBERS OF THE ENGINEERING COLLEGE MAGAZINES ASSOCIATED

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Entered as second-class matter April 9, 1925, at the post office at Minneapolis, Minnesota, under the Act of March 3, 1879. Office, 37 Electrical Building, University of Minnesota. Telephone, Dinsmore 2760. Subscription rate, $1.50 a year. Single copies, 25 cents. Advertising rates upon application. Alumni Directory, 50 cents.

A Country Church in England
A Pen and Ink Sketch
By John Huchthausen

The Situation Confronting a 1933 Engineering Graduate

By MAURICE DWIGHT BELL, M. E. '07

President, Engineers' Club of Minneapolis

Maurice Dwight Bell

Graduating from Electrical Engineering in 1907 Maurice Dwight Bell began his career at the Washburn Crosby Company of Minneapolis. For 23 years he was engaged in designing and maintaining electrical and mechanical equipment of this flour milling company. In 1930 he resigned to establish an office of his own in Minneapolis, and is now doing consulting work for the flour milling industry.

He has been active in the affairs of various engineering societies of the Twin Cities, and is now president of the Engineers' Club of Minneapolis.

AT THIS time of the year, as June and graduation approach, certain questions push themselves forward in the minds of Senior Engineers and demand answers. The answers may be sought among the other fellows, among the professors and instructors, outside friends and engineering alumni, or from the industries who employ engineers.

"What am I going to do? Where will I find a job? What am I best fitted for? Where can I earn my way?" are some of the first questions. This year, because of the situation in business generally, and in certain lines which use engineers particularly, there will be other questions which are more insistent, and which require deeper analysis for satisfactory answers.

"Have I done wisely in selecting engineering for my vocation? Have these four years of expensive training been wasted? Am I any better off than the other fellow who went to work after high school, and now happens to have a job? Are there too many engineers? Is the profession getting so crowded that there will be work in the future only at starvation wages? Should I have taken different subjects in my course? Should I have had less shop work, fewer technical subjects, and more general training in business? What is the position of an engineer in a major depression? What chance is there for me, a new graduate in a few months, to compete with other engineers?"

It is not for anyone to offer to give complete answers to all of these questions. But it is necessary for each man to face the facts as they are presented to him, and to reach a conclusion, on which he can make necessary decisions and go forward. When you see good men out of work, idle, anxious, perhaps actually in need, men of experience and proven ability, what is the answer to this problem of engineering training and employment?

Are Engineers Working?

Some inquiry will show what other engineers have been doing in this present emergency. It will be found that there has been shifting from one job to another, from one capacity to a new one, from a major activity to very minor ones, but they have carried on. It may not even be engineering; but it is an opportunity to use engineering brains, with benefit to the man who needs the job, and to those he is associated with. It is surprising to many who have been "fixed for life," to find how many ways there are of making a living, and having a good time doing it too.

Students at a state university are in a different situation from those at a privately endowed school. This is said without any desire to make any invidious comparisons, but for the purpose of getting a clear understanding of certain conditions which have a bearing on the training that is given engineers in the different institutions. The university is the head of the public school system, and is the next step beyond the high school. It is the logical opening for those who have completed the preparatory courses, and who want to go further. Necessarily the university has to take care of many students who do not know where they are going, but they have the means, they have completed the required work, and they gain entrance. They select courses with little knowledge of what they want to do, or of their own abilities. They have even less knowledge of what their chosen profession requires for successful accomplishment.

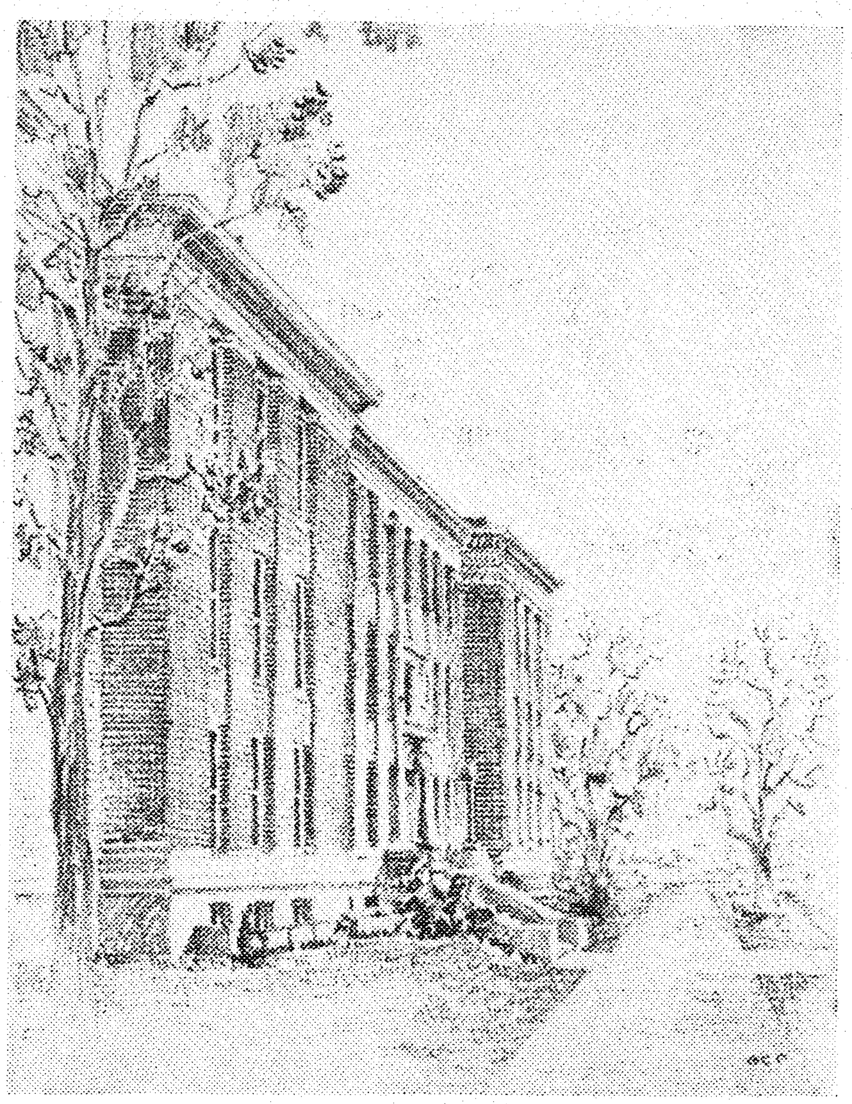
More Education?

This mass education in engineering must go on, but the student must face his own share of the responsibility in it. It is another case of "Eventually, why not now?" It is not enough for him simply to survive the course. It is much more important that he do his part to the utmost to be one of the fittest.

The courses offered must be necessarily very general. It is again a quantity problem, where numbers are the governing factor many times, in terms of enrollment, of teaching staff, of class rooms, of equipment, and of funds that are reduced to the minimum, in competition with the budget demands of state institutions for the care of the less fortunate, squeezed from farmer legislators who have problems of their own. These courses are affected by popular demand, by availability of teaching staff, by individual enthusiasms, or even by politics.

Look Forward

The senior engineer in January may think that this is too late to consider any of these things. It is too late to go over any of the courses that he has given too little attention to. But it is not too late to consider what the situation has been,



We spend four years of our lives in this, our Main Engineering Building, and then what?

to see if full advantage has been taken of the opportunities that were at hand, and to decide whether he will manage his affairs better in the future, or will continue to depend more or less on being handed what he will need, with the assurance that everything will be all right, somehow.

On consideration, every student will recall with appreciation the courses that he has taken that have been well taught, by men who were able to present the subjects forcibly, whose standards were exacting but fair, and who have contributed by their personal characters to making the world in which the class room lives. But the memories that will be most satisfying, are of those courses where the student really worked hard, and where he got some degree of mastery over an essential element of engineering knowledge.

This attitude of appreciation of hard work, and the satisfaction that comes with it, is essential to the student who looks forward to graduation and entrance on active work in engineering. If he has this, and can see that this statement is something more than "tripe," if it strikes a responsive chord in his thinking, then he has arrived where he can recall his course in the university with confidence. If he cannot, he is off to a bad start. For successful work will require that he continue his studies. He will continue them under difficulties. He will be his own instructor, and maybe he will be a poorer and less inspiring one than he has served under before. He will try experimental work at expense of time and money, and recall with a different estimate, the work he rather blindly carried on under the direction of someone else in "the laboratory." He will select his future "courses," not because they are interesting but because the job requires that they be mastered, and his fondness for bread and butter and some of the trimmings only increases with time.

The drastic elimination of those who fail to pass the requirements of the first two college years will seem less arbitrary when the stern necessity is recognized of meeting engineering requirements in competitive practice outside today. The course is a proving ground, fully as much as a source of information. It tends to develop character, tenacity, honesty, the ability to think. It intends to give to each man, the essentials of the special branch of engineering which he has selected, but this cannot be the completed superstructure, all ready to move into, with all the comforts of home. It is the foundation on which each man will rear his own building.

The seniors in engineering can feel assured that they have met the requirements with credit, so far. They can have confidence that they are as well prepared as possible, with their individual special abilities still to be more fully shown. There is every reason to look forward with confidence. They will find subjects arising in the future, with which they have had not even a speaking acquaintance, which they need to know well. But they will know how and where to get the needed additional training. This is true whether it is another language, economics, geology, investments, life insurance or table manners.

Keep on Studying

There is much in the current press, technical and otherwise, dealing with national and world conditions, of vital interest to engineers. He will find that his reading will have to be extended to new fields which may offer work in which he has some ability. He will form new associations, new friends, with whom he will want to talk over these questions of the day. They are problems in which engineers are being consulted, in which engineering of the classroom sort is not in evidence, but in which weight is given to the engineering viewpoint.

More and more men in business are willing to take on engineers for special fields that were not open a few years ago. In some of these positions, the title "engineer" is not an advantage, or descriptive of the responsibility. It is surprising to find in many positions, under other titles, men who are engineering graduates, but who do not identify themselves usually as engineers. This is an encouraging indication of the fact that opportunities for engineers are widening, instead of narrowing. But it is evident, that these opportunities come to those whose reading or outside efforts have prepared them to be of service in lines not defined directly by their college degrees.

Engineers Are Needed

The world needs engineers. It needs better engineers. It needs engineers who are not the well paid slaves of the machine, or of the owner, or of the financier, or the man who says "Yes" or "No." The world needs his accurate thinking from the basis of proven facts. It needs his honesty, his courage, his knowledge of principles, and his ability to find the decision and to get things done well and in the time required.

The world is not yet ready to be run by engineers. There are lots of others who are sure they know how better. But it needs engineers in a new responsibility, in management, in government, in finance, in fact finding, and in the field of distribution. In a recent book by Prof. Walter B. Pitkin, of Columbia University, entitled "The Consumer," it is shown how the great crash of 1929 laid bare an unbelievable state of ignorance among all classes of business men, from the largest banks to the smallest retailers. "Production has become a marvelous technology. Consumption remains a no man's land." This book is a pioneer attempt to explore this no man's land of consumption. It is a most encouraging field for engineers.

Technocracy

"Technocracy" is being given much consideration today. It has been well defined in brief as the results of the work of a group of engineers who are engaged in a study of the effect of the machine on hand labor, and with the purpose of trying to find a remedy in the present crisis. It is unfortunate that so much of the discussion is intended to show up what are called the "fallacies of Technocracy." There rightly may be wide difference of opinion as to the facts that are produced in evidence. The use of statistics is always dangerous. They require common sense interpretation and analysis. This takes time, and intelligence, and experience in the industries to which these figures relate. This is a field in which engineers have a responsibility that they cannot dodge. They should see that the original statistics are accurately prepared, that they are properly compared, and that the conclusions are sound. Engineers are not supposed to be economists, and it is apparent that economists do not welcome the encroachment on their field which they consider Technocracy presents.

Study of this and the many other presentations of present day interest, will give engineers an opportunity to help. It will give them jobs. It will prove to many sick industries that what they need is not less overhead, but more brains at the head. It will insure that returning prosperity will not be quite so much at the mercy of unregulated expansion on borrowed money, of making more than the market can absorb, of attempting to survive by ruthless price cutting, wage cutting, or financial operations close to swindling, which come with business desperation, and result in ultimate loss of public confidence and business stagnation.

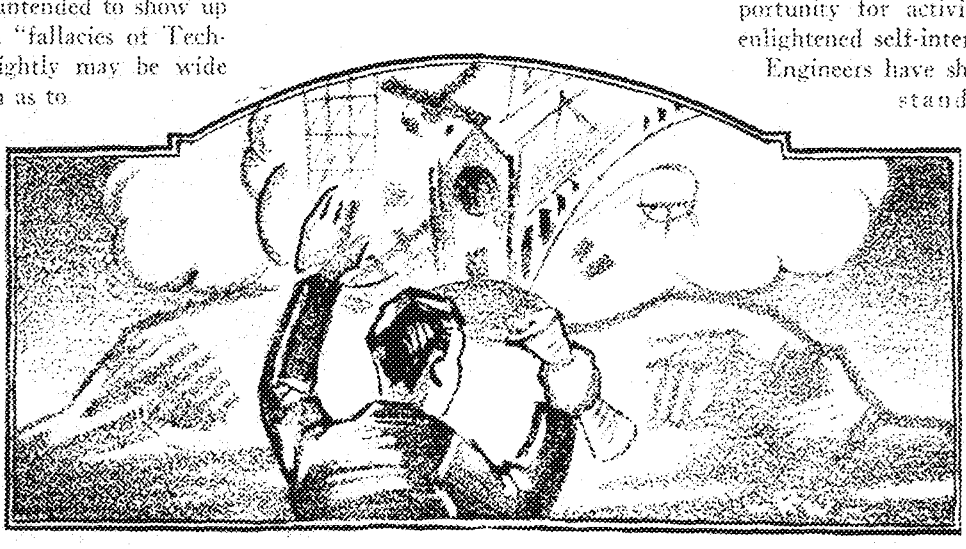
Politics for Engineers

In the present depression, with the study that has been given to all sorts of proposed remedies, whether by government aid in construction or in finance, or in private business, engineers have found it necessary to come out of their modest retirement as professional men, and to study politics, if not to get into it. While it may not be to their liking, it seems to be an established fact, that they must continue to do this. As individuals and through their technical societies and associations, their voices must be heard and their influence felt, to present their intelligent opinions to the public, and to help determine the policies of the people. Otherwise, it is certain that these policies will be determined, and the money of the people spent, by those less well informed, but more vocal and determined to be heard. In expanding this field of activity, engineers should not hesitate because it is new to them. They should think and act as impersonally as if it were a matter of any other sort, to analyze the conditions and then find the best way. It is not alone a matter of their own interest in finding work which they can

Will it ever come to this?

do, but the public interest demands it. If we, as individuals complain that our taxes are high, and that our affairs are not administered as well as they should, we as engineers must take our full share of the responsibility for making them better. It is not as easy as it may appear when reading the paper at home in comfort. It may mean late hours, and long effort to "see the right party," but as long as our government continues to function as it has, there will be the opportunity for activity by engineers, in enlightened self-interest.

Engineers have shown the benefits of standardization, which means finding the best way or the best product, and then making this the normal service. The advantages of this are unquestioned by anyone who looks around him and sees what this has meant in modern



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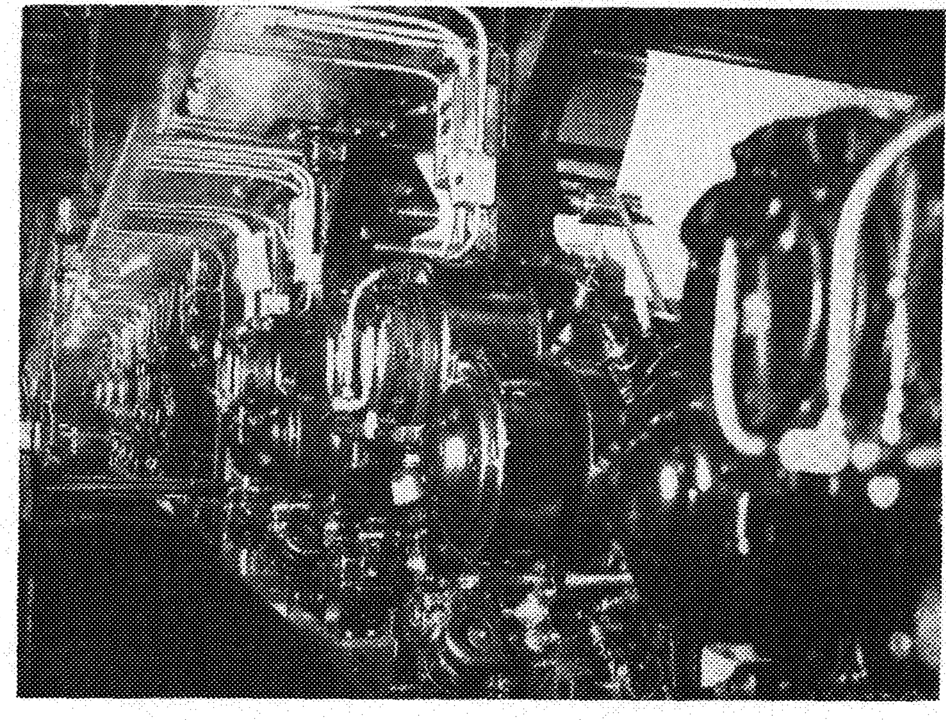


Push button controls are conveniently located to stop and start the modern newspaper press.

MODERN NEWSPAPER PRESSES INSTALLED BY ST. PAUL PAPER

St. Paul Dispatch and Pioneer Press installs presses having capacity of 50,000 papers per hour

By LEO OWENS, M. E. '11

Publisher, St. Paul Dispatch and Pioneer Press

PRINTING presses capable of turning out newspapers of from four to forty-eight pages in size at the rate of 50,000 copies per hour have just been installed by the St. Paul Dispatch and Pioneer Press. This equipment, the latest development in presses, is, without doubt, the most remarkable printing achievement of the Twentieth Century.

This printing press, the product of the inventive genius of Henry A. Wise Wood, head of the Wood Newspaper Machinery Corporation, is the result of many years of study, experiment, and scientific engineering. This man, an inventor by nature, the designer and builder of the automatic plate casting machinery which is used in the large newspapers of the world today, has made outstanding contributions to the processes of newspaper manufacture. It is with his machinery that newspapers are able to put papers "on the street" carrying news that arrived in the editorial rooms but a few moments earlier. Equipment similar to that of the St. Paul Dispatch and Pioneer Press is in operation or in the process of installation in the plants of the New York Times, Chicago Tribune, Cincinnati Times-Star, London Daily Mail and the Paris Intransigeant.

When I first knew Mr. Wood nearly twenty-five years ago, I was struck with his enthusiasm in discussing the development of a modern press. He envisioned printing presses which would print not at the rate of 24,000 copies an hour, but 50 to 75,000 copies. He pictured a press which would not have to be stopped to replenish paper rolls but one which would run continuously with expiring rolls of paper automatically replenished by full ones; a press which would actually produce 50,000 copies in an hour of continuous operation instead of the 12 to 18,000 produced on the then existent presses.

Today his dreams are a reality. Although the automatic roll changing device called the "Autopaster" is not a part of the Dispatch-Pioneer Press equipment, it is on the Wood presses installed last year in the New York Times plant and here production records approaching 50,000 perfect copies are made. If these presses were operated at higher than fifty thousand copy speed per hour, that actual production could easily be made.

Space limitations do not permit more than a brief outline of the history of the newspaper printing press. It can be stated, however, fairly safely, that until recent years improvements in presses did not keep pace with increases in circulations and size of newspapers.

Shortly after the Civil War, circulations rose and there came a demand for larger papers. Up to that time, it was a laborious job to get out the four-page sheets that constituted the daily. It was printed one side at a time on a flat bed press from type and then folded by hand. Gradually improvements were made. Cylinder sheet-fed presses were invented; the printing cylinders carried curved "turtles" holding type. Then came the cylinder press carrying on the printing cylinders curved plates made by the stereotyping process, curved plates cast from a matrix of the type form. Both sides of the sheet were printed at one time from a continuous web of paper.

The first of these presses had no folding or perfecting mechanism and the product was delivered flat and cut into sheets. Later, folding and perfecting equipment was combined with the printing unit itself, and at that time, in the late eighties, it may be said that the modern printing press was born. Then it was that "yellow journalism" came into vogue and circulations and advertising began to expand rapidly. It was realized that the printing equipment was inadequate for those newspapers which are now the leading newspapers today. The printing speed of the equipment in 1890, a maximum of about 24,000 impressions per hour, was deemed satisfactory. But a single printing unit with folder would print only 8 pages at full capacity. To increase this capacity, two units were mechanically connected, one at a right angle to the other, the web from the supplemental unit being brought into the folder after passing over an angle bar to change its direction 90°. Soon two, and later three units were added to the first unit making what are known as sextuple and octuple presses.

During the next twenty years, press manufacturers experimented with different methods of combining the units of multiple unit presses, with little or no change in the speed of printing. The web leads were long and difficult. (I worked on one press that had one lead of about 60 feet from the roll to the folder.) Much time was lost in "threading in" when webs were broken. Roll changes were slow. An octuple was a "big" press during that time.

Out of these experiments was developed the "straightline" press with all units placed in line. In some cases, two units were on the floor and two superimposed for an octuple; or four units one above the other and the paper fed into each unit from rolls supported by brackets at the rear of each unit. The slow and cumbersome method of handling the paper brought out an invention which, in combination with the improved presses, is the key to the high productions of today. This was the "magazine reel" placed in a basement under the presses. These reels carried three or four rolls of paper for each printing unit. As one roll expired, the reel was revolved bringing a new roll into position. It required only a few seconds to paste the sheet from the expiring roll on to the new one and speed up the press.

Early in the second decade of the present century, demand came for larger than octuple press capacity of 32 pages. This brought out the present design of printing unit arrangement, the "unit-type" press. Such a press, with a multiple number of printing units all in line on the floor, and the necessary combination of folders, has the flexibility and capacity to handle a newspaper of almost any reasonable size, and if sufficient units are installed and properly arranged, the up-to-date newspaper can turn out its required circulation on scheduled time regardless of the size of the product. This is the aim of every newspaper—to deliver to the reader his copy of the paper at the same time every day.

At each revolution of the printing cylinders, each press unit will produce two copies of an 8-page paper. To print a 32-page paper, four units are required; five for 40 pages and six for 48. With six units in line, any or all of which may be connected to the folders, the equipment can therefore print any paper from 2 to 48 pages in size increasing by 2 page increments. If two such unit-type presses should be required, the modern way is to place them end to end and have three or four folders placed at the proper intervals between units. A continuous drive shaft with necessary couplings permits the operation of individual groups of continguous units. Such equipment of twelve units with four folders and four motor drives and electric control apparatus would permit individual operation of two 6-unit presses (double-sextuple), two 5-unit presses (quintuple), three 4-unit presses (octuple), or four 3-unit presses (sextuple).

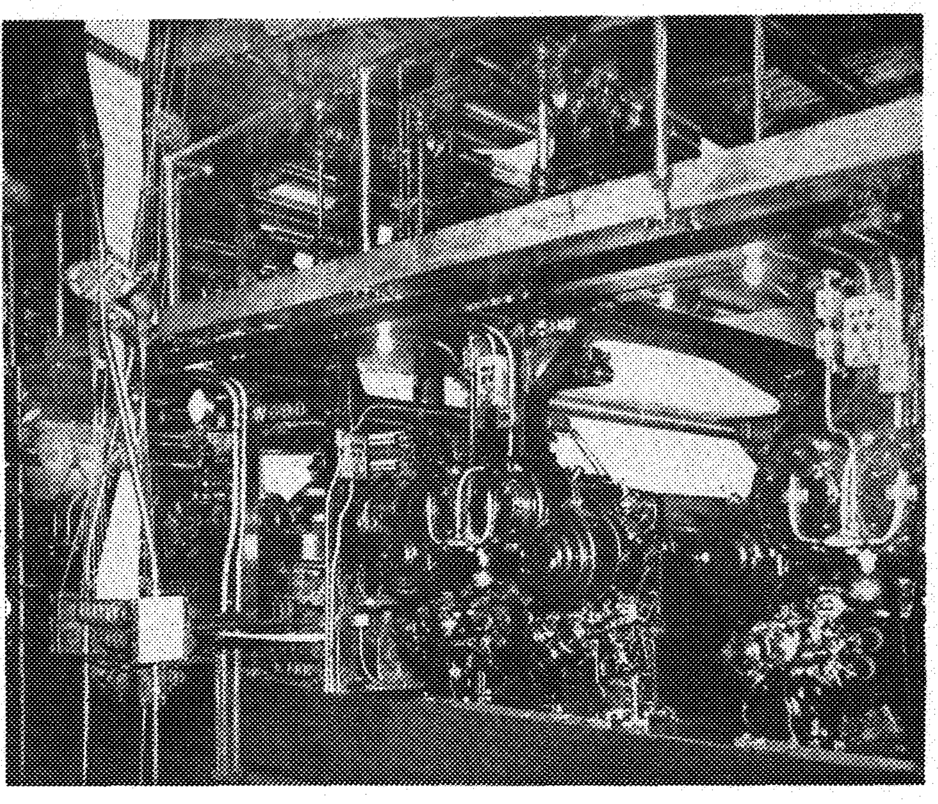
With such equipment, the newspapers of the Twin Cities, for example, would be amply provided. Although it is not ideal, for practical purposes it would be entirely satisfactory.

In the above I refer to two papers per revolution of the printing cylinder. This means two printing plates of each page—hence two papers for each revolution. If only one plate per page is put on the press, then twice as many pages can be printed but the product of the press is cut in two. We refer to such a run as a "collect." A six-unit press run "collect" would print a 96-page paper instead of the 48, as referred to, but the production rate would be 25,000 per hour instead of 50,000 on the Wood press.

Present day requirements (at least those preceding the depression) have been met at last in the modern printing press, but I believe it is not unfair to say that the old line manufacturers of newspaper presses were forced to develop their presses by the initiative, the genius, and the inventions of Henry A. Wise Wood. He had lead; they have followed.

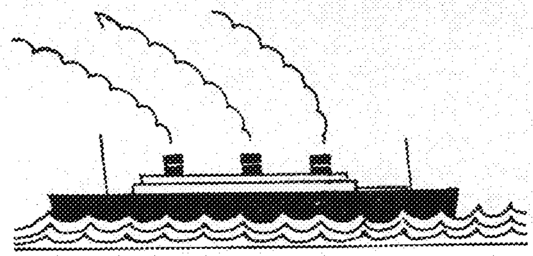
Hoe, for three-quarters of a century, Duplex, Goss and Scott, prior to the turn of the century, had been building newspaper presses. Wood built his first high speed press about 20 years ago. It was not entirely satisfactory, but served as the basis for his first large order—twelve units for the Philadel-

[*Please turn to page 124*]



Paper is fed from rolls located beneath the printing presses, and the finished newspapers are transferred to the floor above by flexible conveyor belts.

MEDITERRANEAN TRAVELS



By LEON ARNAL

Leon Arnal—that little Frenchman in the architectural department—is a personality worth knowing. Paragraphs, pages, even volumes, could not introduce him as well as a short conversation or a few criticisms in a design course. An architect, a professor, a traveler, but above all a Frenchman and Leon E. Arnal. Short with dark, indescribable deep eyes and a subtly changing countenance. Quiet whether feeling particularly humorous or particularly angry — whether sliding witticisms into the middle of a "crit," pelting them at you like hailstones, or just generally telling you where to get off and when and why. A veritable slave driver, but an understanding and exceedingly interesting one. And through all runs his French nature, slipping out in mannerisms and speech, pronunciations and phrasal twists, "and that's all about it."

●

THERE are two memorable days in my life thus far. On the first one, September 21, 1911, I discovered the village of New York. On the second, January 21, 1932, I started on my way to discover the Near East. That day, I picked up my suitcase, boarded a boat, which, figuratively speaking, opened the gates of Marseilles, the so-called "Gateway to the Orient." I was bound for the lands of marvelous tales, splendid architecture, the lands from which myths, legends, religions and philosophies started. It was going to return a call some Phoenicians paid my home-town, Marseilles, some 500 years B.C. when they civilized it. I thought of myself as a modern occidental Ulysses starting for the great adventure. Let me say, right this minute, that I did not flounder on any treacherous rock, or any forgotten island. I came back safe *"in corpore sano"* and I hope in *"Sana mens,"* except for a little tendency to interrupt any kind of conversation with a casual "When I was crossing the Sahara Desert" or something of the sort.

In the ruins of Leptis Magna are many thousands of architectural fragments similar to this bit of stonework.

I was elated pacing the boat's deck. My youthful dreams were at last coming true. Dreams of the days referred to by Professor Siler when there were no movies, no radios, no autos, no aeroplanes to toy with, no international debts question to get mad about, no Technocracy to be disturbed over. Happy days in which we believed all wisdom came from the past! . . . Night came, and I retired to my state room. I must still have been dreaming of mysterious lands, luxuriant tropical vegetation, and unheard of people and faun, when a gentle tugging awakened me. "Sir," said the cabin steward, "if you want to have a good look at Alger la Blanche, you better get up, quick, before we disembark." Sure enough, Algiers, was there, the capital of the decidedly successful and prospered French colony in Northern Africa.

Algiers afforded me my first initiation to the Moslem world, to its life, habits, customs, and to its architecture. It was a real delight to roam around the picturesque Arab district, with its highly colored houses, its whitewashed mosques, its delicate tile faced minarets, and its romantic, peaceful graveyards shaded by cypress. In spite of modern civilization there still hovers about the flavor of the days when Algiers was the laird of corsairs, bringing their booty in those houses built around inner arcaded patios, with no outside windows to speak of.

Leaving Algiers in a chartered car I soon found that out of five passengers two were foreigners, I mean Spaniards, and the other three, including myself, were from Minnesota. Can you beat it? We headed south, passing through the Kabyle region where the Berbers live in their mountains, oblivious to civilization, the same kind of life their ancestors lived centuries ago.

A picturesque town, Constantine, retained our attention from an engineering point of view. It is built on both sides of a deep chasm, crossed by bridges, flying from one side to the other, five hundred feet above the bottom. Farther south the Roman ruins of Timgad (100 A.D.) gave us our first impression of the might of Rome in the days when she was founding towns in her colonies. Here, on a commanding place, in this high plateau, are the remains of baths, amphitheaters, basilicas, temples, where among other things, floor mosaics of great beauty in design, color, and craftsmanship were taken from and displayed in the little museum erected on the grounds.

Descending abruptly from the plateau, passing through the last gorge of the mountain, we had, as it by magic, the first view of the infinite plain of sand, the desert. The first oasis we cast eyes upon was Biskra, with its groves of palm and date trees, its tropical vegetation, its native houses built with sun-baked bricks. We spent a few enchanting days there before starting south and eastward through the desert to reach the Mediterranean at Gabes (Tunisia). This was done over a period of several days, putting up at night in one of those oasis-towns and starting early in the morning for another lap.

I am afraid at this point I have reached my limitations as a narrator. I wish I could convey to you, with the proper words, our feelings, our sensations, traveling on those endless trails in the crisp air of the morning, before the sun got too hot, the ever changing subtle colors as the sun rose higher and the glorious sunsets when it went down. The monotony of the trip was relieved by meeting occasionally a small caravan of peaceful, nonchalant, loaded camels, led by barefooted Arabs trodding in the hot sand, or by the flight of a scared pack of gazelles crossing our trail at top speed, or by a deceitful mirage in the distance. Crossing for a full day a stretch of sand dunes, in an especially built six-wheeled car proved to be sensational although I would hardly recommend it to persons afflicted with weak hearts or subject to sea-sickness.

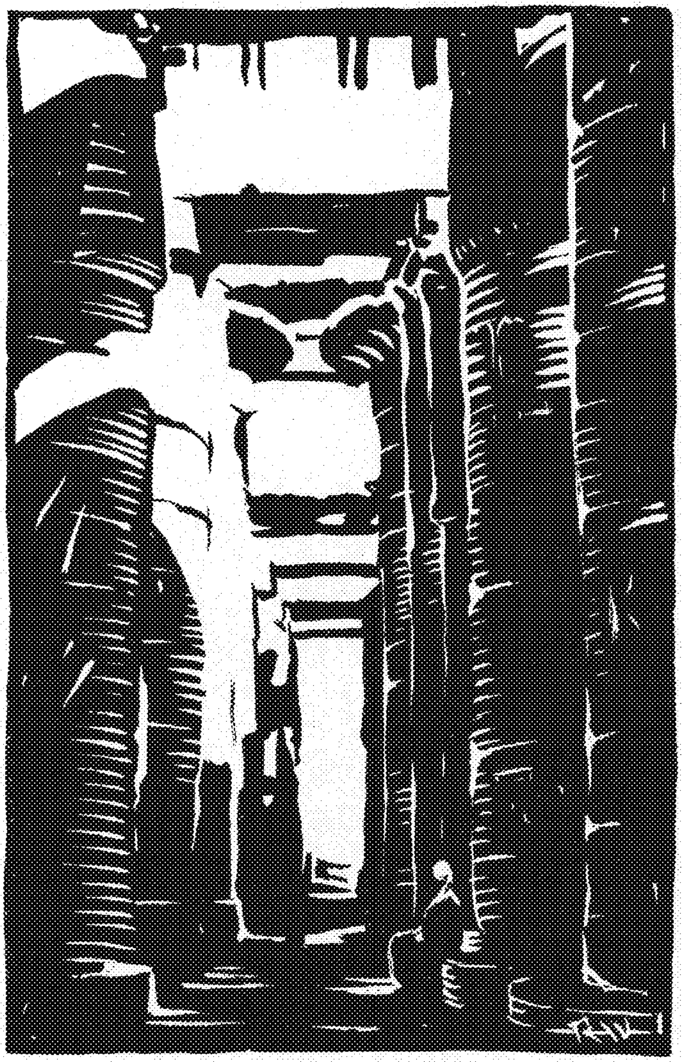
Not far from Tunis, once lay powerful Carthage, but very little of it remains. Time and men have wiped out the proud city overlooking the gulf, its palaces, its temples, its beautiful terraced gardens, so vividly described by Flaubert in his "Salambo." No more gardens are there, no more flowers, only bare ground, withered grass, rocks, chunks of masonry, utter desolation.

I left my companions in Tunis and sailed to Tripoli where modern Italians are trying to colonize again that immense stretch of land, once the sea coast, running from Tunisia to Egypt. Rome once built there rich towns and prosperous harbors which disappeared with its fall. For many centuries one of these towns lay buried in the sand until the time Mussolini decided to unearth it in the most dramatic way reminiscent of Pompei's resurrection. I spent one day in the ruins of Leptis Magna, wandering among thousands of achitectural fragments, dug out from the sand, scattered all over the place, numbered, ready for somebody to solve that gigantic puzzle. Meanwhile I mused on the fate of this town, prosperous during the Roman period, pillaged several times by barbars, pulled down by earthquakes, buried altogether by the desert sand, lost, forgotten, and now coming out again under the sun, yielding the archeologists and the historians a new wealth of materials to contribute to the study of the Roman Empire.

A few days later, I found myself strolling through one of the dusty streets of Athens. In the distance loomed the Acropolis, the sacred rock, the temples atop. At last my day had arrived! Slowly, with reverence and emotion I approached it, reciting to myself some lines I had learned when a young neophyte in Architecture:

> O Nobleness! O Beauty simple and true!
> Goddess whose cult means reason and wisdom,
> Thou whose temple is an eternal lesson of
> conscience, and sincerity, I arrive late on the
> threshold of thy mysteries. . . .
>
> (*Priere sur L' Acropole, Renan*)

Yes, Beauty, Truth were there! But, Oh, let me vent my grief, it will do me good. Why, I ask you, should the gates of the Acropolis be converted into a parking space smelling of gas and oil, full of noise and racket? Why should there be annoying peddlers and photographers for ridiculously posing honeymooners? Why should there be at the foot of the rock a miserable drinking place equipped with a thunderous gramaphone or radio set filling the whole place with jazz? Why should sight-seers treat these grounds as a gamboling picnic place? Yes, why, I ask you again?



The setting sun of Egypt pours streams of fire over Karnak's gray pylons.

The next day I was traveling in the country, where my wrath dispelled itself in the quietness and grace of the landscapes, dotted with cypresses, evergreens, with snow-capped mountains in the distance and delicate skies over all. At last I found peace, beauty, and archeological interest in these places, by name, Corinth, Mycenae, Olympia, Delphia. Returning to Athens, I saw its temples, its beauties in a different frame of mind. The day of my departure, a glorious sunset of the Acropolis and the Parthenon filled me with one of the rarest emotional treats I ever had.

Palestine and Syria were different. In the former I went through Jerusalem, Bethlehem, Nazaretts, where Orient and Occident mingle so curiously, if not altogether satisfactorily. But what a shock it must be for the mystic pilgrim to face such a disturbing commercialization of Holy spots!! In the latter, Baalbek and its Roman Temples was the high spot of interest. I saw there some stones incorporated in retaining walls sixty feet long, twelve feet high, twelve feet wide,

[*Please turn to page 123*]

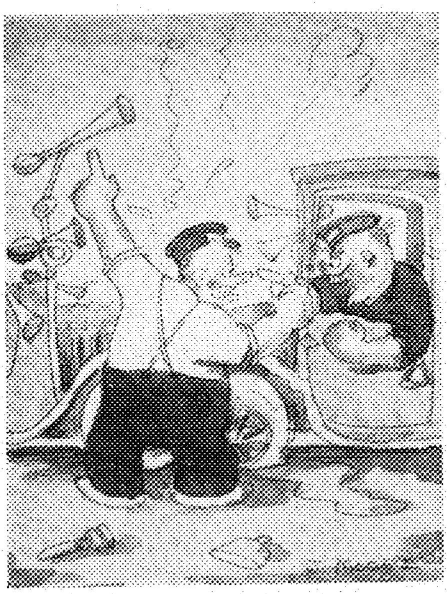
WHILE THE MOON GOES OVER THE CAMPUS

RODERICK WM. SILER

about the day's weather
paul nelson is right
taxi drivers in france
kidnapping class presidents
more cultural courses
the high cost of college
sir raleigh on smoking

IT IS a great comfort to know that we are at last by the shortest day of winter. Each morning now the sun puts in an appearance a few moments earlier. The winter offers one advantage, that if a man has never seen a sunrise he can witness the phenomenon each day through January if he has a first hour class. I always feel that that popular negro melody, "O Lawd, You made the night(s) too long!" is very appropriate at this time of year. It is interesting to think that if the earth's axis were perpendicular to the plane of its orbit instead of being always inclined at an angle of 23° 27′, days and nights would be of exactly the same length, and there would be no changes of seasons. Thus a man who owned a Palm Beach suit and liked sleeping in a hammock could settle down for life in a locality where he would be assured of just that, while the person who hankers for the exercise of getting his car started on mornings when the temperature is 10 below zero could also find a latitude to suit his fancy. I imagine that people who regard efficiency as first of human needs would look upon such a world as ideal.

TALKING of efficiency reminds me of the article of Paul Nelson, former editor of TECHNO-LOG, appearing in last month's issue. I think this was one of the best and most effective articles of the sort I have read. Particularly effective as coming from a student who writes well and says what he thinks. Students naturally, and rightly, too, give more weight to the words of one of their number who is keen enough to analyze and has been long enough out of school to see something of life than they do to worldly opinions of us profs. We old timers, when we preach, are inclined to go back to standards current in the horse age. While Paul did not specifically mention efficiency, I drew from his article that far more important in his opinion was largeness of view and ability to see the truly worth while things in life. Anyone who has lived through the last ten years must be thoroughly fed up on the idea of turning men into machines or judging them in terms of machines. Students in engineering schools are, or have been, peculiarly prone to err in this regard. Knowing that engineering is defined as the business of dealing with material and inanimate things they have very much ignored the human element which, after all, is the element that makes possible the engineer's job and the solution of engineering problems. Thousands of engineers have been going out of the technical schools for years entirely sold on the idea of machine efficiency, and they have later been so efficient that they have left themselves, in many cases, nothing to do. I believe we are due for a new type of engineer, a better balanced man, a man with a greater cultural background, a man quite as well qualified in strictly professional lines but with a greater comprehension of human values; and therefore, as one more acceptable to society, a man more capable in society—or, if you will, a man really more efficient.



French taxi drivers are violently opposed to public brawls.

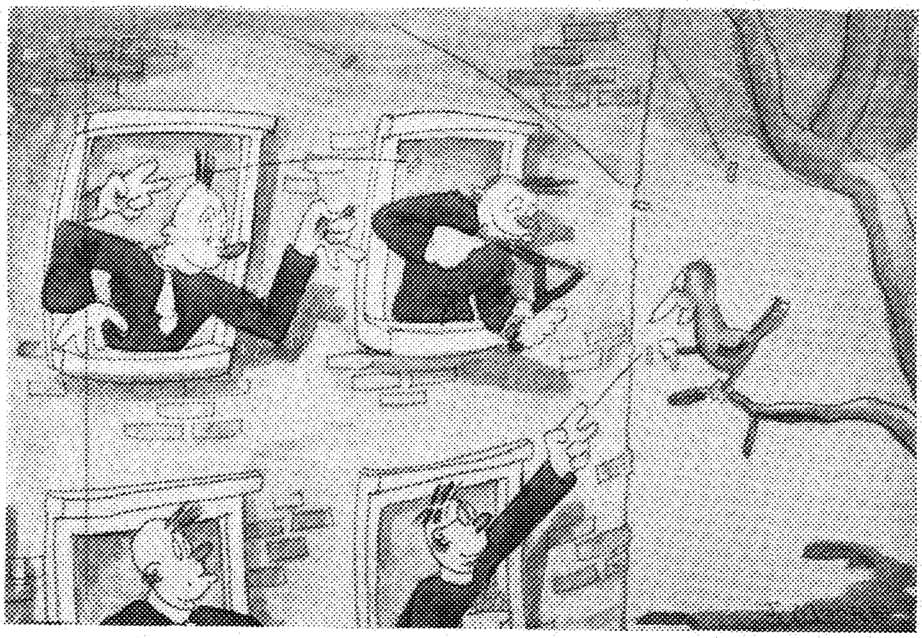
I SUPPOSE that Paul Nelson's conclusions have been influenced by his visiting France. I noticed that accompanying his article was a photograph taken on the beach at Deauville; and a very interesting picture it was, too. In my own visits to France, mostly spent in Paris, the French always impressed me as less inclined to accept current ideas of efficiency than any people on earth. That is, an efficiency by standardization which in any way tended to dominate their lives and interfere with their personal habits and inclinations. Things may have changed since I was over there, but formerly regulation and control of street traffic as we know it was conspicuous by being absent. Yet, though every car driver seemed to follow his own route and methods, I never saw any violent or fatal results. I have seen taxicab drivers argue, threaten and, I presume, curse; though I never mastered French to the extent that I could thoroughly comprehend this profane and interesting side of the language. Anyhow, the drivers never got beyond words. It is not that a Frenchman will not fight as quickly as another man under the proper conditions. But conditions don't favor public brawls over there. To hit a man, even if only on the nose, is a pretty serious offense in France, and by the time the case is concluded whatever pleasure has been derived is found to be considerably less than the pain inflicted by the law. Thus if the French have less external regulation than do we it is because they have more self-restraint.

IT'S the old story: a man can't have his cake and eat it, too. If people do not want interference in their personal affairs from without they will find it necessary to control most of their sudden inclination to become nuisances on small provocation. If university students want freedom from interference by university authority they will have to be capable of carrying on their own affairs in such a way as to assure every student among them immunity from their own prejudices and preferences. For instance, the kidnapping of a class president, formerly a regular event of each college year and even now practiced occasionally, is not the way to remove university supervision. Class presidents universally object to being removed from the public gaze in their high hats and dress suits just before some big class function of the year, and the university rightly feels that class presidents have a right to protest and demand protection. Judging from what I have seen of French students I cannot imagine them going forth and transferring a class president elsewhere, even if he had become so objectionable as to advertize his office by wearing a high hat to class. Foreign students seem less inclined to effervesce in this way.

WHY is this so? I am inclined to think it is because, in general, students abroad have a more mature outlook on life, a better understanding of life than with us. This, no doubt, is partly due to their environment, to the fact that for most men the struggle abroad to advance is, or was, more bitter than here. This, in the first place, brings the foreign student into college with a more completely developed social instinct, a clearer understanding of the fact that if a man is to have anything like peace and comfort while he is on this earth and in this human society he must not only grant to other people as much latitude as possible, but must also make something of a study of society in general and of the particular type of national society in which he finds himself. This is where American engineering graduates have been delinquent. They have imagined that all they could get out of a college education was a certain theoretical knowledge of their profession. Thus they find themselves on graduation unable to connect what they have learned with the world about them. They not only lack even a theoretical knowledge of that human nature upon which they must later depend for advancement and success, but they have very little conception of what their attitude should be towards the state and nation. They do not appreciate the responsibilities of their profession or what its ethics should be.

Yet much of this lacking can be corrected by courses actually given in the university, courses which Paul Nelson in his article suggests, courses in economics, history, English. English emphatically, as it is for the engineer, just as much as for the preacher and the politician and the professor and the bond salesman, is the medium beyond all others through which he must make himself and his work known to other men. I realize that it may be a problem to find time, with present curricula, for such courses as have been suggested. Nevertheless the vital need for them remains, and a student should recognize that if he goes out of college without taking care of this need he goes out lame. I suspect that the average engineering student, whether he publicly admits it or not, nurses under his hat the idea that some day he is going to be a big shot in the profession. That is a very good idea, but he can also make his mind up to this: that he will never be a very big shot until somehow and somewhere he learns those things which, strictly speaking, are not of the profession, yet absolutely necessary to complete success in it.

DURING the holidays I got hold of a publication giving the expenses of education in all the colleges of the land. I found that the average cost at state universities was around $800. At first I thought this was the average expenditure of an assistant professor throughout the entire year, but on closer inspection I discovered it to be the average expenditure of cash of a student between October and June. This, of course, is for men not living at home.



Remember, engineers, that chalk for killing sparrows is not included with your tuition.

At other institutions of similar rank expenses were considerably higher. Harvard appeared as the most expensive school. The difference in expense is chiefly due to the difference in cost of tuition. At good non-state schools tuition ran from $300 to $450 a year. A man going to a state school should not forget this debt to his state. And I might suggest that those individuals in the Main Engineering Building who are consumed with a desire to knock sparrows off the surrounding trees with chalk taken from the blackboards should remember that this ammunition is not included with free tuition.

LAST month I concluded my article with an excerpt taken from the writings of Jacques Cartier, the Frenchman who discovered the St. Lawrence, concerning his first experience with

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The MINNESOTA TECHNO-LOG

UNIVERSITY OF MINNESOTA

1933 AND A NEW HOPE

PROBABLY at no other period in our history have the social and economic policies of our country been brought so forcibly to the attention of its citizens.

Having passed the pioneering stage, where a man could set his goal ever westward and sustain himself entirely by the labor of his hands, we find ourselves at the present in an era of specialization and industrialism. Here we find a strange paradox. As a nation possessing untold capital and credit, unrivalled natural resources, and the world's leading industrial centers with a capacity to produce far above our needs as a nation, it seems ironical indeed to find millions in actual need of the products of our industrial and agricultural machinery which is for a large part standing idle. It is a glaring tribute to a social system whereby such an unequal distribution of wealth is actually precipitating society into ever widening classes—something entirely out of harmony with the spirit of those sturdy patriots who made possible the Constitution and its resulting government "of the people . . . for the people."

To the engineer it is quite obvious that our civilization has progressed much faster technically than along economic and social lines. Therefore, we must correlate our efforts along altruistic lines and bring an end to rampant individualism. Planning and cooperation among the individual units for the common welfare is the keyword to steady employment and production.

There are two paths open to us—to continue along our former haphazard individual way blundering into periods of economic maladjustment and its resulting ever increasing social unrest, or to plan and progress for the common good. The decision can not be put off much longer. It remains for a new year and a coming generation to decide. WHAT WILL YOU DO?

—N. S.

LOST—DRAMA

IT IS unfortunate that drama has ceased to be a part of the engineering program. Until a few years ago, engineers were very active in the presenting of plays, and under the dusky name of "Arabs" produced several outstanding plays. These productions were remarkable not only because of the excellence of the plays themselves (which were written by engineers), but also because of their presentation. Not only did engineers play male parts with professional ease, but they also enacted female parts with unique success, and probably even took the parts of inanimate objects with a convincing lifelessness possible only by engineers.

The singular band of "Arabs" was organized in 1922, and soon after presented its first production, "Caliph of Kolynos." The following year they produced "Blue God." In 1924, the Arabs turned nautical in "Riquiqui." "Mona Lizzie" was presented in 1925. They took a rest in 1926 and awoke in 1927 with a futuristic sensation, "Broadcast." Back to the desert they went in 1928 to show "High Pressure," and appeared in 1929 with "Enginferno." No production appeared in 1930. In 1931, two years ago, the Arabs began to prepare for their "Arab Revue," but because of financial difficulties and the entrance of politics into the organization, they disbanded before the "Revue" was presented.

An organization of this sort should be encouraged by both faculty and student body, because it has unquestionable merits. Enacting a play is truly a profitable as well as an interesting experience. It is refreshing to momentarily leave one's own burdens and live someone else's life, to enjoy another's happiness without having to work for it, to commit another's crimes and not suffer, to be rich without having known poverty, to be powerful without having to learn how to overcome weakness—these and many others are the blessings of the actor. The study of a drama or any other branch of literature, acquaints the engineer with some of the lighter, but quite necessary things in life; it tends to float him along in the technical rut he is in. (Futile it is to attempt to wash him out altogether.) The play should be brought back into our engineering atmosphere, and the sooner it is the better.

—M. C.

A CENTURY OF PROGRESS

IN just five more months a tiny beam which left the star Arcturus forty light years ago will officially open the great Century of Progress Exposition in Chicago. At this time the engineering, architectural, and scientific achievements of the past century will be presented to the world in a truly novel and interesting form.

Modern architecture will be seen everywhere, in the design of the exposition buildings themselves, in the architectural exhibits within the buildings, in the weird lighting effects used for all the exposition buildings, and in the many commercial buildings which fill the spaces between the huge main structures. Architecture of other lands and other times will serve as a delightful contrast to the futuristic buildings of today.

Modern engineering practice will be shown in the huge Travel and Transport building, for here actual locomotives, steamships, and all other modes of modern rapid transport will be on exhibit. The construction, step by step, of these machines will also be shown, for the assembly lines of many industrial plants will be transported to Chicago for this great event.

The electrical group of the Fair, which has but recently been dedicated, will present the story of the development of electricity for mankind's uses by means of moving, animated exhibits. Manufacturers of electrical equipment of all kinds have already contracted for extensive blocks of space in the electrical group and are developing their exhibit plans rapidly.

A new kind of University will be the Century of Progress—a school where lessons are taught not from dry, tedious textbooks, nor by drowsy, mono-toned professors, but by actual, colorful, full scale reproductions of the subjects studied. Here animated experiments of all kinds, covering modern physics, chemistry, electricity, and all the other fields of engineering, will give to the fair visitors an education which is obtainable nowhere else in the world—an experience which will never be forgotten—and here one will really appreciate the vast advances of civilization within the past few years.

Chicago will be the Mecca of the world for five months this summer—for all nations—for all peoples—for all classes.

—L. J. M.

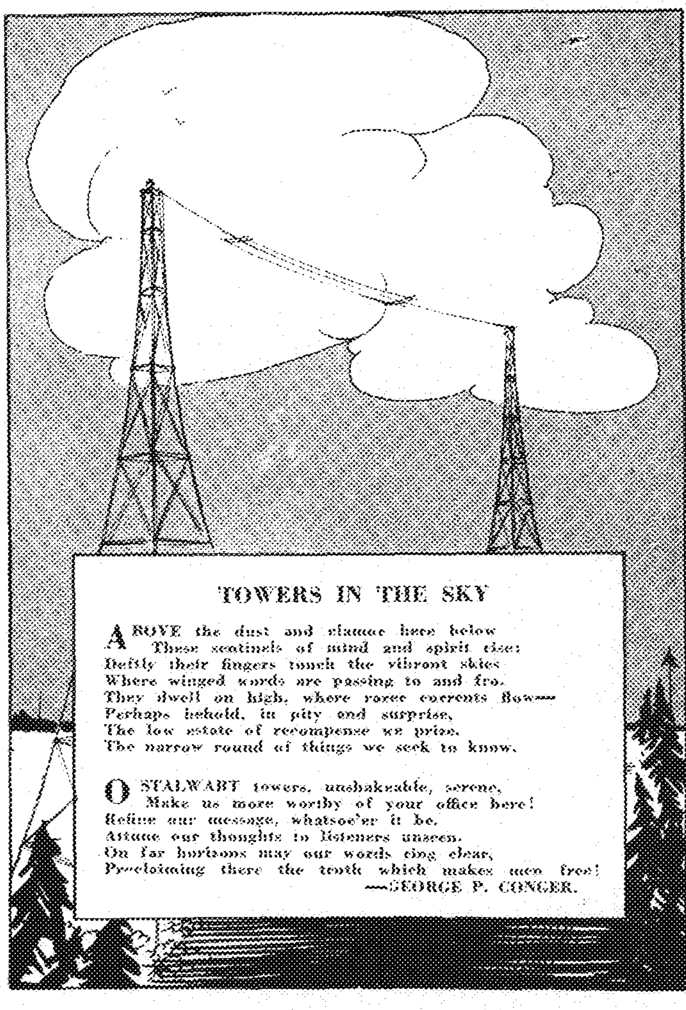
FRESHMEN TAKE HEART

THE first and worst quarter of your college career is now a fading memory. You may have done fairly well last quarter, but the probability is that you did not, for the new conditions, the new surroundings, and your many new experiences must have left you slightly up in the air.

In this respect, however, you are no different from all others who have preceded you. They also had a tough time their first quarter, and felt slightly discouraged after it was over. They also could not understand what use their efforts were if they achieved nothing. But they kept up their spirit and soon found that many of the tasks became trivial routine and took little effort, for diligent application to a task soon makes a mole hill of a mountain.

Therefore, we encourage you to take heart and keep up your efforts, and always to remember that a good foundation of hard work in your freshman year will pave the way to real enjoyment of your studies in the future. Without a clear understanding of the fundamentals of a subject, study becomes mere memory work, while with a good grounding in the fundamentals, study becomes an interesting pursuit of knowledge.

—S. L.



MISSING COPIES

The Library of Congress in Washington has informed us that their files of the MINNESOTA TECHNO-LOG are incomplete. A few of the issues which they lack have also been entirely exhausted in our own files. If there are any among our readers who have saved their issues and would be willing to contribute them to the Library of Congress on the understanding that the file would be taken care of and be permanently preserved, it would be greatly appreciated by the MINNESOTA TECHNO-LOG and the Library. If you have the desired copies won't you co-operate and bring them to the TECHNO-LOG office, 37 Electrical Engineering building, for forwarding? The numbers which we lack are as follows:

Vol. 1 No. 8—June 1921
Vol. 2 Nos. 1, 2—Nov., Dec. 1921
Vol. 2 Nos. 6, 8—April, June 1922
Vol. 3 Nos. 3, 4—Jan., Feb. 1923
Vol. 4 No. 4—Feb. 1924
Vol. 6 Nos. 1, 4-6, 8—Oct., Jan.-Mar., May 1926
Vol. 9 No. 1—Oct. 1928
Vol. 10 No. 9—June 1930
Vol. 11 No. 2—Nov. 1930

YE SHOE-HORN

By OSCAR QUACKENBUSH FEGAS, B.V.D. '111

oscar muses

A queer bunch are the staff members this year. We have on one hand the high pressure salesman who just loves to talk for hours with the telephone operators—he can give you the first names of every one of the sixteen young ladies just by hearing their voices. And there is the young man who like the sailor has girls in every port, only here the ports are New York, Iowa City, Chicago, and all points west. Rumors have it that he is the author of this choice bit taken from a letter found on the floor of the office. . . . "Darling, in my narrow gauge path of life there is only one thing that carries me on, and you are that. . . ."

And there is a sweet young thing who persists in taking the editor's soft chair every time she drops in to work.

Mental Tilts that no one can work—the ideal of the business manager and the terror of the editor—and the Mental Tilts editor finally did turn in one he couldn't work himself. Ask him how he frantically rushed from one mathematical wizard to another among our faculty, trying to get a solution in time for this issue.

And who spends hours arguing with the engraver over a few cents extra on the bill?

many years ago

The Chemysts are a strange class of mortals impelled by an almost insane impulse to seek their pleasure among smoke and vapour, soot and flame, poisons and poverty; yet among all these evils I seem to live so sweetly, that I may die if I would change places with the Persian King.—Berzelius.

exposed

Here's the way one math prof spends half the hour every day. He'll start to tell an old one, and then say, "Have I told you that one?"

To which the class may reply, "Yes, but tell us another one."

So the exponent of the slide rule lays down his book and tells the bed time story of the toad and the turtle. (Stop me if you've heard it.) It seems the toad became very sick one morning, so sick, in fact, that he had to send the turtle after the doctor. By evening the poor toad was in great agony, but the turtle had not yet brought the doctor.

Imagine the poor toad's consternation when the M.D. had not arrived at the end of a week. Well, this went on and on. Finally, after three weeks, the toad was ready to die. But he rose up and cursed the turtle mightily, as Demosthenes might have done, were he a toad.

When he finished and sank exhausted, the turtle raised his head from behind a near rock and said, "All right. Just for that I won't get the doctor."

yes i heard

It wasn't told to me, you understand, I only heard. But in a chemistry lab. stockroom window a voice was heard to say, "You remember when I cancelled out of Organic lab? So I flunked the final on purpose so as not to hurt Doc. Smith's feelings. Yea—sure, that's a fact."

sonnet

(By an Engineer—to His Sweetheart)

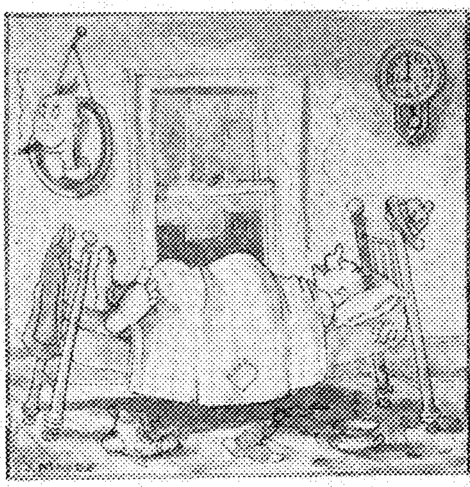
Sweet—thou art sweeter than saccharin, rarer than xenon,
More attractive than lodestone, more precious than radium,
More intoxicating than ethanol, more fascinating than the spectrum,
More radiant than the light of softly glowing neon,
Lovelier than the glow of the swiftly moving ion
In a cathode tube. Thou art brighter than chromium,
More radiant than the arc, more dazzling than flaming magnesium,
—wonderful, irresistible, unique as the electron.

Ah, sweet. Thou art to me as current is to motor.
Thy touch—as a short circuit thru a coil of nichrome.
Oh, let us be spliced and be as one conductor
To share alike each charge, each amp, each atom.
What say? Be not impassive as an insulator—
Come, let us find a cozy ohm sweet ohm.

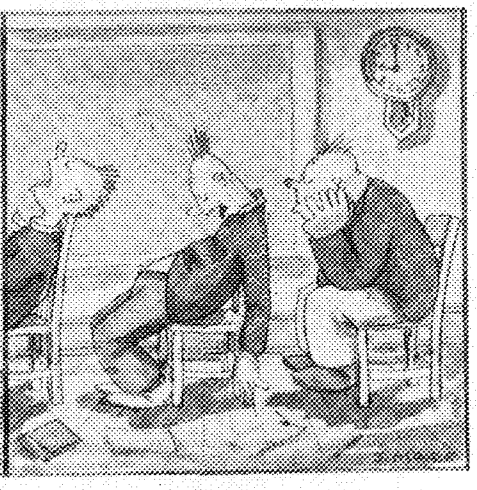
Morris Cohen.

▾ ▾ ▾

One objection of the old fashioned housewife to the electrical flat iron is that it can only be thrown the length of the cord.



In days of yore he went to bed at nine p. m.



But now the night is made for love and day for sleep.

the question box

(Having travelled extensively, Oscar feels that he is quite competent to answer important questions for his engineering readers.)

Dear Oscar—I am inventing a text book without any pages. Do you think I am a fool?—*Worried.*

Dear Worried—No, but I may be mistaken.—*Oscar (Infallible) Fegas.*

▼ ▼

Dear Oscar—I like to put salt in my beer, but my doctor says it is killing me. What shall I do?—*Soused.*

Dear Soused—Put salt on your bier. *Oscar (Bier-maker) Fegas.*

▼ ▼

Dear Oscar—On Mondays my books are much heavier than on Tuesdays when I have the same number of them. Why is this?—*Bookworm.*

Dear Bookworm—Maybe it is because the books are bigger.—*Oscar.*

▼ ▼

Dear Oscar—I am going to Paris and would like to know how to drink and stay sober. Can you help me?—*Traveling.*

Dear Traveling—Sure, I can help you. Just jump off a high building. When you hit the ground, you will be sober and well "lit."—*Oscar (Eveready) Fegas.*

▼ ▼

Dear Oscar—For many years now I have noticed engineers sliding little white sticks of wood back and forth, and mumbling queerly now and then. Can you tell me what this mysterious jigger which they call a slipstix really is.—*Archie Tek.*

Dear Archie—A slipstix is a convenient excuse for approximating an answer.—*Q. Quackenbush Fegas.*

softening of the brain

It is a well established fact that a certain young man on returning home one evening at six, stopped at the corner drug store. At ten that evening he ceased his studying and went out to put his car away for the night. Imagine his utter chagrin, confusion and mortification on remembering that he had walked home from the store and had left his motor running for four hours on the corner two blocks away.

Who? Pay, oh pay, oh pay, oh pay.

is it a dream?

C'mon 1933, let's get down to biz
Let's corner the prof and make him promiz
To never give another quiz.

Let's make the alphabet a thing for cooks
So an A or an F is the same on the books
And a sleep in class improves your looks.

(Houdini, where art thou?)

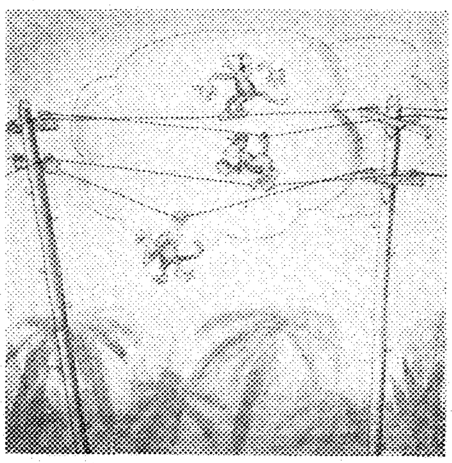
home in the morning

Of course there is the case of the newly married Electrical who returned home very late one night and when he reached the top of the stairs his wife awakened and said,

"Is that you, William?"

To which he replied, "Yes, my dear. Whom were you expecting?"

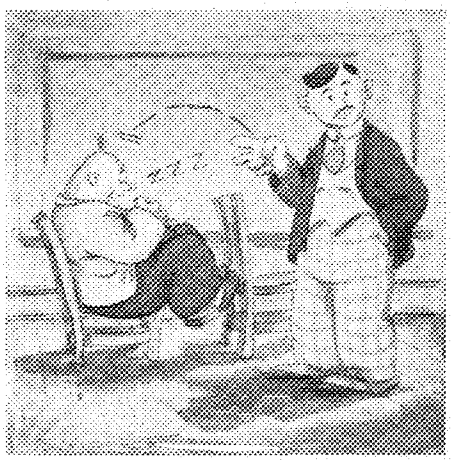
●



tropical atmosphere

Dean Leland tells this one. Down in Central America a group of engineers evolved a certain amount of pleasure and recreation from their professional duties in watching a family of monkeys attempting to walk along the telephone wires. The humorous part was the fact that after walking a few steps, the monkey would lose his balance and fall over to an upside down position. Proving the rule that science is the mother of invention, one of the hairy Cercopithecidae discovered that by extending his tail up to the wire above and using it as a modern trolley wire, he could race along the telephonic conductor with amazing alacrity.

Maybe Darwin was right.



awake, buttercup

The old adage "Death, Where Is Thy Sting?" might be modified by one class sleeper to "Sleep, Thou Surely Hast a Sting." The story goes that small boys used to throw acorns at the congregation to keep them awake when the Deacon was preaching. But our mathematics department has another system. When one habitual slumberer succumbed to the attraction of Morpheus, Mr. professor did something about it. Just as did David in his tussle with Goliath, so did this ever smiling prof take careful aim with a piece of chalk and cause this missel to connect squarely with the end of our slumberer's nose.

That's one way to cut short a cat nap.

ratings

And coming now to human nature, why is it that thoughtful business men prefer always to buy a 1½ ton truck with a one hundred per cent overload rating to the very same truck having a 3 ton rating with no overload? Engineers, too, must have a knowledge of psychology if they are to succeed in this world.

manual labor

Although engineers have developed to a high degree of perfection many labor saving household appliances, the old fashioned manual method of spanking youngsters still remains in vogue.

radiocracy

A famous radio star recently said the radio programs had improved since he went off the air.

And when he came back on the air, one program got worse.

Nels W. Elsberg

NELS W. ELSBERG

Minnesota State Highway Commissioner

▾ ▾ ▾

A Successful Minnesota Engineer

By RALPH MONSON, E. E. '34

ALTHOUGH he was once told by Professor Brooke that he "couldn't add skunks and peas!", N. W. Elsberg did succeed in adding twenty-four years experience to a University of Minnesota engineering education to get a position as Minnesota State Highway Commissioner. His recent appointment to that office by Governor Olson comes as a climax to more than twenty years of continuous public service.

Mr. Elsberg was born in Minneapolis in 1887 and was schooled in the city. After graduating from South high school in 1905, he entered the University to study Civil Engineering, graduating with the class of 1909.

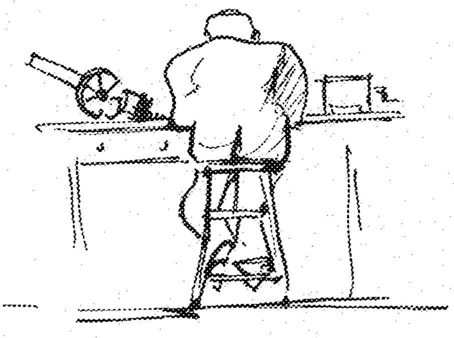
In comparing the Engineering college of 1909 with that of today, Mr. Elsberg points out that although there were fewer buildings and much less equipment, there were also fewer students—there being only ten or eleven "Civils" graduating with his class. He recalls surveying the campus lawns and also the Mississippi river valley adjacent to the University—an experience duplicated by every "Civil" since that time.

HE also brings to light a unique system of marking which was at one time employed at Minnesota. The system employed letters to designate the student's record in the instructor's class book. In looking through his grades in a particular drawing course, Mr. Elsberg once discovered a grade of "K.M." after his name. Greatly perplexed, he asked the instructor the meaning of the grade K.M.

"Well," said the instructor, "Your drafting isn't so bad, but you letter like a *Kitchen Mechanic.*"

IN recalling his college days, Mr. Elsberg remembers especially one experience (similar to one which has been experienced by many of the present engineering students). It seems that Descriptive Geometry—"Good old Descript"—proved a stumbling block for him, and several of his classmates. (If fifty per cent of the students failed "Descript" in those days as is the case now, we should estimate that Mr. Elsberg was accompanied in his grief by some four or five others—fifty per cent of eleven).

At any rate, these students returned to school one fall to find that they were not allowed to register because of non-passing grades in Descriptive Geometry. They immediately hunted up Professor Kirchner, and arranged a condition exam. On the specified day, the students met with Professor Kirchner for the ordeal. If our most geometrically minded readers were to be given ten guesses each we are sure they would not guess the first question the professor asked nor the reply he immediately received. Well, here they are:



"Good old Descript"

Professor Kirchner, "What questions would you fellows like to have me ask you?"

Five "Civils" (as one): "Ask us when Columbus discovered America."

P. K.: "Oh yeah!" (or something similar.) "Here are three points. Find the traces, etc.—" Suffice it to say that Mr. Elsberg passed the course, registered for the quarter, and completed his college work in the prescribed number of years.

In 1909, Mr. Elsberg explains, the goal of every Civil Engineering graduate was to get into railroad work, since that field presented the greatest opportunity to students. This explains why, after leaving school, he served for almost two years as engineer on railroad location and construction with the Duluth, Missabe, and Northern and the the Duluth and Iron Range Railway companies.

Leaving the railroads in preference to municipal work, he returned to Minneapolis in 1911 to accept a position with the city sewer department. Later he was transferred to the department of water works.

WHEN the war broke out, Mr. Elsberg served as a lieutenant in the navy, being stationed at Norfolk, Virginia. Although his position there was referred to as coal terminal construction superintendent one of his chief jobs was to see that the entire coal supply for every convoy of ships sent to Europe was absolutely uniform. The reason for this was to keep some of the ships from running away from others due to differences in coal.

Following the war, Mr. Elsberg returned to Minneapolis where he took up his duties with the municipal government. Perhaps his most outstanding work during this period was as construction superintendent of the Cappelin Memorial bridge across the Mississippi at Franklin Avenue.

In 1921 he took over the office of Minneapolis City engineer, left vacant by the death of F. W. Cappelin. He held that office from 1921 until January 1, 1933, when he gave it up to accept his new position. During these eleven years he has had charge of all bridge and street and other municipal construction in Minneapolis.

As state highway commissioner, Mr. Elsberg has supervision of all pavements, bridges, and other constructions and improvements carried on by the highway department. He believes that transportation is a good field — one which young engineers can always look forward to for their life work.

HERE AND THERE WITH OUR ALUMNI

Architecture

'25—A. Gordon Lumm is pursuing his business as architect at 717-718 Jones Building, Tacoma, Washington. His home address is at 6418 So. Lawrence, Tacoma.

'27—Porter W. Kilpatrick is head of the Department of Architecture at the University of North Dakota. Professor Kilpatrick is also designer for Wells & Ellis, Architects.

'28—Frederic von Grossmann, whose home is at White Bear Lake, Minnesota, writes that he has completed a graduate course in Architecture and received his Masters degree from Harvard last June.

'31—Francis V. Gorman is a Fellow in Architecture at the University of Minnesota. Francis' home address is 2029 Marshall Ave., St. Paul.

Chemical Engineering

'17—Ward E. Kuentzel, Research Chemist for the Standard Oil Company of Indiana, writes that he now has two children, both girls. Ward is working in the High Pressure Development Laboratory and he enjoys it very much. Ward lives at 1827 Central Ave., Whiting, Indiana.

'24—Alvin O. Fuhrmann, Chemical Engineer with the American Container Corporation, St. Paul, recently went through that age-old custom of saying "I do" to Miss Betty Reisner of Nokomis, Illinois. Felicitations will reach Al at 522 Front Street, St. Paul.

'28—Herbert H. Blosjo is employed as metallurgist with the Minneapolis Electric Steel Castings Co., Minneapolis. Herbert is working on "Static and Dynamic Properties of Steel Castings" as a thesis for his Masters Degree; major—Metallography, minor—Metallurgy. His home address is 3229 Park Ave., Minneapolis.

Electrical Engineering

'92—James Herbert Gill is Professor of Machine Construction at the West Virginia University, Morgantown, West Virginia.

'03—Ingram G. Kjosness, President of the Madison Lumber Mill Company, Lewiston, Idaho, writes that his oldest daughter, Evelyn, a graduate of University of Oregon, is practicing in Spokane, Washington. His second daughter, Kathryn, graduate of the University of Oregon, married recently to Harlow Hudson, an Architect. His son, Ingram, is a Junior at the University of Oregon, and majoring in English.

'06—E. H. Haeberle, manager of the New Ulm Ice Co., New Ulm, Minn., is studying the effect of the earth's magnetic field on the melting of ice. His research was recently rewarded by his discovery of a law showing that the melting point varies as the third power of the magnetic intensity in the horizontal direction.

'18—Oliver S. Hagerman, with the American Light and Traction Co., writes that another son has been recently added to the family bringing the grand total of future disciples of Saint Pat to three. Oliver's home address is 1436 Edgewood Lane, Hubbard Woods, Illinois.

'23—Arthur Gilstad is with the Standard Conveyor Co., North St. Paul. Arthur lives at 865 Ivy St., St. Paul.

'24—Joseph M. Juran is Chief of Inspection, Results Division, Western Electric Co., Hawthorne Station, Chicago. On the side, Joe is studying law at Loyola University.

'25—Robert V. Ludlum is now Commercial Engineer with the George Belsey Co., Ltd., of Southern Calif. His main work is in the distribution of General Electric Refrigerators. Robert's home address is 1531 So. Spaulding Ave., Los Angeles, Calif.

'26—J. Philip Lynskey, Line Extension Engineer for the Commonwealth Edison Co. in Chicago writes that everything is about as usual including Old Man Depression. Mr. Lynskey is at home at 4705 N. Winchester Ave., Chicago, Ill.

'28—Hugo F. Gustafson is in the technical department of the Goodrich Rubber company, 318 Merriman Road, Akron, Ohio. We envy Hugo—what ample facilities for taking a good stretch every morning.

'29—Robert H. Heyer is instructor of metallography at Purdue University, Lafayette, Indiana. His address is 117 Main St., W. Lafayette, Indiana.

Civil Engineering

Gidd-i-ap Napoleon
It looks like war

'16—R. W. Grow writes that he is Major of Cavalry, U. S. Army, on duty as operations officer, Mechanized Cavalry, at Fort Knox, Kentucky.

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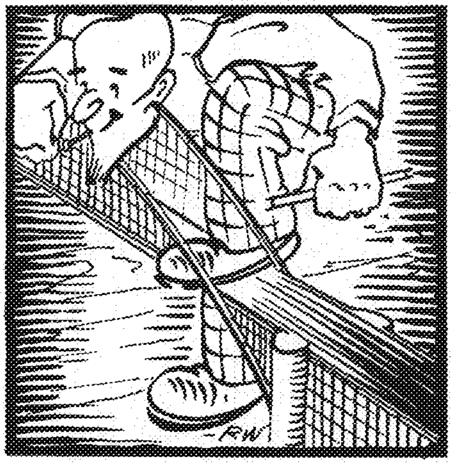
'17—W. D. Ludlow is now assistant to the U. S. District Engineer at 401 Custom House, San Francisco, Calif. His present address is at 1526 32nd Ave., San Francisco.



'29—Paul A. Helseth, resident engineer of the Minneapolis Bridge Company of Savanna, Illinois, is now working on the construction of a toll bridge over the Mississippi River between Savanna, Illinois and Sabula, Iowa. Paul resides at 11 Diagonal Street, Savanna, Illinois.

•

'20—Roy O. Gilbert has gone from transit to stethoscope. In 1924, Roy got his M.D. at the University of Michigan and is now serving as District Health Officer, Los Angeles Co. Health Department, San Fernando, California.

'21—Carl S. Johnson, Structural Designer, writes that he has just finished design of Cleveland's $5,000,000 post office. Mr. Johnson resides at 15617 Chatfield Avenue, Cleveland, Ohio.

'22—Earl H. Lund has risen in Washington circles and is now supervising the architectural office of the Treasury Department there. His official title is Associate Architectural Engineer. Mr. Lund's address is 3511 Davenport St. N. W., Wash., D. C.

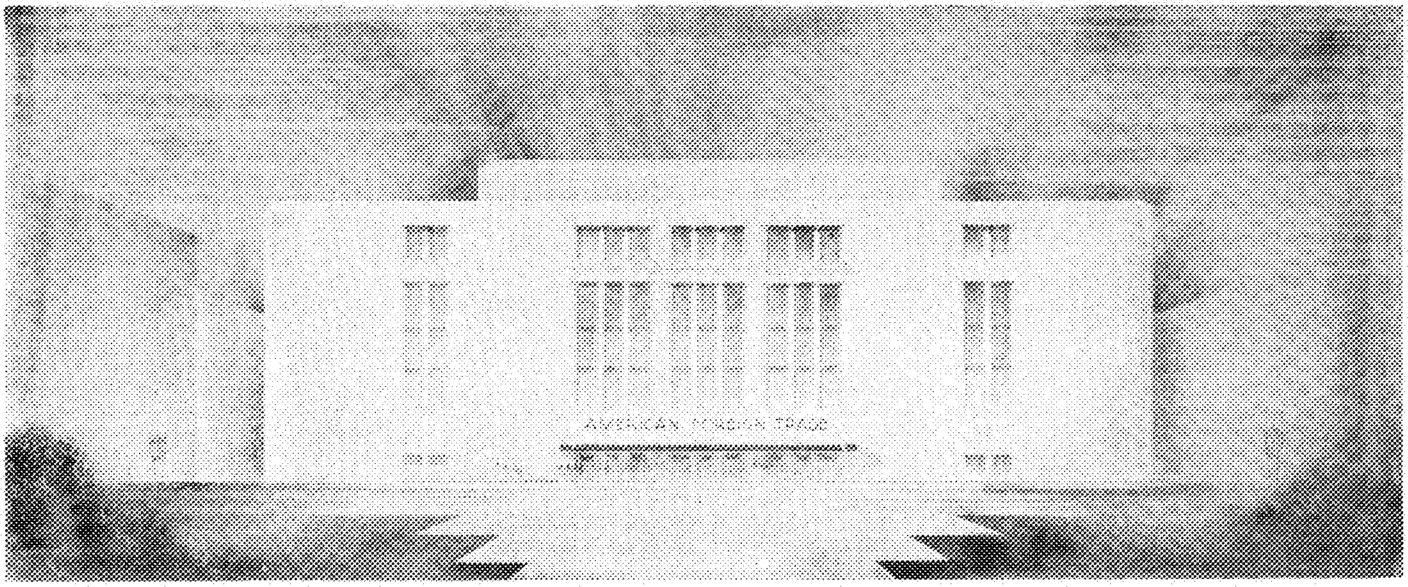
'22—Howard B. Palmer, 1112 E. Nevada St., Appleton, Wisconsin, is Superintendent of Construction, Kimberly-Clark Corporation. Howard writes that he is married and has one daughter eight years old and one son, one year old.

'23—H. W. Gillard is assistant manager of the Simplex Ejector & Aerator Corporation, manufacturers of sewage treatment plant equipment. His address is 340 S. Kenilworth, Oak Park, Illinois.

'24—Roy V. Lund is now a construction engineer in the office of the Supervising Engineer at the University of Minnesota. His address is 3956 13th Ave. S., Minneapolis, Minn.

'25—Esther Marie Knudsen is a Junior Bridge Draftsman with the Wisconsin Highway Commission.

'27—Carl F. Luethi is now engaged in a very interesting line of work. He is a pilot with the Northwest Airways, Inc., at Fargo. Bet he's been having quite a time dodging about amongst the clouds. Carl's address is also in Fargo, N. D. at 1518 9th St. South.



Among the Architects

THE senior architects' final design for the fall quarter was "An American Office for the Development of Foreign Trade." The problem concerned the development of a building to be used to foster and develop commercial relations between the United States and the rest of the world. It consisted essentially of the proper solution or placement of the four essential groups, namely, general information, publicity and propaganda, offices representing all countries in the world, and administration. Space was to be provided also for a restaurant and lunch room, with adequate service facilities.

The number of floors, the height of the building, and the exterior design were left to the student, the mediums used in drawing being French sauce and water color.

The design of John Huchthausen, pictured above, received first mention chiefly for having the proper relation and placement of the main essentials.

The first floor had a main lobby with stairs at either end, and a large lecture hall opening on the lobby. The lecture hall carried through four stories, with the various offices arranged around the main room.

Do Architects Ever Work?

"Say, can you . . . ?" "Sorry, but I've got to do design for 'crit' tomorrow."

And again—"I've got some work for you to do this afternoon." Still again—"Can't. Design, you know. And a history quiz in the morning. Gosh!"

Finally, after one quarter of this—"I want you to write an article on the hard worked women in Engineering." "Not for this issue? I've got four hours of classes this morning and seven this afternoon." "That's more than there are!" "Yes, I've been realizing that all quarter." "Well, I'll give you till first thing tomorrow morning then." "O.K." And that's that.

First of all, of course, these women are freshmen, but we won't consider them then because they just take S. L. A. subjects, with the possible exception of freehand. Next year they are "freshmen," sophomores taking freshman design, "Elements of Architecture." And that's where the trouble begins. "How do you show windows in plain? . . . O-o-o-o, I smeared ink! . . . Gee, our problem's due a week from Saturday and I don't know yet what I'm going to do to it." By the end of spring some progress has been made—the same gals are worrying about the last four outdoor sketches and starting to get nervous about those nine hour sketch problems they'll get in sophomore design.

Then in the sophomore year they have those sketch problems. And the second quarter they may even get one the first day—or possibly instead it's one of those troublesome preliminary sketches known as an esquisse. They think nothing of missing a symphony every now and then, and take it as a matter of course that the night before a problem is due they take their boards home to work some more after the building closes at 10:30. But when the problem's handed in they sling things into the drawer any old way to get home for food, a hot bath, and bed despite the three sketches they are short in water color and the history notes that were due last week.

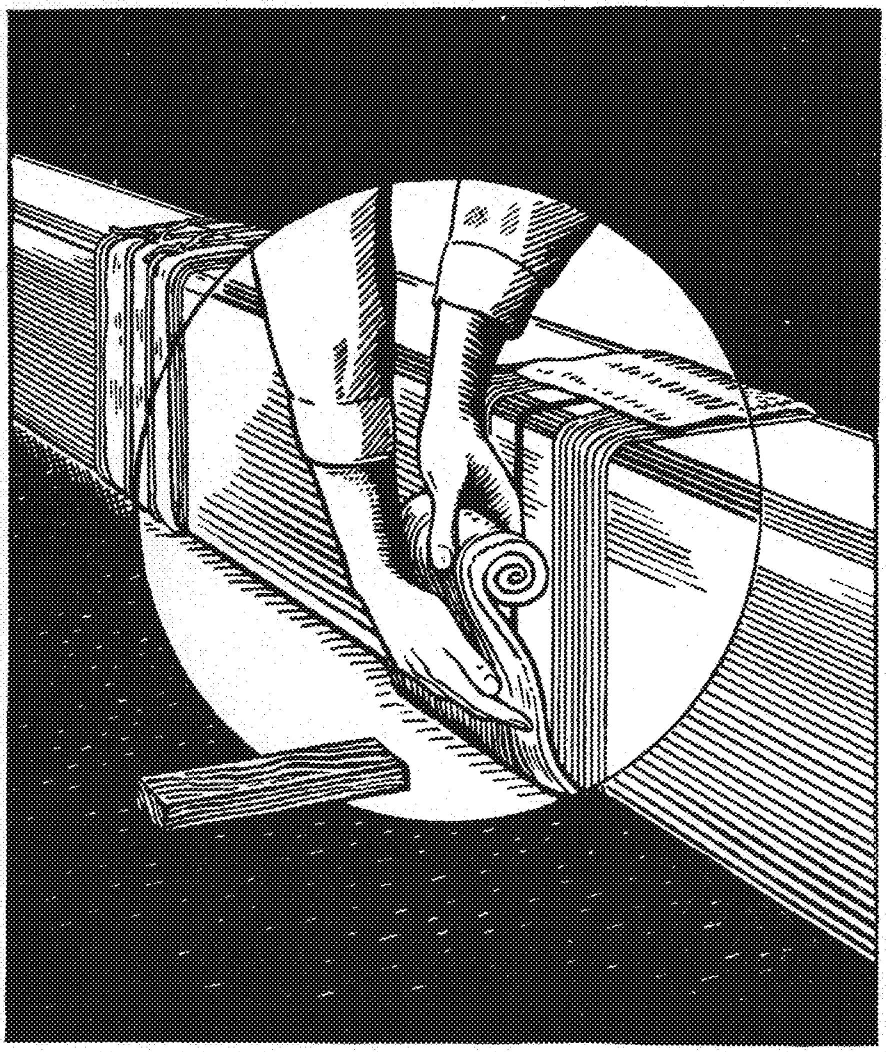
Did I say history notes? Ah! yes—architectural history! First you go to class and see some slides and hear some words about them, and after several sessions a quiz is announced. You buy blue prints of the slides at a penny a piece or crowd around the slide rack in the library and study till you think you know them, then you read the book and underline it. Next morning in class you fill in blanks—if you can—and spend the rest of the day doing required sketches of buildings, plans, etc. to hand in with your class notes.

By the senior year you are advanced enough to take two such courses, the second year of history and one of furniture and decoration, and it's always good when the quizzes and notes for both of these are due at the same time.

Now with modelling it's a different matter. You get some tools and, after making ears and noses, help yourself to a stand if there are any left.

When it comes to senior design you have something to think about. Of course the average interior architect is taking architectural history, furniture, seminar, freehand, and an elective or two at the same time, but what's a little thing like that? You miss Roland Hayes because a problem's due the next day, you turn down a date for Galli-Curci to do an esquisse, a problem's due Homecoming noon and you're dead that night, you miss a trip up North over Thanksgiving and take your board home to work all day even though you're having company for dinner, and the St. Pat's queen has to miss the green tea and dance because of design.

Oh, gee. Just ain't no justice.



Patronize our advertisers and mention the Techno-log.

AROUND THE CAMPUS

A. I. E. E.

With the election this week of the student manager, plans will be under way for the 1933 Electrical Show which is to be held on April 21. Senior electricals will vote for the manager Friday, January 20. Members of the various committees will be selected by the end of the month, and active preparations will begin immediately thereafter.

The Electrical Show is sponsored by the Electrical Engineering department every other year under the auspices of the student chapter of the A. I. E. E. for the purpose of fostering a closer relationship between the electrical college and its outside friends. It also gives the residents of the state a more perfect insight into the work of the students in the electrical department.

New and original ideas are in great demand, and any students having ideas for electrical stunts and exhibits are requested to turn them in to the Student Exhibits Manager at the beginning of next month.

The members of the student chapter of the A. I. E. E. inspected the new Minneapolis telephone building and equipment January 18, this being the first field inspection trip of the new quarter. Telephone engineers acted as guides for the parties—each guide taking only ten men—and explained to them the operation and purpose of the dial system, toll, manual, telegraph, and radio equipment.

Taylor Goes to Penn State

Dr. Nelson W. Taylor, assistant professor of physical chemistry, has resigned his position at Minnesota to take over the duties of the head of the department of Ceramics at Penn State College. Dr. Taylor will begin his new work about February first. He is spending this month in travel about the eastern states, visiting various research institutions and universities. During his stay at Minnesota, Dr. Taylor was active in research on crystal structure and related subjects, and just recently designed an X-ray camera for use with temperatures ranging between that of liquid air and about 1000 degrees C.

The Law and the Chemist

'Twas the morning after the big bank robbery. Play boy Sid Miller, erstwhile assistant in Organic Chemistry, was walking with a friend by the University State Bank on Washington Ave. Just about this time Chief Meehan's men were busily engaged at the aforementioned location in locking up the stable doors—as is always done after the horse is stolen. Now organic chemists, though not exactly degenerate either by nature or training, can under certain conditions take on the appearance of bank robbers, particularly if the bank robbers look like organic chemists. Then, as you know, a cop is a man of action: when he sees anything that looks like a bank robber he acts even though the name is Miller.

"Smile you mug," growled the crimson shamrocker as he collared our hero. So Sid smiled revealing a gold tooth as he did so.

"Call the wagon boys. I've got the rat that pulled the job."

Suddenly it dawned upon Mr. Miller that he was in the hands of the law. An organic chemist is no better off in the hands of the law than an analytical. Sid knew this. Things looked bad indeed for the hope of the Miller's. Suddenly came a tapping on the cranium. An idea begged entrance. "What do you think would be the effect of increased temperature on the sulphonating reaction used in the preparation of sodium ditolyl-disayo-beta naphthylamine?" Sid inquired of the officers.

"Well, to tell you the truth I'm not familiar with the effects of temperature on that particular reaction; in my opinion, however, there would be a great tendency toward decomposition of the molecule at slightly elevated temperature," the officer dryly retorted. "I guess you're not the bandit, after all, so perhaps you had better depart. You're a free man."

Flying Club Meets

At the luncheon meeting held on Jan. 12, 1933, Mr. Armstrong, president of Tau Omega, National Honorary Aeronautical fraternity, was the chief speaker. Mr. Armstrong, a graduate of the University of Oklahoma, was one of the founders of Tau Omega. He spoke of the advantages of such a chapter at the University of Minnesota, and the activities of the organization since its founding in 1927.

A report of the Flying Club activities shows that 21 members have soloed. Flying is being taught by the Northland Aviation School at Wold-Chamberlain Field.

Orientation

Norman Carlson, president of the A.S.M.E., presided at the last of the orientation lectures, and seniors from the various engineering colleges talked to the students. Paul Erickson, president of the A.I.E.E., discussed the senior advisory system; Gayle Priester, president of the senior class in engineering, discussed ethics in engineering; Archi Japs, president of Tau Beta Pi, presented the case of high scholarship and honor societies; George Brimhall, president of the Minnesota Society of Aeronautical Engineers, told of sportsmanship in college; Austin Lange, president of the Technical Commission, told of the mechanism of student government in the engineering colleges and in the rest of the university; Kenneth C. Johnson, president of the A.I.Ch.E., spoke of methods of study, and Jim Nelson, president of the A.S.C.E., urged freshman to participate in intramural athletics.

In previous meetings of the fall quarter, Professor Otto Zelner had been in charge, but in this, the last lecture of the quarter, he turned over the entire hour to the seniors.

A. S. M. E.

At the regular semi-monthly meeting of the student chapter of the American Society of Mechanical Engineers held Thursday, January 12, President Norman E. Carlson appointed Roy King chairman in charge of the meeting next Tuesday evening.

This appointment inaugurates a new policy, of having each meeting planned separately by a chairman appointed at the previous meeting and introducing a general round table discussion following the reading of papers or reports on selected engineering subjects (as outlined by the national officers of the A. S. M. E. during their visit last November).

William H. Richards

MINNESOTA OFFERS OUTSTANDING LECTURE COURSE IN MECHANICAL TECHNOLOGY

By W. H. RICHARDS, Asst. Prof. of Woodworking

BEGINNING with the school year of 1924 a course in Mechanical Technology was introduced to Mechanical engineering students with the thought of conveying a better understanding of professional engineering, and its relation to commerce and industry.

In the early days of the course the subject matter dealt largely with problems in manufacturing, and was illustrated by the use of lantern slides and such motion pictures as were available at the time.

About 1927 students in other departments of engineering, including aeronautical, business, and agriculture students, were admitted to the course, and the attendance soon increased from some thirty-eight students to as many as one hundred and forty.

The course is given during the fall quarter of the sophomore year, and has two one-hour lecture periods each week. In all there are twenty lectures, which are given throughout the course by prominent engineers and business men of the Twin Cities, Detroit, Cleveland, Chicago, and Duluth.

Manufacturing alone is not the only important part to be considered in engineering, but rather much thought should be given to the ethical side of the profession in developing personality, according to Mr. Harry E. Gerrish, of Morgan and Gerrish Company. Making favorable and lasting impressions of good will adds greatly to our opportunities for success.

Radio broadcasting, as commented upon by Henry A. Bellows, was one of the outstanding lectures of the fall.

Mr. B. V. Moore, vice president of the First Minneapolis Trust Company, discussed present day banking in industry, and Mr. J. H. Mitchell explained the importance of properly advertised merchandise. Other speakers, all well acquainted with their respective subjects, told of the use of efficient mechanical methods followed in obtaining raw materials and in fabricating these materials into structural parts such as steel plates, beams, and rails.

Other lecturers of this school year covered the problems relating to supplying power and water for industrial and public use, to cement, glass, and lacquer manufacture, and to petroleum products which are used in the automotive industry.

That the purpose of the course, namely that of acquainting the engineer with the many fields of engineering that are open to him, is fully accomplished is evidenced by even a hasty inspection of the various reports that the students turn in during the quarter. Their enthusiastic tone and the completeness of thought indicates, as has been implied, that the student values the information received very highly.

Students seem to consider these lectures well worth attending, for last quarter the absences amounted to less than one-half per cent of the total class attendance. The success of the course is due largely to the interest shown the different lectures, and not one of the lecturers has complained of a lack of interest on the part of the audience.

CAMPUS NEWS

Radio

The Institute of Radio Engineers recently created a student grade of membership available now to students attending colleges and universities "providing an engineering curriculum of not less than three years and granting degrees." Arrangements have not as yet been completed for the organization of local branches, but plans are well under way. Student membership includes a year's subscription to the Proceedings of the Institute, the outstanding publication on radio, television and electrical communication developments.

Membership applications may be obtained from Dr. J. S. Webb or Parker Lowell, sponsors of the organization on the campus.

Engineers Are Active in Newman Club Affairs

Cledo Brunetti, '32, of Virginia, Minn., and a teaching fellow in electrical engineering, is chairman of the general arrangements committee for the annual Formal party which will be given under the auspices of the Newman Club of the University, on January 27th, at the Radisson Hotel, Minneapolis. Mr. Everett Bach, who graduated in December '32 in Engineering Business Administration, is the president of Newman Club and is assisting on the general committee. Fred Probst, of St. Paul, a sophomore in Chemistry, is chairman of the ticket committee; Joseph J. Talarico of Hibbing, a junior, is head of the poster committee; Angelo Bartoletti, another junior from Hibbing, is chairman of the committee on programs; John Burke of Langdon, N. D., '32 aeronautical engineer, will see that the grand march is carried out correctly; and Leo Kujawa of St. Cloud, a junior, will attend to transportation. Other engineers who are assisting in the plans for the party are Adolph Bartoletti, '34, of Hibbing, Loren Moore, '36, of Wadena, Paul Prendergast, '35, of St. Paul, Alfred Raiche, '35, of Minneapolis, Robert Theis, '33, of St. Paul, Leonard Lustig, '35, of St. Paul, Ray Phillips, '32, of St. Paul, and Tom O'Laughlin, '35, of St. Paul.

Music will be furnished by Julie Madison and Jack Malerich's Minnesota Breezes.

Eta Kappa Nu

Perry Peterson, president of the General Control Corporation of Minneapolis, as guest speaker at the formal initiation and banquet of Eta Kappa Nu urged that engineers take more interest in economics and governmental affairs. Al Green, '24, electrical graduate, who is X-ray technician at Glen Lake Sanitarium, gave an interesting picture of the uses of electricity in medicine. Professor J. M. Bryant, head of the electrical engineering department, one of the founders of Eta Kappa Nu, and a most excellent toastmaster, was introduced by Ray Milner, president of the society.

Dr. H. E. Hartig of the Electrical Enginering department, five seniors and five juniors were formally initiated into the Society. At a card party held as an informal gathering after the speeches new and old members were given an opportunity to chat and become better acquainted with each other.

Rowley and Algren Issue Heat Transmission Bulletin

The study of heat transmission through insulating materials and of building construction has been in progress at the Engineering Experiment Station here at the University for several years. At first, the problem was that of developing an apparatus for determining overall heat transmission coefficients of built up wall sections. New ideas as to the apparatus have led to a general broadening of the scope of the work.

A bulletin has been recently issued by the University in which the accomplishments of this investigation have been set forth. This bulletin has been written by F. R. Rowley and A. B. Algren of the Experiment Engineering Department. They have determined the flow of heat in such structures as boilers, condensers, heat exchangers, and refrigerators. They have also covered the field of insulating for such structures as building construction, refrigerator cars, and structures where it is desirable to limit the flow of heat to as small a value as possible.

OUTLOOK IN 1933

[*Continued from page 103*]

living. Efficiency has been a by-word and the extremes have been given too much prominence, but efficiency remains, a good faithful servant. There are larger fields ahead that have not yet been touched, where this sort of activity will open up new wealth, and reward the engineers who engage in it.

This Machine Age

The machine is here to stay. There will be more machines in the future. There will be an increasing field for design, for invention and for manufacture. The present stopping is only a pause,—let us hope it is a "pause for refreshment." There will be a new distribution of the consumable goods produced by the machine, a new division of the leisure that results, and a new division of the benefits in many other ways. Engineers can contribute to the proper evaluation of the machine age, and thus hasten this transition.

What does this all mean to the Senior Engineer looking for a job? It means the same thing that it does to the old grad who is out of work. It means the opening up of new opportunities, a new frontier, a new expansion in which there is need of his services, and a large promise of reward. Getting down to brass tacks, is there any one who can say truthfully, "There is nothing for me to do." Is there any one so situated that there is nothing for him to do, as long as he can think? We are concerned with the immediate returns, far too much. We have to do a certain amount of preliminary work to get anything done that is worth while. This means doing the job that is at hand. It may not mean a big salary. It may mean just getting by, doing what someone wants done, even if the return is only "in kind." But there are countless such opportunities, and all the time there is the necessity and the opportunity to learn something new about this business of living we are in, and how to do it.

The writer does not look for any super-management group to lead this nation out of the wilderness. Rather is it in his opinion likely that there will be more confidence placed in industrial groups managing their own affairs, under proper plans, whereby the public interests will be taken care of.

When asked questions as to how to find a job, the writer has tried to learn something about a man's interests, his past experience, his reading, his electives, his social demands. There will be an outcropping of likes and dislikes, of evidences showing keen, accurate thinking, or again an indication of something that has been overlooked or passed up. There may be some statement on which he has other and independent information which will invite discussion. At such a time there is usually no chance to outline what could have been done during college to meet the deficiencies. It is sure that experience will show them up to the student, anyway, and if a man is determined enough, he will meet these with courage and initiative. Suggestions are usually offered as to how to attack the job hunting, by letter, by personal contact, or through others that may be known, or taking this or that which is turned up. But there is always something coming along, which the student finds himself. There is no cause to worry, if he will do the work that is at hand.

Another Year of Study

This may mean a re-adjustment of plans and expectations, but no more certainly than has been forced on many engineers who have found themselves out of work. It may mean another year of special study for those who can finance such a course. It is certain that this additional preparation can never be had as cheaply as at the present time, figuring the cost by adding the sum that may have to be borrowed, to the net savings that might be left after a year if gainfully employed on some job. Such a course, after spending next summer checking up on one's interests and the opportunities that are presented by diligent search, may be the most valuable part of the college course, by increasing the earning power of work already completed.

Men and Metaphysics

Engineering is more than dealing with materials and forces. It is dealing with men. It is much more concerned with courage than with calculus,—success in engineering depends more on metaphysics than on physics. The rewards will come to the engineer who thinks accurately in terms of today's new conditions, who will use the principles he knows for pioneering in new fields which are at hand. He will help organize society for a new prosperity, with a new division of wealth and leisure resulting from more intelligent planning and operation. The graduate of 1933 will help make history.

MEDITERRANEAN TRAVELS

[*Continued from page 107*]

monolithic, if you please! A jaunt of ten days in Egypt concluded my trip in the Near East. Cairo the fascinating place with its innumerable mosques, its native quarters, its marvelous museum were hard to leave. Of course, I had to see the Sphinx, the pyramids, take a camel ride, sip tea at the Mena House, and watch a native climb and come down the highest pyramid in less time than I could say "Jack Robinson." But after all, this is the penalty modern civilization places upon you at the gates of wonderland. Do not expect me to describe that wonderland to you. Go and spend hours admiring the carvings in the tombs and temples depicting the life of the Egyptians; go and watch the rising sun, touching the tops of the Temple of Luxor; go and see the mirrored reflections in the still waters of the Nile at noon; go and reflect when the sun goes down over the desert, pouring fire on Karnak's gray pylons! Go farther south and shed a tear on the delicate Philae temples almost submerged by the waters, but anyway marvel at the magnitude of the works done by British Engineers in daming the Nile at the first cataract at Assouan.

And if after all this, you do not come back home as I did, with the motto:

Be a traveller first—then an architect.
Well, I'll be . . . surprised.
Thrice blessed is he who first thought of granting
Sabbatical year leaves.

▼ ▼ ▼

BOOK REVIEW

Problems in Human Nature

By F. A. Magoun, *Asst. Prof. of Humanics—Massachusetts Institute of Technology*

While going to school, we think too much of the technical side of our work and not enough of the human side of engineering. This book attempts to help the engineer solve the various problems dealing with human nature that are encountered after leaving school.

In the book, Professor Magoun presented certain problems of a nontechnical nature to his class in humanics and then had the students write a short article on the method they would employ to overcome these difficulties. A large number of these problems were actually encountered in practice. These problems were encountered by the engineer while working up to the position of superintendent of a plant, chief purchasing agent, chief sales manager, and finally president of the company.

There are several interesting articles telling what the students would do if they had an income of $10,000 a year. The articles are written in various styles, a large number being in story form, while others are simply discussions, and others are even written in the form of short plays.

MODERN NEWS PRESSES

[*Continued from page 105*]

phia Enquirer. These presses were outstanding and undoubtedly spurred the other manufacturers on in an attempt to build presses to match Wood's in simplicity, power, strength, durability and speed. Mr. Wood's first real successful, tried and nearly perfect press went into operation about five years ago in the main plant of the New York Times. This press "sold" the Times on Wood and when they built their beautiful Brooklyn plant several years later, they installed sixteen Wood units, incorporating many of the newest inventions.

Last year, the New York Times installed 12 units of the Modern Wood Press, the last word in newspaper printing presses with the full complement of automatic equipment. With this equipment in operation, it is difficult to imagine how any improvement could be made.

The Dispatch and Pioneer Press equipment is a double octuple press consisting of eight units and two pairs of double folders. It has the "Auto Clamp" to automatically lock the plates to the cylinders; paper break detectors to stop the press if the web breaks; electric brakes to decelerate the press quickly and avoid waste when breaks occur; magazine reels; and other features the result of engineering and inventive genius too numerous to mention. It is geared to run at a productive speed of 60,000 copies per hour. A two hundred H.P. D.C. motor is used to drive each press. Each motor is large enough to drive six units if this number is required. The electric control apparatus furnished by Cutler-Hammer of Milwaukee gives the operator complete control of the movement of the press. Push button stations are strategically placed at various points about the press, available to men on the press room floor and in the sub-basement where the magazine reels are located. Each station has buttons for "inching," "full stop," "start," "slowing down," "speeding up," and signalling for start to warn the men the press is to move. Other push button stations control the web margins and the sheet tension by changing the position of the reels.

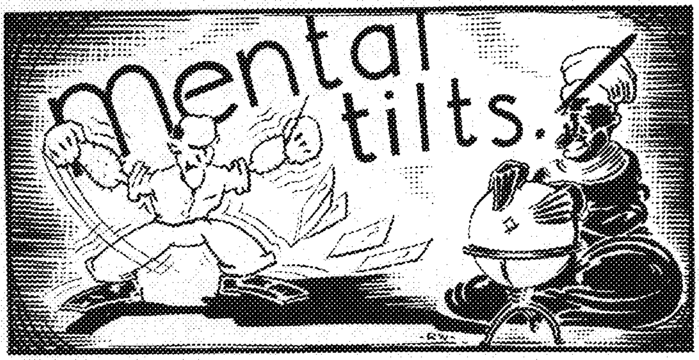
The operation of printing on a web of paper about 3 one-thousandths of an inch in thickness at high speed requires delicate adjustments, fine balance of rotating parts, strength, even tension, and complete co-ordination of every element of drive, unit and folder. A thin film of ink, a forty-thousandth of an inch thick has to be laid on the web traveling 20 miles an hour by the fleeting impression of a plate. The ink has to come from a fountain roller which rotates in the fluid. A thin film is picked up from this roller by another, the amount being governed by an adjustable blade through "fountain screws." This ink is then thinned out and spread out by other rollers and drums before it goes onto the plates. From the plates it is laid on the paper. The rollers used for this purpose are rubber covered. These rollers have practically replaced the old "composition" rollers, made up principally of a mixture of glue and glycerine, which could not stand up under the strain of high speed and friction.

After the printing, the web travels to the folder and this apparatus, for years the limiting factor to speed, is now designed to keep pace with the printing units. In the folder the sheets are collected, folded and cut, and printed newspapers are spilled out in a stream and carried to the delivery rooms by endless coiled spring conveyors.

To those of us who are accustomed to watch presses in operation, it seems almost incredible that nearly 1,000 papers can be turned out in a second; that in less than that time blank paper from four or five rolls can be turned into daily records of our life and history. The modern printing press in operation is a joy to watch and is, indeed, a tribute to the engineer.

A Radio Knife

WE ARE all familiar with radio and radio broadcasting. We are not so familiar, however, with the innumerable by-products of radio which are finding their way into industry in an amazing way. Many of these devices make possible operations hitherto impossible by other means, and others permit the carrying on of many operations with a speed and efficiency and accuracy unknown by the previous methods or by human means. An extremely interesting device was exhibited in Cleveland about a year ago known as the radio knife. This device is merely a straight wire or loop of wire connected to a high frequency outfit and so arranged that this wire literally burns its way through living flesh, searing the blood vessels as it goes with the burn extending hardly beyond the point of contact of the so-called knife as it is used for surgical operations.



ORDERS from the business manager of the MINNESOTA TECHNO-LOG: Make the Mental Tilts so hard that no one can work them, and keep on offering prizes for the first solutions.

Orders were carried out to the word last month, and only one student, C. W. Janes again, had the temerity to offer solutions. The card problem was the sticker for everybody, so we saved $2.00.

Again, then, we offer $2.00 in exchange at the Engineers' Bookstore to the student turning in the first correct set of solutions to this month's Mental Tilts. Answers will be given in February.

A SIMPLE ONE

HOW often must a die be thrown so that the probability that a four appears at least once is greater than 5/6?

MONEY AGAIN

A BAG contains five coins of which one is coined with two heads, the other four are normal coins having a head on one face and a tail on the other face. A coin is drawn at random from the bag and tossed three times in succession. If heads turns up each time what is the probability that this coin is a normal one?

LEAP FROG

TWO pails whose masses are m and m_1 are connected by a rope which passes over a frictionless pulley. A frog of mass M is placed in the bucket of mass m. Just at the instant the pail containing the frog is at rest the frog jumps up so that he just gets to the top of the bucket, whose height is h. If the rope and pulley have no mass, what is the absolute height of the frog's vertical ascent?

▼ ▼ ▼

Answers to Last Month's Mental Tilts

THE WAY OF WAYS TO WEIGH

The kettle broke into four pieces whose weights were one, three, nine, and twenty-seven pounds.

WAR DEBTS AND HOW TO SETTLE THEM

The British would have to pay $13,970,000,000.

TRY IT—IT HAPPENS OFTEN

The answer to this problem may be obtained by first finding the probability that the ace of spades is next to the king of spades. The probability of this is 1/26. Then one finds the probability that the ace of spades is next to the king of hearts, but not next to the king of spades. This is $\frac{50}{26 \times 51}$.

One continues to do this, finding the probability of the ace of spades being next to the king of diamonds and none of the above-mentioned kings, and so on for all the aces and all the kings. The total probability will then be the sum of the individual probabilities, and this summation gives .455 as the probability that an ace and king will be together somewhere in the deck.

WHILE THE MOON GOES OVER THE CAMPUS

[*Continued from page 109*]

smoking. Here I conclude with something from John Aubrey, an Englishman, 1626-1697, telling of other men's first trials. Please note that I am neither advocating nor deprecating the use of tobacco. Heaven forbid that I should ever be drawn into that argument. And these excerpts are quite neutral. Cartier, while he said a man makes of himself a chimney when he smoked also admits that the fumes did on a cold day warm a man's insides. Aubrey, while telling that Sir Walter Raleigh smoking a pipe in a park caused the ladies in the neighborhood to move out, adds that when Raleigh was finally brought to the scaffold he found comfort in a few puffs before he was executed. From these excerpts you can argue either way.

Says Aubrey:

"Sir Walter Raleigh was the first that brought tobacco into England and into fashion. In our part of North Wilts it first came into fashion by Sir Walter Long. I have heard my grandfather Lyte say that one pipe was handed from man to man about the table. They had first silver pipes; the ordinary sort made use of a Walnutshell and a Straw.

"It was sold for its wayte in silver. I have heard some of our old yeomen neighbors say, that when they went to Malmesbury or Chippenham market, they culled out their biggest shillings to lay in the scales against the tobacco. Sir Walter Raleigh, standing in a stand at Sir Robert Poyntz' parke at Acton, tooke a Pipe of Tobacco, which made the ladies quitt it till he had done.

"Sir Walter Raleigh tooke a pipe of tobacco a little before he went to the scaffold, which some formall persons were scandalized at, but I think 'twas well and properly donne, to settle his spirits.

"Sir Walter was a tall handsome and bold man; but he was damnable proud. He had a most remarkable aspect, an exceeding high Forehead, long-faced and sour, eie-lidded, a kind of pigge-eie. His beard turned up naturally. His voice was small, and he spake broad Devonshire to his dying day."

Mercury for New Power Plant

WHAT is probably the largest single shipment of mercury ever made arrived in New York recently for the General Electric Company, to be used in generating power in the new 20,000 kilowatt mercury turbine just installed at the Kearny station of the Public Service Corporation of New Jersey. The shipment consisted of 270,000 pounds, and was delivered in 3553 iron flasks, each flash containing 76 pounds. The remaining 270,000 pounds will be delivered later and will be used for generating power in the new mercury turbine plant being built in Schenectady.

The total order represents about 89 per cent of the mercury consumed by the United States in an average year. The present production of mercury in the United States is about 12,000 flasks a year. The amount of metal ordered by General Electric would supply about 50 million ordinary thermometers—the commonest use of mercury.

Mercury purchased for the new generating stations does not need to be replaced unless it is lost by accident, since it is condensed after operating the turbine and used again in the generation of power and steam.

Six Electrons per Second

TO a vacuum tube that to the average person differs little in appearance from the usual radio receiving tube now belongs the credit for being the world's most sensitive measuring device. It will measure a flow of but six electrons per second. When the tube was first announced some months ago by the General Electric Company, it was recommended for measurement as small as 10-17 ampere; refinements in the tube and circuit since then have increased its sensitivity tenfold in certain work.

If the six electrons per second that are measured by the tube are considered as that many drops of water, then the number of electrons flowing in one minute through the usual 50-watt incandescent lamp equals the number of drops in the enormous volume of water going over Niagara Falls in the whole century.

More sensitive than the most delicate electrometer, the tube is far more sturdy and easy to use. Its applications, purely scientific, include measurements, in conjunction with phototubes, of the light of stars, even down to the 14th magnitude; the counting of cosmic rays; and the recording of neutrons, protons and alpha particles. The normal eye, incidentally, can perceive a star of the sixth magnitude; but not even the six inch reflector of the amateur astronomer is sufficiently powerful to reveal a 14th-magnitude star.

The extreme sensitivity of this tube, designed as Pliotron FP-54 is the outcome of a careful, scientific study of the source of "electric leakage" in vacuum tubes.

NEW FIELDS IN ENGINEERING

Coolidge Directs G. E. Lab

W. D. COOLIDGE, formerly senior associate director of the research laboratory of the General Electric Company of Schenectady was appointed on November 1, 1932 as director of this laboratory to succeed Dr. W. R. Whitney, who retired on that date because of poor health.

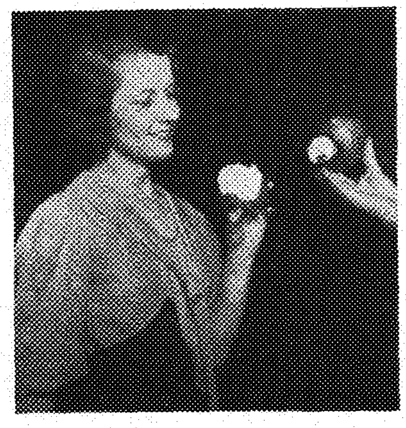
Dr. Coolidge is a native of Hudson, Mass. He studied at the Massachusetts Institute of Technology and the University of Leipzig, and since 1905 has been active in research work for the General Electric Company.

Dr. Coolidge is perhaps best known for his work with high voltage X-ray tubes, and especially with the high vacuum, hot cathode "Coolidge" tube, of which he is the inventor.

An Electric Taster

AN "electric palate" or Electrynx, that tastes and indicates on a meter the ripeness of apples, oranges, lemons and other fruits and vegetables, by measuring their acidity has been developed by the Westinghouse Manufacturing Company.

This latest electrical measuring device is so sensitive that it records the

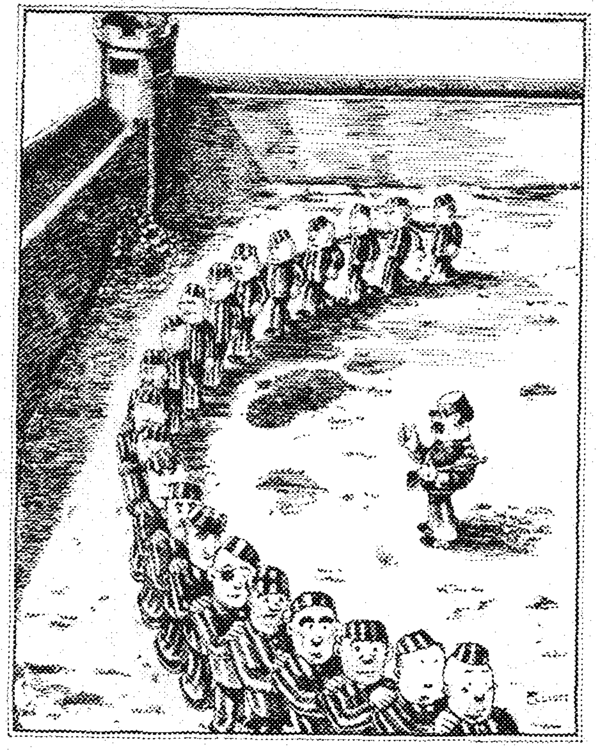


Electrynx and the lady agree that her apple is sweeter.

action of one-millionth of an ampere or about one-tenth of the "wing power" of an ordinary house fly and is 100% more sensitive than any of its type now on the market. Previous recording meters of this sensitivity were expensive and not readily portable.

The Electrynx was primarily designed for the measuring of the minute currents that flow in photoelectric tube circuits or "electric eyes" that are used in sound motion picture projectors or other light and sound sensitive devices. With this new instrument it is possible to check the current continuously.

The principle involved in the development of the Electrynx is not new but dates back to Alessandro Volta and his original Voltaic or "wet" battery of over a hundred and thirty years ago. Two dissimilar pins or terminals used in the Electrynx are the electrodes and the materials under test supply the solution or electrolyte.



IN an article just released by "Redbook" magazine, Chaplain Peterson of Sing Sing Prison says that "All the best known colleges are represented in Sing Sing Prison, but the majority of crimes for which the college men are jailed are different from those in the case of non-college men. College prisoners commit larceny three times as frequently as others; forgery is their most popular crime, and very rare is the prisoner who has worked his way through college."

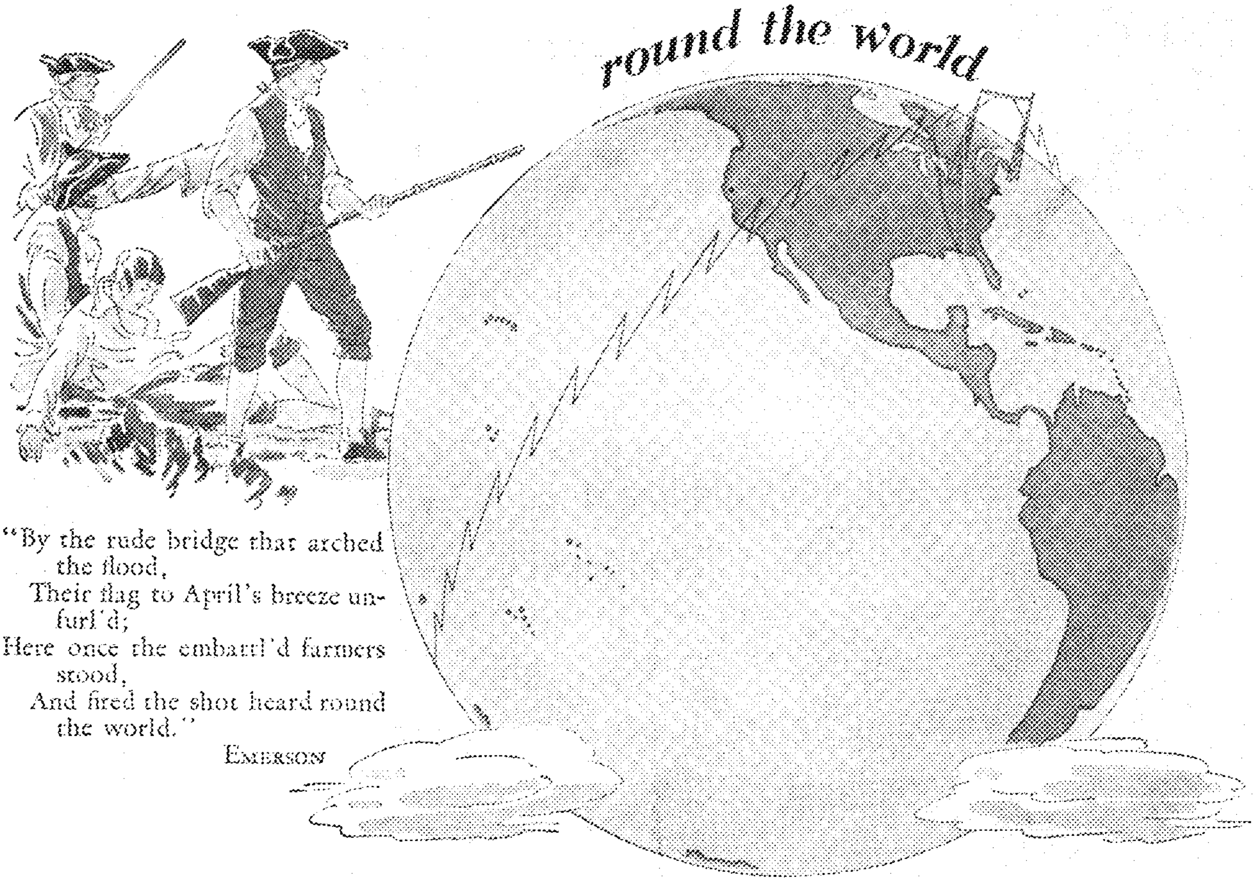
In the long list of American colleges which have had representatives at Sing Sing, our own Minnesota is present. The chaplain of the Federal Prison says that almost invariably when a college choir or glee club comes to sing, there is an alumni reunion with at least one man present who wears the prison gray.

Numbered among the inmates are experts in science, religion, and many of the fine arts branches. The chaplain shows how the intellectual atmosphere of Sing Sing is far more cultured than the general public would suppose. There are even college trained lawyers to give professional advice to those who desire it.

Although some of the prisoners display a conceited spirit, practically none of the college men show this attitude. On the other hand, they seem to feel the disgrace of their conviction, and quietly accept their fate as a deserved one. Disciplinary measures among them are practically unknown.

Although Mr. Peterson has not a definite theory as to just why so many college men are in prison, he admits the plausibility of a college man now at Sing Sing. This man says that "In periods of financial depression the proportion of highly educated men who are in prison should be expected to increase, because, in the first place, a depression hits earliest and hardest those who are holding white-collar jobs, and in the second place, these men are used to living better and more expensively than laborers or mechanics, and so when the crisis comes, they are less able and willing to adapt themselves to a lower scale of living."

The shot ACTUALLY heard round the world



"By the rude bridge that arched the flood,
Their flag to April's breeze unfurl'd;
Here once the embattl'd farmers stood,
And fired the shot heard round the world."
EMERSON

ON the one hundred and fifty-seventh anniversary of the Battle of Concord, a shot was actually heard round the world. Fired from a musket that was used in that battle, it was broadcast round the world from General Electric's short-wave radio station.

The sound of the shot made the 24,000-mile loop in one-eighth of a second, and on its return was loud enough to be rebroadcast over the longer waves of station WGY. To do this, the sound was sent out from station W2XAD, on 19.56 meters, to Holland, where it was relayed to Java, which in turn rebroadcast it to Australia, where it was relayed back to Schenectady, being received on 28.5 meters. The fact that the shot was sent out on 19 meters and returned on 28 meters is proof that it completely circled the world.

This dramatization of Emerson's lines was made possible because of research and developments in the electrical industry — developments that are largely the work of college-trained engineers. They are leading the way to even greater progress and are helping to maintain General Electric's leadership in the electrical industry.

95-952DH

GENERAL ELECTRIC


Minnesota
WILLIAMS
FEBRUARY

FEBRUARY, 1933
VOLUME XIII, NUMBER 5

Minnesota Techno-Log

37 ELECTRICAL BUILDING . . . U of M

Published monthly from October to June inclusive, by the students of the College of Engineering and Architecture, the School of Chemistry of the University of Minnesota

THIS MONTH

WHILE YE EDITOR SLEEPS

Well, midquarters have come and gone again, and if you are one of the few who didn't get a note of congratulation (or something) from the registrar, then you must have studied. Oh, well, there's still half a quarter left to catch up in.

Did it ever occur to you that putting out this magazine every month is quite a job, and, in fact, that it might even become a tiresome job after several successive months? Whether you ever thought of it or not, that's the case, and ye Editor, finding himself in sore need of a bit of studying, has resigned the duties, honor, and WORK to his first assistant, who humbly submits this issue for your approval.

On one particular item of this issue, we welcome your comments, and urge your co-operation. That item is the "Gleanings from the Wastebasket." If you enjoy a little "dirt," help us keep the column alive by dropping your contributions in the Techno-Log office. We started the column, but we expect you to put the finishing touches to it.

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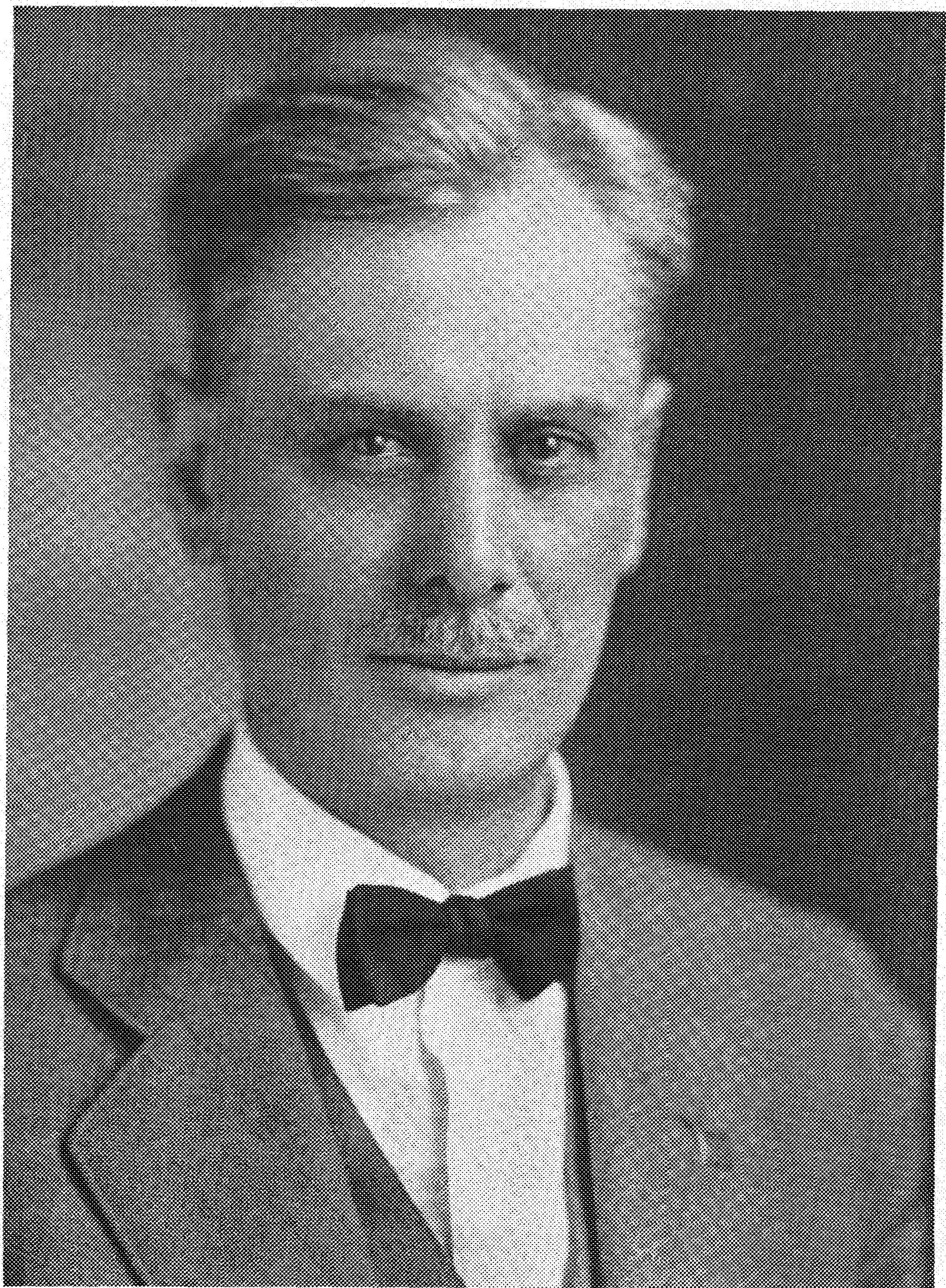
Entered as second-class matter April 9, 1925, at the post office at Minneapolis, Minnesota, under the Act of March 3, 1879. Office, 37 Electrical Building, University of Minnesota. Telephone, Dinsmore 2760. Contents copyrighted and permission must be secured for re-publication. Subscription rate, $1.50 a year. Single copies, 25 cents. Advertising rates upon application. Alumni Directory, 50 cents.



FRANKLIN WESLEY SPRINGER

He was the soul of frankness, of honesty and cheer.
A student of all sciences - a loyal engineer.
Scholars, teachers, friends - esteem from all he won - -
But his quiet voice is silent, his cheerful presence gone.

FRANKLIN WESLEY SPRINGER

1870-1933

By WILLIAM T. RYAN
Professor of Electrical Engineering

PROFESSOR FRANKLIN WESLEY SPRINGER, Professor of Electrical Engineering, died on January 25 at his home, 127 Orlin Avenue S. E., after an illness of several months. Surviving him are his wife, a daughter Suzanne who is a freshman student at the University of Minnesota, his mother Mrs. J. W. Springer of Anoka, and a brother Dr. R. D. Springer also of Anoka.

Those who have known Professor Springer's interest in education and in his instruction of young engineers for the thirty-five years he has been continuously associated with the University of Minnesota are cognizant of his unusually high intellectual honesty, his frankness, his honesty of speech and thought, his persistence, his cheerfulness, and his willingness to discuss any subject at any time with any student, and to give advice on any phase of their work or any of their life problems. He always thought of the subject he was teaching in terms of its part in the whole scheme of the boy's education, not only as a professional engineer but as a useful citizen as well.

Professor Springer was born in Anoka, Minnesota, in 1870, twelve years before the first electric generating station in the world was put into operation. In 1892 just before the beginning of his senior year at the university, he devised a scheme for a "series-parallel" controller for the cars then operated by the Twin City Rapid Transit company. This device reduced the maximum power demands twenty per cent, thus postponing for some years the necessity for a larger power station, and reduced enormously the controller repairs. This was one of the first, if not actually the first, series-parallel controller used in the operation of street cars. The scheme was later universally used both in this country and abroad.

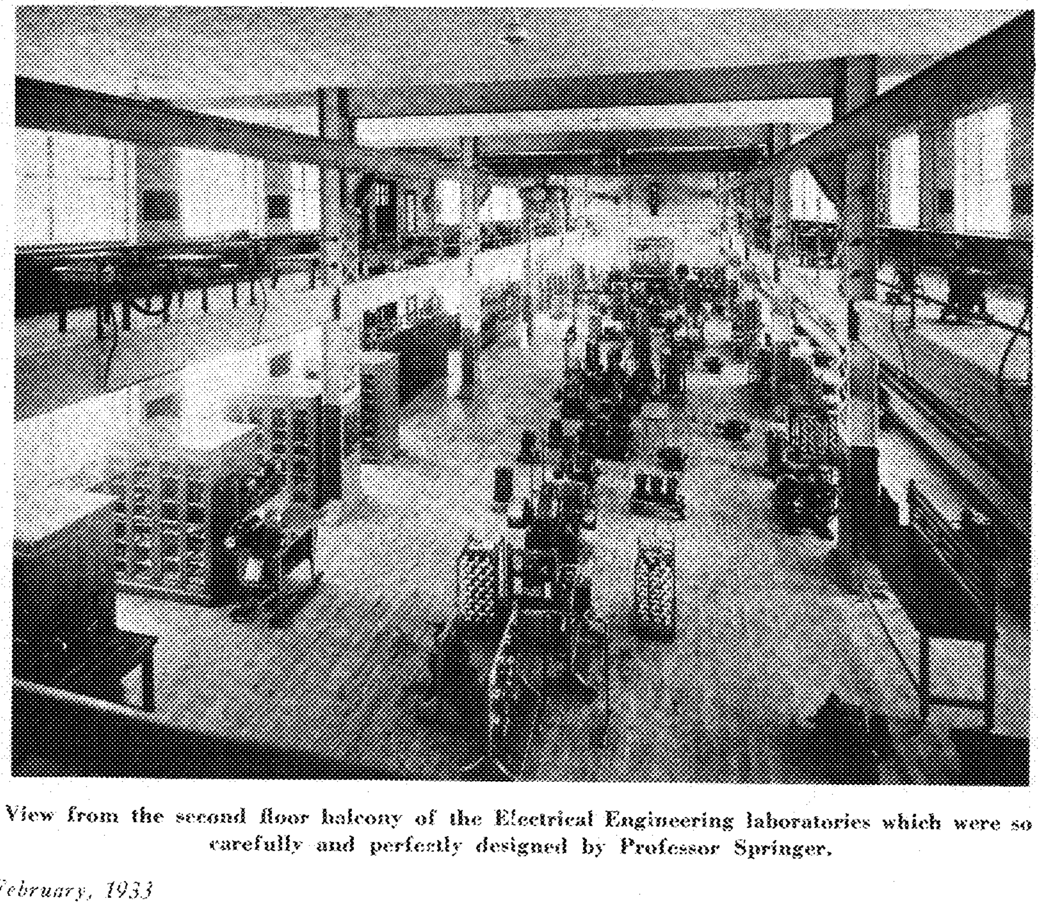
In 1893-94 he assisted in solving the commutating problem on the street railway motors then in use. At that time a first-class armature would last, on the average, not over thirty days.

He received his B.E.E. degree from the University of Minnesota in 1893 and his E.E. degree in 1898. He studied at the Berlin Technische Hochschule in 1910-11 for one year and spent a few weeks attending lectures at Ecole de l'Electricite in Paris. He was a Laboratory Assistant at the University of Minnesota in 96-97, Instructor, half-time, 96-98, Instructor from 98-99 to 00-01 when he was made an Assistant Professor. In 1901 he spent several months traveling and studying in Europe. In 1910-11 he studied in Berlin and Paris. In 1911-12 he was appointed Professor of Electrical Engineering retaining this title until the time of his death. As Acting Head of the Department of Electrical Engineering in 1925-26 and 1926-27 following Professor Shepardson's death, he built up in the department a high "esprit de corps" and an excellent spirit of cooperation.

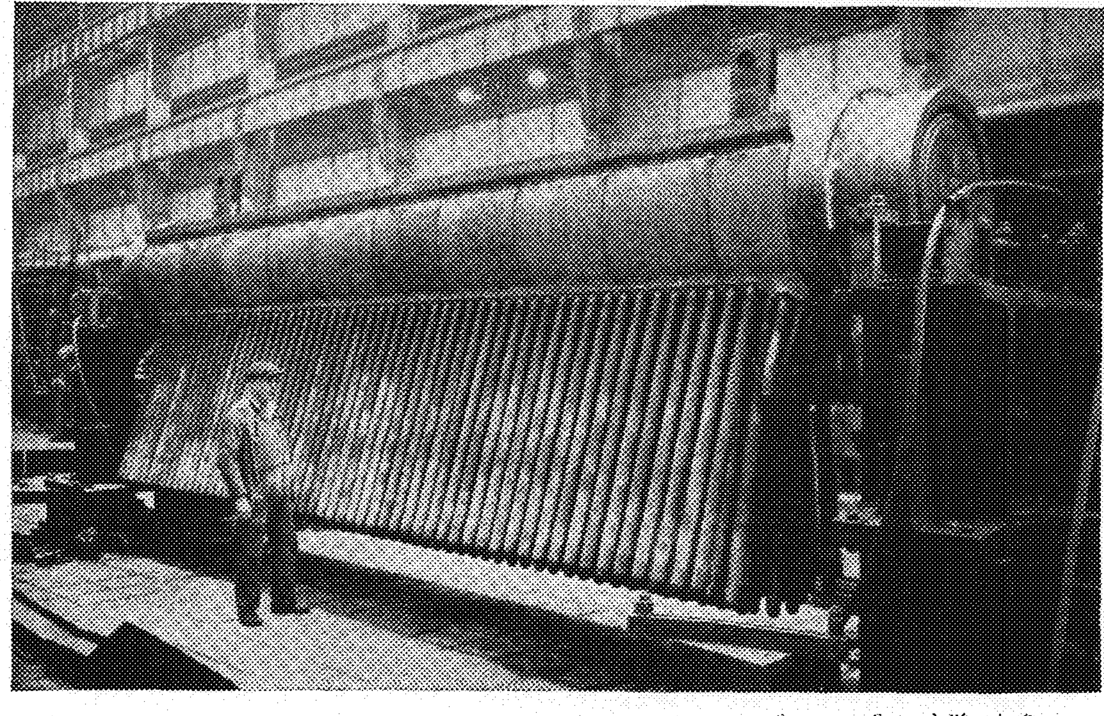
Professor Springer is credited with the major part of the work in connection with the design and arrangement of the present Electrical Engineering Building. He began his preparations for designing this building at least fifteen years before it was built. I remember well of often studying with him preliminary plans, as far back as twenty years ago, long before there was any prospect of the legislature providing the necessary building appropriation. I often marveled at his unusual optimism, and at how he kept working for and planning this building in season and out, never doubting for one moment that the time was soon coming when it would be built.

He studied the principles of building and laboratory design while traveling in Europe. He also studied laboratories at several universities and industrial plants in this country. The building, especially the laboratories and their service arrange-

[*Please turn to page 157*]



View from the second floor balcony of the Electrical Engineering laboratories which were so carefully and perfectly designed by Professor Springer.



A typical mercury boiler with its many projecting tubes making it look like a bottom view of a porcupine.

Courtesy—General Electric Co.

MERCURY VAPOR TURBINES

Increase Generating Efficiency

By ROBERT MARSHALL, E. E. '34

A brief review of the theory and development of the mercury vapor turbine and its uses in industry.

●

THE mere mention of mercury and mercury vapor turbines to some people arouses thoughts of dangerous liquids and gases, and of complicated power plants to use them. However, it is almost impossible to be harmed by mercury as it is used in mercury vapor turbines, and although the system has complicated details, the principles are relatively simple. With the mercury vapor system applied to power generation, efficiencies not obtainable with steam are realized.

As we learned in elementary physics courses, the efficiency of a heat engine may be increased by increasing the temperature range through which the engine operates. Since the final temperature must be that of the atmosphere or of the condensation medium, any material gain in efficiency must come from a decided increase in the initial temperature. It is for this reason that steam turbines have been constructed to operate at higher temperatures and consequently much higher pressures.

In the Rankine cycle, the fundamental factor in determining the theoretical efficiency is the temperature at which the fluid is evaporated, and the temperatures of evaporation always depends upon the pressure.

Mercury boils at 677 degrees F. at atmospheric pressure, and at the temperature of 706.8 degrees F. its pressure is five pounds above the existing pressure. Water reaches the critical pressure of 3226 pounds pressure at 706.1 degrees F. and cannot exist as a saturated vapor above this point. Throughout these various temperatures, the heat of vaporization of mercury remains almost constant, and the ratio of the latent heat to the specific heat has a much higher value than that for water. The liquid line on the temperature-entropy diagram is much steeper, and the work area as compared to the work added to the liquid is greater than that for water.

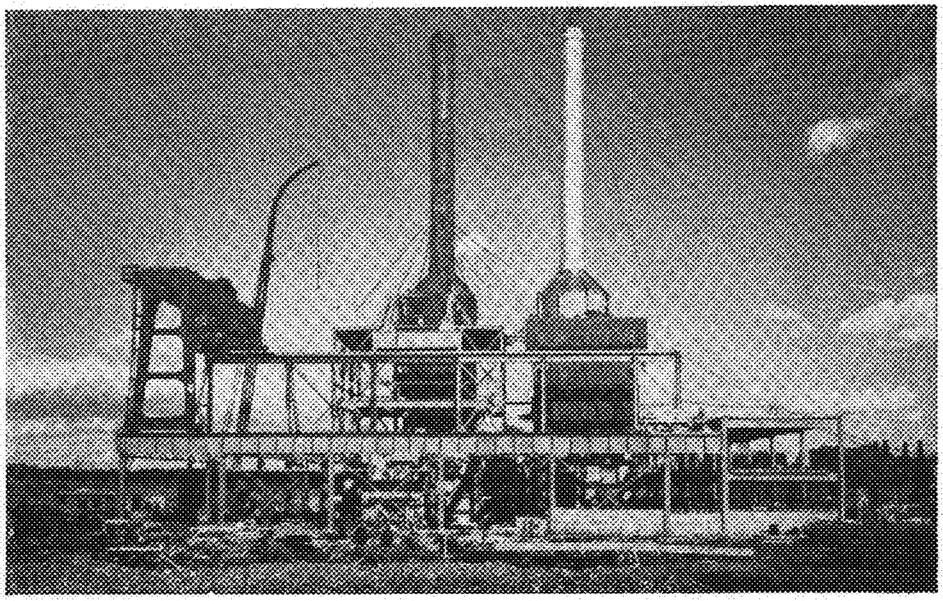
On the low temperature side of the cycle, mercury loses these desirable characteristics. Steam, at a temperature of 162.2 degrees F. has a pressure of .001 pounds and a volume of 33,000 cubic feet. The two desirable qualities of mercury in the high temperature range and one of steam in the low temperature range are combined in the binary fluid cycle for efficient power production.

Mercury is heated and vaporized in a boiler much in the same manner as water is vaporized in a steam boiler, then is conducted at 70 pounds pressure to a turbine which drives a generator. In the mercury turbine, the type and amount of work obtained is similar to that which would be obtained from a condensing steam turbine of moderate steam pressure and super heat. No greater amount of work can be obtained from mercury than from water per amount of heat applied to the fluid.

After passing through the turbine, the fluid is exhausted under a 29 inch vacuum into a double surface condenser in which a level of water is held.

All heat, in a steam cycle which is not used to do useful work or to heat feed water is lost to the water in the condenser; in some cases this loss is 65 per cent of the heat produced in the boiler. In contrast to this loss in the steam plant, the heat delivered by the mercury turbine exhaust is about 60 per cent of the heat applied to the fluid. This heat, however, is not lost but is sufficient to produce steam at a pressure of 350 pounds in the mercury condenser.

The cycle for the flow of mercury is completed through a steam preheater. The combustion gases pass successively through the mercury boiler, a mercury liquid heater, feed water economizer and an air preheater, thus lowering the effective fuel rate of the mercury plant; and which, for some runs reaches the low figure of 4000 B.T.U. per kilowatt hour. The net fuel rate calculated for the entire plant, fuel to electricity, if all steam was used in efficient turbines under desirable conditions, would be about 9,500 B.T.U. per kilowatt hour, which is 25 per cent lower than is possible with super-heat steam.



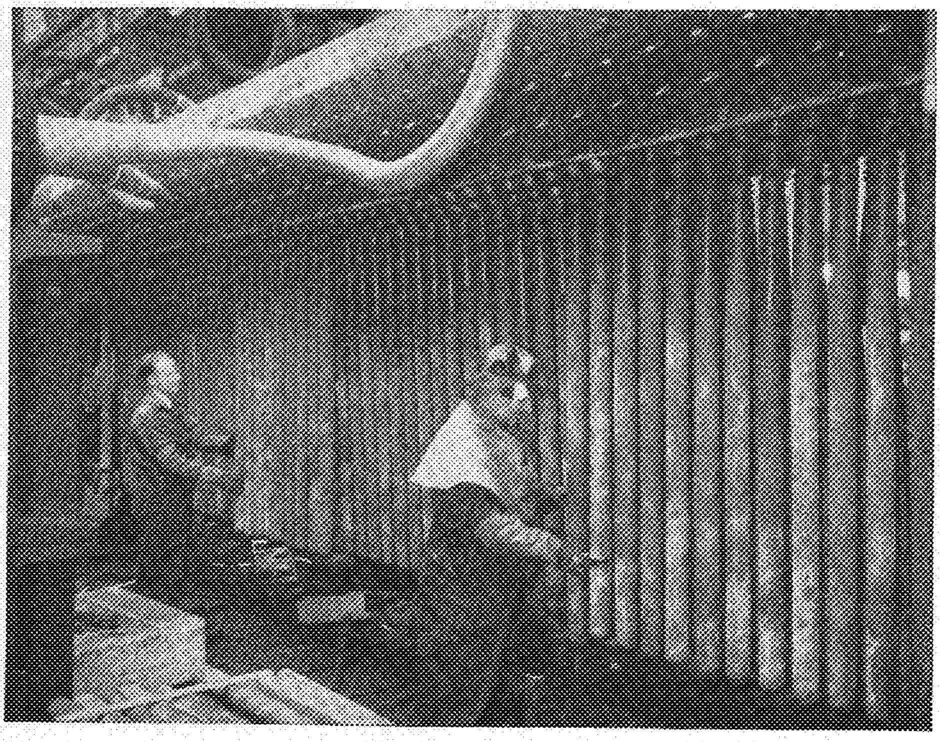
Courtesy—General Electric Co.

Exterior view showing a new plant under construction.

The mercury boiler construction presents many startling and unusual features of design. In the Hartford (1930) plant, the boiler consists of seven forged steel drums 21 feet six inches long, 30 inches inside diameter, and 37 inches outside diameter. The drums are suspended from outside the boiler and 432 vertical, dead ended, modified Field tubes are welded into each drum. A suspended tube design provides a maximum amount of mercury. These tubes are five feet six inches long and three and one-eighth inches in diameter.

A core is centered in each tube and a definite space is formed for the flow of mercury and mercury vapor. These cores are provided with sealed air jackets which retard the transfer of heat to the mercury as it passes down the inner tube of the core. The mercury is practically vaporless at the bottom of the tube, due to the pressure of the liquid mercury. The liquid is vaporized in the small space between the outer tube and the jacketed core.

A positive system of circulation is necessary because the vapor interposes itself between the liquid and the tube and causes the tube to burn. The danger of the end of the tube burning is minimized by maintaining mercury to the depth of several inches in the end of the tube. A valve prevents an increase in the flow of mercury liquid should the pressure on the vapor be released.



Courtesy—General Electric Co.

View of the mercury boiler in place.

A system of circulation of mercury in the drums is provided by a series of circular baffles on the bottom third of drums with space between the surface of the drum and baffles for mercury liquid and vapor. Through holes in the baffles opposite the cores or "down tubes," couplings are fitted to each core. In the drums, the space from one inch above the baffles to the liquid level, is filled with an iron casting which occupies a space which would otherwise be filled with the more expensive and heavier mercury. The mercury then flows down through the core of the vaporization tubes, up into the drum and through the space between the drum and baffles, to the liquid level. At this point the vapor is released and the mercury liquid flows back to the beginning of the cycle.

The vapor collected in the drums is conducted directly to the turbine. The turbine generator unit in the Hartford plant is a 10,000 kilowatt installation with a five stage, two bearing unit which operates at 720 revolutions per minute, three phase. The low speed of the unit is explained by the fact that mercury vapor has a high density and a low specific heat, therefore, the nozzle velocity is lower than that for steam for the same pressure, making it possible to obtain a good efficiency with a turbine of few stages and low speed.

[*Please turn to page 156*]

A SKIN GAME

By LEON ARCHIBALD

This is the second of a series of articles from "Between the Lines of a Surveyor's Notebook" in which Mr. Archibald continues the tales of his surveying experiences in the Canadian wilds.

IN his transactions with the Indian, "a dime for a dollar" seems ever to have been the white man's motto. Stealings rather than dealings is a better term to employ where the two have met in a business way. Having a sizeable stock-in-trade of cunning of his own, the Indian not infrequently gets even.

Back in the winter of 1909 we were running timber limit lines some sixty miles or so northwest of Prince Albert. Since the scene of these activities embraced an area completely devoid of previous surveys and dependable landmarks, we secured the services of Narcisse, a young Indian trapper, as guide.

Narcisse's main duties were to conduct the party by the best available trails to our objective and later to act as advance agent in the selection of suitable camp sites. Simple as they were to one so capable, these affairs left to the guide a fairly generous leisure, and this he employed with trapping together with keeping our larder stocked with game.

This beautiful piece of virgin forest was then, and I presume is still, a veritable hunters' and trappers' paradise. Deer, moose, and caribou, together with partridge abounded, and thanks to Narcisse's skill, our foundation fare was plentiful and various.

Narcisse made the round of his line of traps about once a week, and on these occasions he would be gone from camp from one to two days. Seldom did he return from these excursions empty-handed, his trophies including mink, marten, muskrats, weasels, and an occasional fisher. Once he was gone for three days to return at last the proud possessor of the grandest prize of all—a silver tipped black fox pelt.

Black fox skins of the primeness of Narcisse's triumph were then bringing almost fabulous prices; some as high as a thousand dollars. Completely transported by this sudden acquisition of wealth, the Indian packed up his two months' accumulation of fur and left for Prince Albert. As we watched him depart, it was but natural that we entertained grave misgivings concerning his return. In fact, the dog driver was given orders to pick up another guide on his next trip out. But we reckoned without an Indian's notion of financial independence.

What was our surprise when along toward sundown one day a week later Narcisse slipped like a shadow into camp and smilingly yet somewhat sheepishly asked for his old job back. The request was granted, after which we wormed from the truant his recent experiences in the marts of commerce.

Arrived in town, instead of going to the Hudson's Bay Company where he would have been given the market price for his furs, but no whisky, Narcisse hied himself to an unscrupulous free lance trader who thoroughly understood the red man's love of firewater and his total ignorance of money. This wolverine, masquerading as a human being and representative of a race which is wont to feel superior to the Indian, took Narcisse's skins in exchange for three bottles of cheap whisky, a varied assortment of cheaper merchandise, and about one hundred dollars in cash.

"By the time Narcisse had accumulated a few more drinks—"

The process of barter after viewing with cunning eye the Indian's treasure was first to give our erstwhile guide several liberal drinks. Allowing these time properly to make their presence felt, he next took his victim about the tawdry little shop magnanimously requesting him to pick out anything he wanted.

This product of the big, honest outdoors, in any condition, had no knowledge whatsoever of the value of machine-made goods in terms of dollars. If the trader told him that the tin, tinsel, and loud-ticking watch with gaudily gilded chain was worth a hundred dollars, he accepted the statement as fact and handed over ten mink skins. A cheap and shoddy suit absorbed three marten, a dozen or so rat skins, and a fisher; while a like amount of beautiful fur was placed against a pair of high yellow and alleged kid shoes. By the time Narcisse had accumulated a few more drinks, a violently red tie, shirt, and celluloid collar, together with some tea, sugar, tobacco, beads, and gaudy calico for his mother on the reservation, all of his smaller pelts had passed into possession of the reprobate store keeper.

Then came the grand coup! For the beautiful fox skin with its long, silky black fur tipped in sparkling silver, worth at least a thousand dollars, Narcisse received the handsome emolument of three bottles of firewater and one hundred dollars in one dollar bills and two or three hands full of silver. Thus does the white man sometimes show his superiority to his red brother.

Upon leaving the store in this condition of affluence, Narcisse had no difficulty in making the acquaintance of two or three itinerant lumberjacks. They helped him drink his whisky and then obligingly assisted in the investment of his cash for more. Toward the end of the week, his pockets were empty, but his copper colored hide plumb full of hard liquor. Narcisse's circle of acquaintances was extended to embrace several members of the local constabulary in a short but sharp action immediately prior to his incarceration in the calaboose. Here he rested overnight, and the next morning found him on the thirty-five mile trail to the reservation, a sadder but not much wiser Indian.

Narcisse's stay at the maternal fireside was short. In spite of the tokens of filial esteem which the guide placed at her feet, his mother's wrath over the knavery of the tradesman and the gullibility of her son waxed very warm. So heated, in fact, that the happy-go-lucky son of nature became quite uncomfortable.

Shedding the vestments of civilization which, all saving the watch since it had not yet been wound, bore strong evidences of strenuous service, Narcisse donned orthodox raiment. Then he slid his toes into his snowshoe loops, heaved a vast sigh of relief, and slipped silently away into the sanctity of mighty pines. In this selfconscious mood, it is little wonder that he thought the jaunty blue jays and saucy red squirrels were poking fun at him as he glided along through their principality.

At the end of Narcisse's rather stirring recital his listeners made a solemn resolve to take suitable action on our return to town in the spring. But it was our guide's mother who, aged and resourceful, balanced the account, and, I submit, after a very fitting fashion.

On our way to the refining influence of civilization at the completion of the winter's work, we stopped over night at Narcisse's reservation. As we were about to push off the next morning we were surprised to learn that Narcisse intended to accompany us to town. He explained that he had a commission to execute for his mother. And we judged from the earnestness of tone with which the wizened old squaw gave him his instructions, as she tucked a light but bulky package under her son's arm, that the errand was an important one.

What was our amazement when we learned along the trail that Narcisse's parcel contained two silver-gray black fox skins and that they were to be sold to the shyster trader and to no one but him. To all our arguments against such a course the Indian remained steadfast in his resolve to carry out his mother's wishes. All we could do, then, was to accompany him to the trader's store to see that a fair market price was paid for the pelts.

On account of their scarcity that winter the price of black fox had steadily advanced and fine skins were now bringing about twelve hundred dollars. And since the big fur centers were clamoring for them, they found a quick market among local buyers.

One of Narcisse's skins was slightly larger than the other, but both were, in the dingy and ill lighted shop, apparently prime pelts.

The larger brought twelve hundred dollars and the smaller a thousand, and since his previous transaction with the Indian had netted him such a handsome profit, there was an absence of haggling by the smooth little slicker at these prices.

"Yon's fine eematations."

The next morning Narcisse was introduced to a savings teller and later bade God speed on his way back to his realm of straight and towering pines. In the afternoon of the same day a few of our fast dissolving party were in the Hudson's Bay store settling general and personal accounts when in walked the free lance fur trader with a parcel under his arm. Approaching the Company's fur buyer, he untied his bundle and proudly threw upon the counter two black fox pelts, one a little larger than the other.

"How much am I offered?" he demanded in a chesty sort of tone, "for two of the finest black fox pelts you ever seen?"

The buyer, whose birthplace was somewhere north of the Tweed, leisurely picked up one of the skins and then the other and still as deliberately adjusted his spectacles as he sauntered to a window for a critical inspection of the hides. At the end of but a second or two his examination was finished.

"Nine dollars is what we're payin' today for red fox," the buyer announced as he returned the skins to the counter.

"Yes, but black fox?" corrected the seller.

"Yon's fine eematations," and then stroking the furs as he continued his appraisal, "In faact, verra fine eematations, but red fox for a' thaat."

Narcisse's mother had adjusted matters according to her lights, and again I submit, quite satisfactorily.

While the Moon Goes Over the Campus

RODERICK WILLIAM SILER

THE editors of TECHNO-LOG have impressed on me the fact that in writing these articles I should try to speak of things that would interest college men and even stimulate them to great deeds. I have been thinking of that this evening. I think I have hit on something. Here it is.

Last fall I noticed that a group of Northwestern students had started, on the morning of a certain day, a contest different from anything yet attempted in the colleges. It was more of a physical than a mental test, and yet it could hardly be called a form of athletics. It was a whisker race. Or perhaps it should be called a whiskers race, using whisker in the plural. Or a race of whiskers. Anyhow, it appeared to be a case of trying to determine who in Northwestern University could raise the longest beard in the shortest time. I am sorry that more details of this struggle were not given, as I would like to know how the whisker (or whiskers) are to be judged, when the contest ends, and whether any artificial stimulants such as massaging with hair oil, combing, curling, and so on, are permitted. If I knew the exact time at which this beard cultivation would end, I believe I would go down to Evanston and take a look at it. If the Northwestern boys have any success and their whiskers really become visible before time is up, I am inclined to believe that this thing will spread to other schools.

An intercollegiate contest of this kind, with the champion whiskers in each school being sent to some central point for a decision as to the champion of champions, would arouse universal interest, I believe. There are a lot of college stadiums throughout the country which are practically unused a considerable part of the year, and the final affair could be staged in one of them, beginning with a parade of the individual school champions, followed by the judging, and ending, with the crowning of the greatest champion of them all. The whiskers could be judged on different points, as for instance color, luxuriance, curliness, length, and shape. I am not an authority on whisker growing, never having had much success with my own, but I am under the impression that whiskers do, like flowers, blossom out in different shapes as well as colors. There are actually names for the different species of the genus as judged by shape: Burnsides, shovel, Dundreary, forked, goatee (not goatie), Horace Greeleys. This last sort, the Greeley, is named after the great Civil War editor of the *New York Tribune*, and is, or are, worn under the chin, encircling the face from ear to ear. I doubt if a young man of college age could grow this whisker, but if he could, why of course he should be credited with an extra point or two.

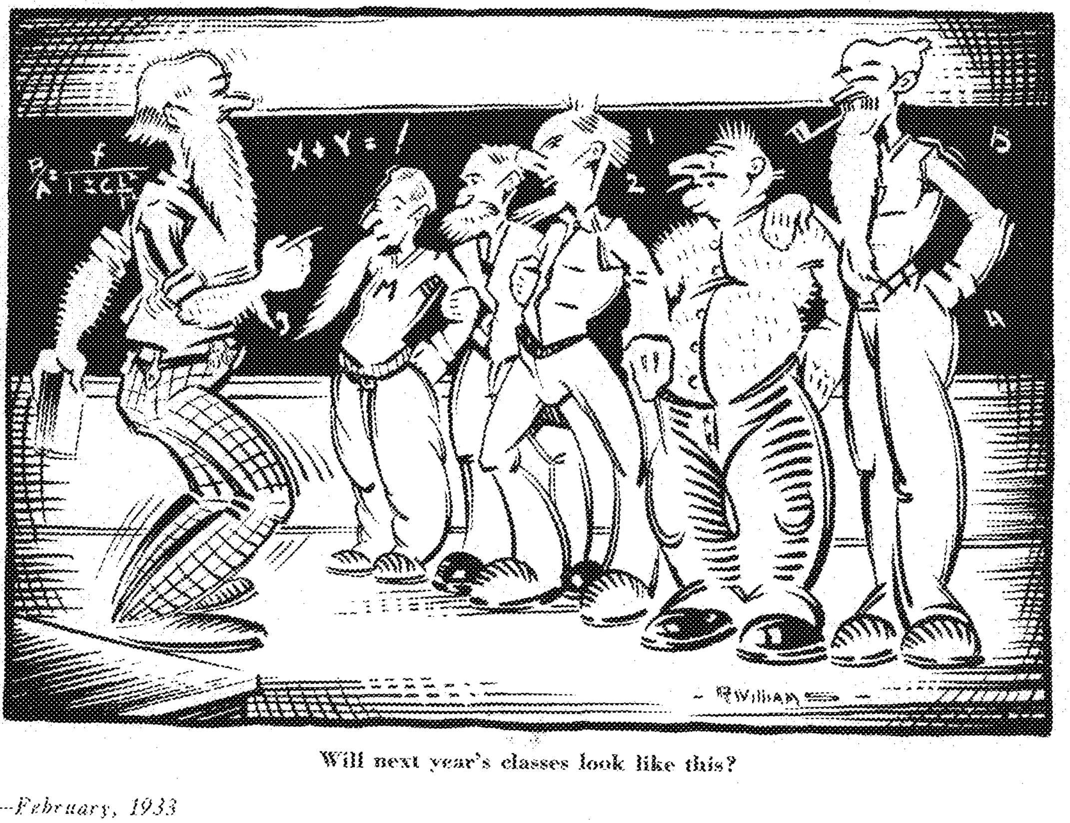
There would, I suppose, develop a certain amount of opposition to these collegiate whiskers. Some might say that a young fellow with a fine, long, red beard would be inclined to put on airs with his father or his profs if they had nothing similar to show. Let the elders raise whiskers, would be the solution here. Some will say that while men with long beards can do a lot of thinking they are incapacitated for activities of a physical kind. I am not so sure of this. It is true that in wrestling and football long whiskers would offer advantages to opponents if they were unsportsmanlike enough to seize upon them, but track, baseball, basketball, and drill remain—and dancing, of course. I have seen the famous baseball team of the House of David play, and they are advertised as having more whiskers than any other nine men in the universe. My personal feeling is that there really can be no valid objection presented to ranking these whisker contests as decidedly athletic. Remember, it is no weakling's job to carry a long beard around, especially if, as is possible, these whisker contests are introduced into the Olympic Games, and contestants, attempting to break world's records, begin to tow whiskers ten feet long into the field. The last objection to the whiskers might come from our co-eds. I cannot help but feel that this would be due to just a touch of jealousy on the part of the girls. They will realize that this is one form of competition in which they haven't a chance in the world. And I admit that it appears to me about the only competition in which we are sure to keep ahead of them. Looking at it from a selfish standpoint we men ought to support whisker races.

I do not know how long it will be before this new form of intercollegiate contest can be organized, with suitable coaches, captains, managers, cheer leaders, trainers, publicity men, and all that sort of thing, but in the time intervening the Engineering College might start something by challenging the other colleges of this university. It is claimed that tough, fast growing whiskers indicate virility, in which case it looks to me as if a contest of this kind between the colleges would result in a walk-over for the Engineers, with the Aggies the only others able to offer anything like competition. If this contest is brought about it might be started in the fall, both because of the desirable windshield effect of a beard in the cold weather and to accustom a man to the added weight and warmth in summer. To show that my heart is in this matter, I am willing to offer as prizes for first, second and third best beards of the Engineering College raised between, say, October 1 and June 1, gold, silver and bronze medals, total value not to exceed one dollar. Of course as donor of these emblems I cannot be drawn into this contest in any other capacity, whether it be referee, umpire, starter, or judge of finish. I want to say, however, that in case whisker races go over in a big way, and extend eventually perhaps to all the world, I would like to be remembered as the man who first recognized the latent possibilities here and fearlessly suggested them.

Well, perhaps I ought to quit with this, because anything I can say now must be only an anticlimax, a descent from the sublime to the unimportant. However, the moon is still hanging over the campus, and I have beside me a couple of fat books which contain educational statistics that might interest you. There are objectionable features about statistics, one of the most objectionable being that they tell things that no one wants to know. For instance, statistics tell us that the average man of the present lives to be, not three score and ten years old, but only fifty-seven. Pretty tough, isn't it? Regarding educational statistics, do you know that in the United States there are over six hundred institutions listed as colleges and universities, and that there are close to a million students in these schools? Do you know that in 1900 the number of college students was about 115,000, that as late as 1916, when many present day students were interested only in a milk bottle, the number of people in the colleges was about 260,000? But the total population of the United States in 1900 was 76 million, in 1916 about 100 million, in 1930 about 123 million. In other words, while the total population of the country in 1930 was far from being twice what it was in 1900, the college population in the same period became more than eight times as great. Now of course I cannot complain too much about the situation indicated by these particular statistics, because it is an undeniable fact that the more people there are in college the greater the number of profs needed. So I am not complaining. What I want to do is bring home the fact to engineering students that these statistics, showing a tremendous increase in the proportion of college students to total population, indicate the increasing severity of the economic struggle, and growing appreciation of the fact that the best way to meet it is with more training and education. Men in college today ought to be made fully conscious of the fact that upon graduation they are going to meet stiffer competition than college graduates in this country ever met before. There are considerably over a hundred schools giving courses in engineering. The competition between graduates of these schools for years to come will be keen, and it seems reasonable to conclude that the men who make the best use of their opportunities while training for the race will be the least handicapped when the race is on.

Well, as I warned you, statistics are as often as not unpleasant. But you must admit that they are sometimes enlightening. You might, I suppose, ask just what is the connection between these gloomy facts as stated and whisker races. I hardly know, myself, unless it be this: that the statistics advise putting no more energy into whisker races than the whisker races promise to be, in the long run, worth.

Let us turn to something of a more joyful sort. There is, for instance, the Tech Frolic, announced to take place March 10. The air is full of rumors concerning this event, but we can be pretty certain of this much: that it is to be held off the campus, that an eleven piece orchestra has been engaged, and that it is to be informal. Think of that, Engineers: good company, good music, and no high hats. This last, concerning the absence of high hats, is significant. There is something about a high hat which is depressing to the average man, and particularly to an engineer. Of course engineers have worn high hats, but I doubt if on such occasions they have felt perfectly natural, certainly not like engineers. I believe that the average engineer feels that high hats are more appropriate on solemn occasions, such as funerals or weddings, than at such a gay event as the Tech Frolic promises to be. Many students have the idea that the social side of life is of no great importance. Wherein such students are greatly mistaken, for it happens that the social is the most important side of life. Let me quote from the fine article of Maurice Dwight Bell appearing in the January TECHNO-LOG: "Engineering is more than dealing with materials and forces. *It is dealing with men.*"



Will next year's classes look like this?

YE SHOE - HORN

By OSCAR QUACKENBUSH FEGAS, B.V.D. '111

spring is caming

Nature has been up to her giddy tricks again, and here we are at the side door of another month. Sakes to Betsy, but the old world is stepping along like a pay-car passing a bum.

Midquarters have been here already—soon finals, and a short vacation—then some more exams and vacation. But don't forget the exams and all the glorious study that has to be done—and how we all love it! Remember, men, we must search for knowledge unflinchingly. Don't forget how long they looked for Gracie Allen's lost brother.

Oscar wishes you many pleasant nights of midnight oil. (The kind you burn, you dope.)

can you beat it?

In years gone by our one time Major (neanderthal man) Lentz would tell his cadets, when asked a question they did not know, they would receive as much credit for the answer, "I do not know" as for any other answer. (Editor's note: This made it very hard to pass the course.)

sum poetry

Here he lies
Poor Olaf Blopp,
He thumbed his nose
At a traffic cop.

who won?

Before going riding she bet her bashful freshie a carton of cigarettes against a box of candy that she wouldn't pet, and then asked him what kind of cigarettes he liked.

Fun With Electricity
or
Exciting Times in E.E. Lab.

Experiment No. 1. (by Ben Axilrod)

1. Set up voltmeter in parallel with large field winding.
2. Apply full D. C. voltage.
3. Open switch quickly and watch voltmeter.
4. Examine voltmeter and set down what you see, hear and smell.

Discussion: Could you have done more with a runaway street car?

Experiment No. 2. (by Paul Erickson)

1. Set up D. C. motor without starting box.
2. Close circuit. How do you account for the sparks and noise? How would you like to be the insulation?
3. After motor has started, pull out the field lead.
4. RUN LIKE HELL.

Discussion: Describe results. State number of people killed, injured.

Experiment No. 3. (by Sam Levy)

1. Set up 10-1 transformer with 220 volts on secondary.
2. Induce Lit student to grab two primary leads.
3. Ask Lit student for his reactions. (Note: In case Lit student refuses to speak, disconnect him and try another.)

The student may substitute an enemy for Lit student in this experiment at his own discretion. For personal good do not use instructors.

Experiment No. 4. (by Jerry Shepherd)

1. Try D. C. on a transformer.
2. Can you suggest a better substitution for fireworks?

Experiment No. 5. (by James Stottard)

1. Set up a coil of wire in series with several big condensers.
2. Close switch for two minutes.
3. Open switch and feel condenser terminals to see if they are warm.

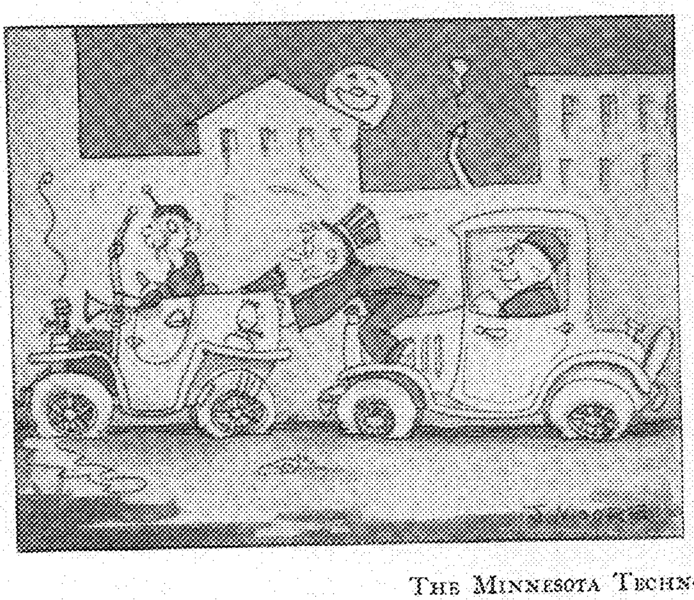
Discussion: Have some friend write the obituary.

figure it out

It is always interesting to hear about a new story as told by Professor Wilcox. More than once in years gone by he has yanked your old sourdough out of the clutches of Morpheus on a lazy morning by a little joke rather than some caustic remark.

Mr. Wilcox was considering the case of the individual "X." "Now there are two possibilities," murmured H. B. W. "Either he *is* a fool, or he is *not a fool*. Now by eliminating one of the possibilities, we can arrive at just what he is. And we do this by stating that he is not a fool."

Ketch un?



What instructor in Chemical Engineering was seen one night sitting on the radiator of one car pushing his own car with his feet while his sweetie steered the gas buggy after they had run out of gas?

the question box

Dear Oscar—How come your new "Question Box"? Haven't you got enough trash without this added unit?—*Wet Blanket.*

Answer—Yes, I had so much trash, that I had to get a Question *Box* to put it in.—*O. Q. E. D. Fegas.*

Dear Oscar—I like my gal very much, but I don't know if she would like to be told that she is the eighth wonder of the world. What do you think?—*Lovesick.*

Answer—That would be all right, but don't let her catch you out with any of the other seven.—*O. Q. P. X. Fegas.*

Dear Oscar—Our advertising this month is very low. We haven't enough to fill up the pages. What should I do?—*Ted.*

Dear Manager—Run an ad on the back cover and put in it "Compliments of a friend."—*Oscar (All-knowing) Fegas.*

P. S. Why don't you give up?

says ossie

Oswald, the P. O. cynic says, "Chaste girls of today are like money—easy to change, but hard to find."

the sport world

At football games one can continually see white puffs of smoke rising across the stadium where the boys are consuming the nicotine pellets. In a like manner one hears arise near him interesting remarks during a basketball game. The disjointed comments go something like this:

She: I bet that man with the green sweater doesn't know the rules very well.

He: Hey, ref, that's Minnesota and Carleton playing down there.

She: Oh,—why does that big fellow let that little man with the white pants take the ball away from him?

He: Hey, ump, there's an eye specialist over on fourth street.

She: They've played around that basket long enough. Why don't they come down to this one and play a while?

He: All right, ref, let's give them ten points and then play the game regular.

new wrinkle

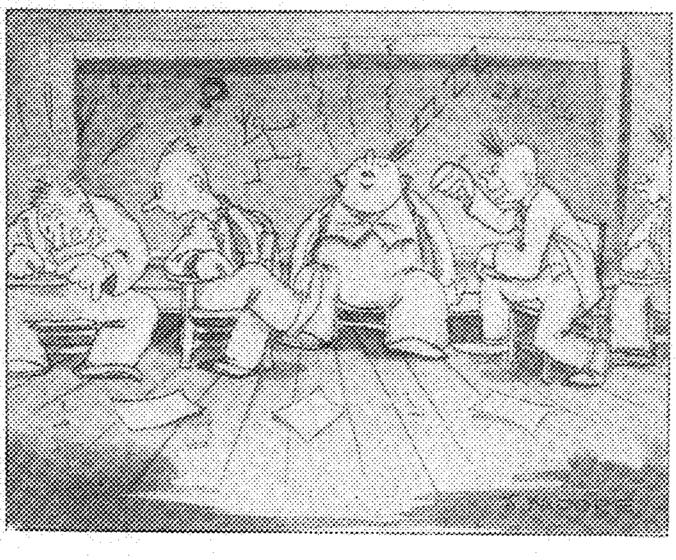
Who was that gentleman I saw you with last night?

That was no gentleman, that was an Engineer.

sad narrative

Who ever stopped to wonder what a lecturer's sentence thinks about? It probably goes something like this. Herr Doctor mutters, "The average sex life of a female bumble bee—."

Now take a row—take any row—of students—if you can find any single row of them where they're all awake. Examine student number one. He's sticking a wad of gum under the seat. Manages to write down in his notes, "The average sex life—" and then stops.

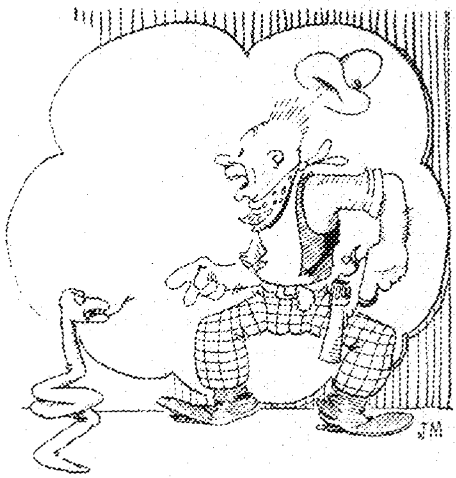


Person number two is slumping down behind the fellow in the seat in front, hoping to grab off a nap when the prof can't see him. He looks at number one's notes and copies a few words.

Number three is trying to make a date with the girl behind him. Finally he copies a few words from number two. By this time the prof. has gotten much farther along. Meanwhile— — —

Meanwhile, how about our poor little sentence? Just imagine what it would feel like to be transferred from notebook to notebook. Or can you imagine it?

Now let's take down our hair and have a good cry—or shampoo.



Consider the lonely Civil out in the great open spaces, and muttering, "No one loves me any more. Oh, why can't I die?"

To which the Asp answers, "I'll bite."

first prize

Lucian Voroahl wins the fur lined ear laps this month for the catchiest phrase of the day. As we strode into the Union with fosty icicles projecting from all over our face after navigating the arctic zone between the auditorium and the Mechanical Engineering building, he snapped, "Didja finally get across 'Hell's Half Acre'?" But since the advent of a new commandant, the boys have to think up some other answer. The other day Major Shippam asked what "D. O. L." meant. To which none other than our own Bob Bernier was called upon for answer. Said he, "Y'know, I've often wondered what that meant."

fun—dam ent al

Kenneth Goldblum was asked to use the word "fundamental" in a sentence. Without even scratching his head he replied, "When I broke a front room window by papa gave me a spanking and made me eat my supper fun da mentle."

Archie Japs has another solution to the question. Said he, "I am fund a mental tests."

What's your solution?

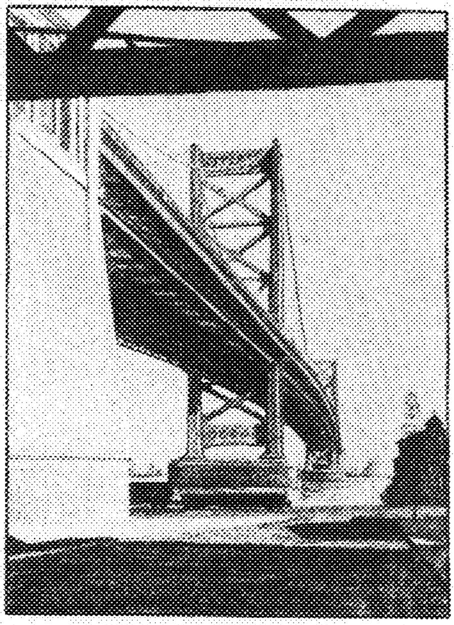
try this on your umbrella

It is reported that a symphony orchestra violin player recently "up and quit." Seems if he just couldn't play second fiddle to anybody.

famous last words

Now, professor, here's where you're wrong.

WITH OUR ARCHITECTS



The two pictures on this page are reproductions taken from the Scarab Travelling Sketch Exhibit. The one at the top is an interesting charcoal and crayon study of the Delaware River Bridge in Philadelphia. The composition is well conceived to give the bridge an appearance of its strength and stability. The handling of the medium of charcoal is well done, clear and concise. This bridge is one of the longest suspension types in this country, it stretches across the Camden River from Philadelphia to Camden, New Jersey. The skyline of Philadelphia is evident in the distance in the picture. This drawing is one from a group sent to the exhibit by Thebes Temple of Scarab at Pennsylvania State College.

The other reproduction is of one of the group sent in by Isis Temple at the University of Southern California. It is an interesting combination of pencil and Conte crayon. This sketch also has a good composition and a clear cut, concise technique, well suited to the type of industrial subject such as this. The accuracy and truthfulness to detail contribute much to the fresh look that the drawing has. The addition of Conte Crayon, which is a powdered chalk and is rubbed on to the paper with cotton, is an interesting note and it gives the drawing an interesting tone. Artists have found the beauty and good compositions in subjects like these two on this page after many years of shunning them to avoid the mingling of art and industry. All the forms that exist in nature are evident in the struts and braces and cable of the bridge, and the smokestacks and scaffolding and ventilators of the buildings in the gravel pit, only here the forms have all been worked out mathematically beforehand and all we draw is the answer.

▼

Just Amblin' Around

I took a stroll the other day to visit the architects and see what they were doing. And, hating stairs the way I do, I climbed them all at once to get it over "toute-de-suite."

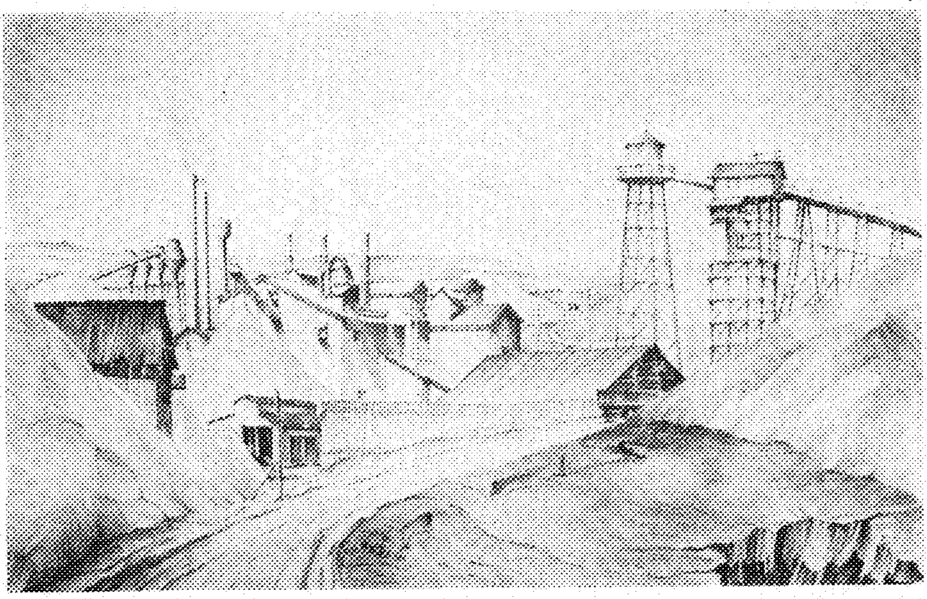
The sophomores up there under the roof didn't have much to show because they were just starting a new problem, but they told me all about the long problem they had handed in. It was a railroad station built on two levels, with the tracks and small waiting rooms on a hill about fifteen feet higher than the land in front, where the main part of the station was situated. I went down to the third floor hoping they would have been judged and hung in the hall, but they hadn't been, so I went on into the senior room.

Most of the interior architects were gone, for they had just handed in a problem, too. They had designed a modern flower shop and, before that, a Jacobean library. The latter had been judged, and first mentions were given to Ella Stucky and Alice Linsmayer, while Helen Hammond and Dorothy Wilson received mentions.

The architects' long problem and twenty-four hour sketch problem had also been judged. In the long problem, Everett Young, Kenneth Lundberg, and John Huchthausen had received double checks—the sign of a mention. The design was a ballroom with adjoining foyer, lounges, etc., and I hear it was quite interesting to see the architects do an interior for a change. In the sketch problem, which was the study of a college group, Kenneth Lundberg, Everett Young, and Henri Bruner carried off the honors.

Seeing no one else here to bother, I sauntered down the hall to the junior room and found everyone hard at work. It was the third or fourth week for them, and they had more to show. They were working on a high school building. The first part of the quarter they had designed a bridge and customs houses for the U. S.-Canadian border at Pigeon River. Austin Fraser had placed first in this and Day Woodford, Aaron Wabash, and Loren Abbott had also received mentions.

I went across the hall to call on the graduates, but their door was locked. They were all out looking up material for the Housing they are carrying on, so I went on down to 225. The freshmen there were working on an analytique of a niche, which was also to be a study of a Grecian order. In the other end of the room were the architectural engineers, and, not being a partial person, I went over to visit them too. They have had four problems this quarter, a water tower, a textile school, a fire station, and a community building. The textile school and the community building, which they were working on when I talked to them, are longer problems.



Realization of a Dream of an

Air Service to the Northwest

By HENRY B. PITTELKOW, Aero. E. '31

WHIMSICALLY speaking, air transportation began about ten seconds after the gods of destiny created the universe. Whether the first ten seconds were a million years or more, no one really knows and it probably does not make any difference, but in all probability they represented but an eight hour working day at the time. Regardless of this, however, after creating the greater part of the universe and probably impishly setting those parts so created into motion, the toiling gods must have been amazed by the furore stirred up in the heavens and must have sought hurriedly to set the solar system on some kind of an efficient schedule. Stars and planets had to be routed, constellations given certain air lanes, an express schedule arranged for the sun, an accommodation special charted for the moon; and with it all seasonal fluctuations had to be considered. Probably it was during that ten seconds lapse between the creation and the scheduling that the earth was born, for it is well known that the earth was originally connected in some way with the sun, and it is only reasonable to assume that the heat liberated when the sun came in contact with some unlicensed barnstormer of the heavens was too much for the poor earth to endure.

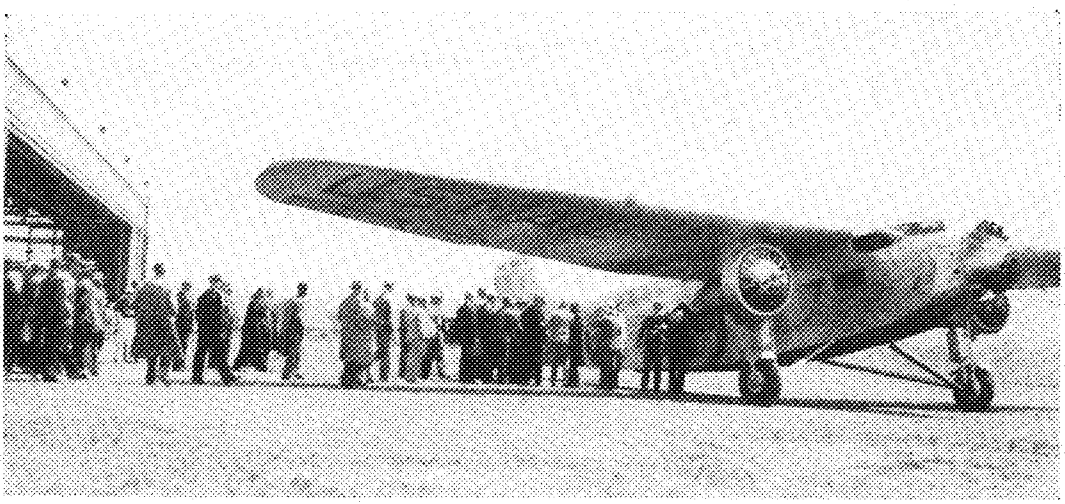
Doubtless this accounts for man's efforts to soar into the skys in an attempt to emulate his forebears and regain for the earth its former location in the sun. However, like all children whose first attempts to imitate the parent are treated with amusement and scorn, this child of the earth who thought he could fly by flapping arms to which he had attached various accessories, suffered the extreme excruciations of pain for many years before the Wright Brothers back at the turn of the century grabbed the bull by the horns, metaphorically speaking, only to discover themselves staring it in the face. Invention is born of necessity, 'tis said, and as this was no exception, the Wright Brothers finding themselves in a peculiar position responded eloquently and mothered the invention. Thus was the child—the airplane—born, and although he was extremely fragile and wobbly at birth, he quickly responded to the drastic treatments given him by the various intrepid souls who dared to allow their names to be associated with his. Under these treatments, and treatments which were not always given with loving care, the child progressed after the first few weeks slowly and indifferently until about 1914, when with all the world hysterically engaged in blood fueds, he ...denly burst through his ...restrictions and be...y engaged in the same conflagration. Before long he was high in the air above the fighting lines of the army, heaving, throwing, and otherwise manipulating bricks at his brothers who were also his enemies.

Probably more damage was done by the bricks when they landed on the ground below than was done while they were in the air, for it was only a short time before all earthbound combatants were going about their business with coal scuttles upturned over their heads and orders had been issued to equip the youngsters with rifles. Summarily this order was also rescinded and machine guns, then also a youngster but since grown to manhood, were added to obtain a lustier conflagration.

Now naturally this youngster who had known the privations and hardships of boyhood, and who had endured the presence of death and destruction in his youth, could not and would not give up and passively die in his early manhood. He demanded action, vigorous action—action that fitted his talents and at the same time gave him an opportunity to fill the gaps created in his uglier moments; and Uncle Sam, recognizing his possibilities and remembering his destructfulness in time of war, soon gave him a job and put him to work—to work carrying the airmail.

Carrying the airmail from New York to Washington, that was the first constructive job, and on May 15, 1918, under the direct tutelage of the Post Office Department, the first flight was made. The occupation was successful, so successful in fact that on July 1, 1919, the Post Office decided to experiment with the route from New York to Chicago, and that route having shown great possibilities, on September 8, 1920, it was extended west to the coast at San Francisco.

At about this same time, the Post Office Department decided to establish feeder lines to the transcontinental route, and one of the first to be considered and approved was the route from Minneapolis to Chicago via La Crosse, Wisconsin. This route was established and the first trip was made with

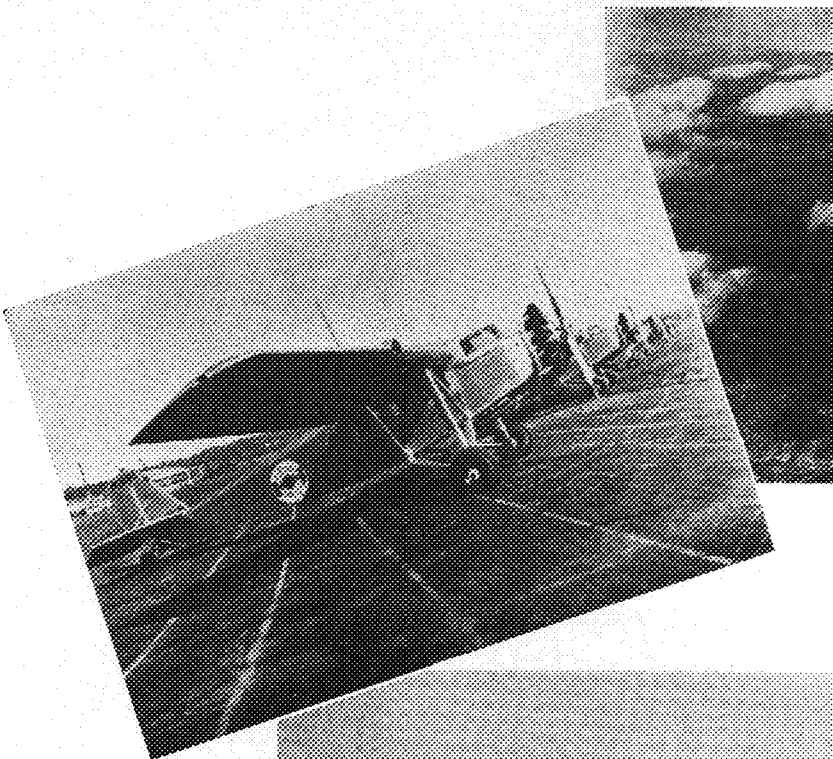


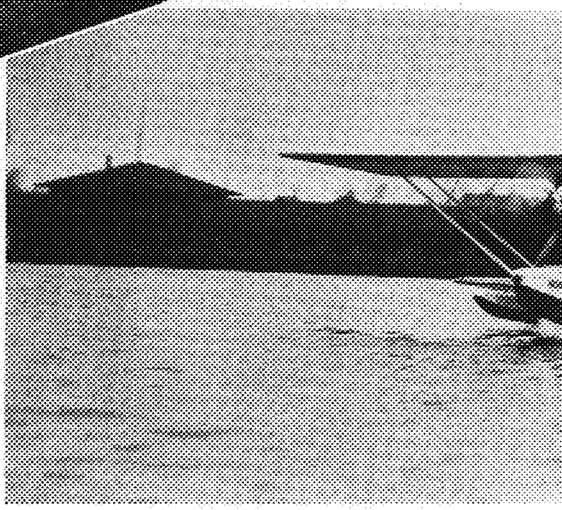
Travelers boarding a fast, comfortable plane at a Twin Cities airport—soon to find themselves in Chicago.

mail on September 1, 1920. For the sake of safety, one intermediate landing field was established, at Lone Rock, on the Wisconsin River. The line, like the others then in operation was handled directly by the Post Office Department and the equipment consisted of surplus war materials which included converted Martin bombers, single and twin motored DeHavilands, Hisso Jennies, and Hisso Standards. The operating base was located at what was then the Speedway field but which has since become the Wold-Chamberlain Airport, and the personnel was war trained. The original schedule called for one round trip a day, but because of the fact that the route traversed two great water sheds, the Mississippi and the Great Lakes, it proved to be a hard one to operate, and before operations had progressed very far, a serious shortage of equipment was encountered. Operation of the line was discontinued about June 1, 1921, but only after eight ships had been crashed and four pilots killed.

After the failure of this line, the other feeders to the transcontinental were all discontinued, and the Post Office concentrated on the transcontinental route in order to obtain experience and practice in the art of flying the mail.

No further attempt was made to fly the airmail from the Twin Cities to Chicago until 1926 when the Post Office Department let the routes out on contract. Charles Dickinson bid for this contract in the northwest and secured it. The contract called for operation over a route from Minneapolis-St. Paul to Chicago via La Crosse and Milwaukee, Wisconsin, and operation was to be begun June 7, 1926. A rate of 20c per ounce was established for letters from Minneapolis to Chicago and intermediate points were served on a zone basis. For his operations, Mr. Dickinson chose two OX-5 Laird biplanes, one Whirlwind Laid biplane, and one rebuilt cabin plane. His pilots were Billy Brock, Nimmo Black, Dan Kaiser, Henry Keller, and Earl Patridge.





(*Above*) A fleet of all-metal, hornet powered Hamilton Monoplanes. (*Right*) A Sikorsky amphibian taking off at Duluth.

Extremely bad weather was encountered on the opening day and difficulties pursued the organization throughout its period of operation, so that in August, 1926, Mr. Dickinson announced that he would have to discontinue operation on October 1, 1926.

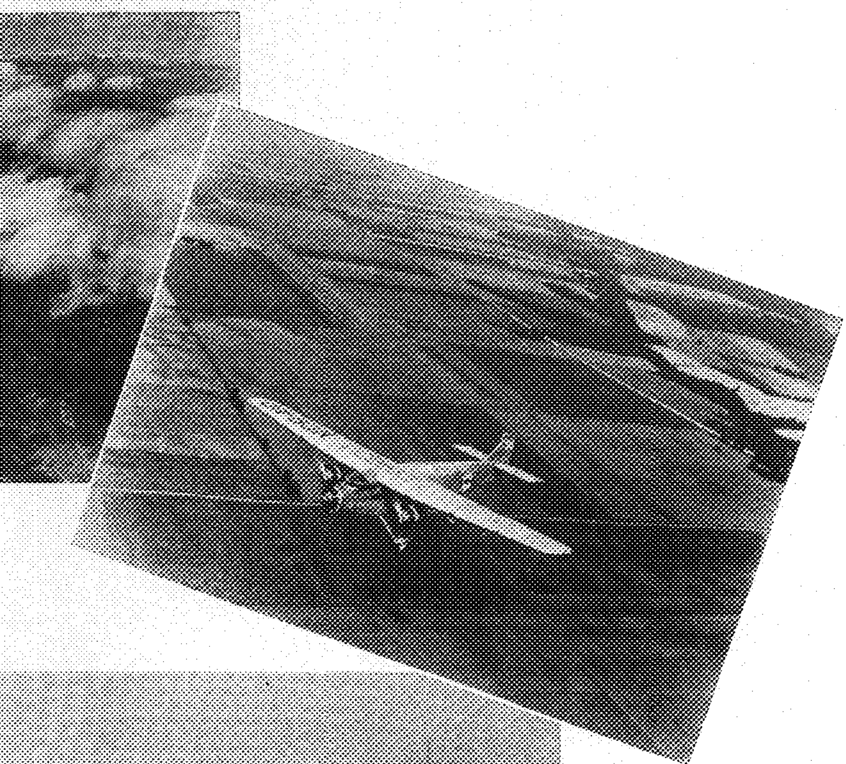
At the time of the inauguration of this second service, St. Paul had had no field of its own, but immediately after the inauguration, it set about securing the site whereupon the Holman Municipal Airport is now located. Consequently upon the announcement by Mr. Dickinson that he would have to discontinue the operation of the air line, St. Paul found itself with an airport but no air service. Accordingly certain St. Paul business men who were loath to see the new industry fail without a fair trial, resolved to organize a company to carry on the project. Of this group, Col. L. H. Brittin was the dominating figure, and it was through his sincere efforts and clear foresight that the Northwest Airways was created and has since reached its present eminence as the finest airline in the west.

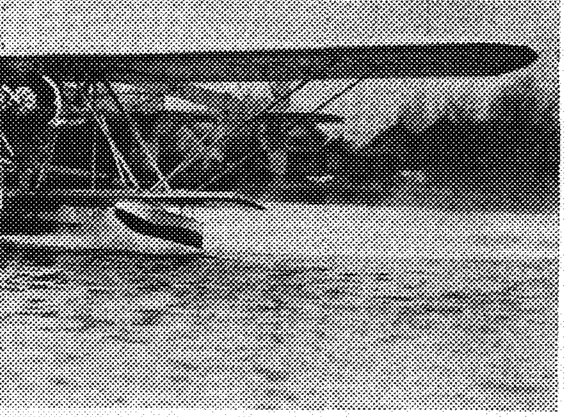
Operation, under the new organization, was begun on October 1, 1926, the day after the discontinuation of service by the Dickinson company. Because of the rapidity with which the new firm had been formed, the equipment on the opening day consisted of one OX-5 Oriole and one OX-5 Thomas Morse, which ships were flown by David Behncke and Chester Jacobson, the first pilots of the company.

From the beginning the new company was destined to be successful, albeit it took extremely efficient management to insure this success, and by November 1, 1926, one month later, it was necessary to enlarge the equipment. For this purpose three Stinson Detroiter cabin planes seating three passengers and equipped with Whirlwind engines were purchased. They represented the largest and finest transport planes in operation at the time.

The service was operated on a schedule of five round trips a week, with departure from Minneapolis in the afternoon and with the return trip scheduled from Chicago on the following morning. No passengers were carried for the line was still operating without the benefit of intermediate landing fields, and the new organization depended entirely upon the air mail for revenue. By July 1, 1927, however, intermediate fields had been created and as the summer was coming on, a passenger service was inaugurated. This also was an immediate success although the one way fare to Chicago at the time was $40.00, and in October of the following year, it became necessary to operate on a seven day a week schedu

Then in 1928, a new idea was born of the Colonel began to negotiate with the railroads for a co-ordi





(*Upper Center*) How the clouds appear to the air traveler. (*Above*) Minneapolis-Chicago travelers get a bird's eye view of the country.

rail service. This was a radical departure from accepted usages, and had never before been suggested in the history of transportation, but the idea was sound and very shortly the negotiations for the first co-ordinated air-rail service were consumated. The railroads entering into the negotiations and the arrangements were the Northern Pacific, the Great Northern, the Milwaukee, the Pennsylvania, and the Baltimore and Ohio, and under the schedule arranged, passengers coming into the Twin Cities from the west by rail could transfer to the fast air transport for a three and one-half hour flight to Chicago where they could transfer to either the Pennsylvania or Baltimore and Ohio, and so save between eight and ten hours of train travel. Travelers soon flocked to this new service, and scores of letters piled into the office of the company congratulating it on the service. These letters were appreciated and are still very much cherished, but the Northwest Airways quietly forged ahead, firmly believing they were just doing their duty in bringing the finest of fine travel facilities to the northwest. To properly handle the travelers depending upon this service, two Wasp powered Ford Trimotored Transports were bought and put into operation on the Chicago flight. This also was a departure from regular proceding and introduced for the first time the Wasp powered Ford on the regular transport lines.

In the latter part of the year, permission was asked of the Post Office Department to establish and operate an airmail route in the Fox River Valley of Wisconsin. For the inauguration of this service, the three original black and gold cabin planes that had brought air passenger service to the northwest were transferred to Milwaukee for operation over the Milwaukee-Green Bay schedule which had intermediate stops at Fond du Lac, Oshkosh, Appleton, Neenah, and Menasha, Wisconsin. As on the Minneapolis-St. Paul-Chicago flight however, these planes soon became too small to handle the flow of passengers, and it became necessary to retire them in favor of the 6-place all-metal Hamilton monoplanes which had been used on the Chicago flight but which had also become too small for that route.

These two lines then, supplemented with a second passenger service to Chicago via Rochester, Minnesota, provided exclusive transportation to the northwest until August, 1929, when, the airmail becoming increasingly heavy, it was necessary to operate a third service over the Minneapolis-St. Paul-Chicago route. This latter service was flown in both directions at night in order to provide a flight to business men that would allow them to mail their correspondence after business hours in the four cities along the route of Minneapolis, St. Paul, Milwaukee, and Chicago, and most other midwest cities, and still have delivery on the first distribution in the morning.

In March, 1930, airmail, passenger and air express services were inaugurated between Chicago and Madison via Rockford, Elgin, and Janesville, Wisconsin; and in February, 1931, the same services were inaugurated between Minneapolis-St. Paul and Winnipeg via Fargo and Grand Forks, North Dakota.

In May, 1931, the Duluth service was inaugurated and in June of the same year, the service to Fargo was extended as far west as Mandan via Valley City and Jamestown, North Dakota.

The Northwest Airways have in every case used the type of aircraft particularly adapted to the route being flown, and for this reason all-metal Trimotored Fords are used exclusively between the Twin Cities and Chicago while Hornet powered all-metal Hamiltons are used on the other lines with the exception of the Duluth route where a Twin-motored Sikorsky is used because of the excellent amphibian landing base only a mile from the center of the loop. For the carrying of the night mail however, where no passengers were accepted, high speed Wasp powered Wacos were used. With Waco equipment on the night flight, extremely large mail compartments were available and a high cruising speed could be maintained.

With these routes and with this equipment then, the company made no attempt to expand its territory for it was serving a territory covering the entire middle west extending from Chicago to Winnipeg and from the Great Lakes to Bismarck, North Dakota; but concentrated every effort upon placing the finest and most efficient equipment and accessories in service.

In line with this progress, one of the first projects requested was the lighting of the airway from Minneapolis to Chicago, and this route via Milwaukee was soon equipped with the best in beacon facilities. Plans are even now being

[*Please turn to page 159*]

The MINNESOTA TECHNO-LOG

UNIVERSITY OF MINNESOTA

ENGINEERS . . . OR MEN?

SUCCESSFUL engineers must be able to meet people—to gain their confidence—and to talk intelligently with them. Some, it seems, are born with the gift of personality; others not so fortunate must develop themselves along social lines if they are to succeed in life. Engineers are, as a whole, rather at a disadvantage when in the presence of those having more cultural tastes; some engineers are actually afraid to talk to ladies, young and old.

Engineers! You have before you clear evidence that your technical training will be little in demand for some time to come. Industry today wants more than technicians—it wants men who are able to sell themselves—who are able to use their engineering training to full advantage—it wants men who are able to convey to others what they do know, rather than men who know a lot but keep it to themselves.

Develop your personality—get out and meet more people—talk to your professors whenever you have a chance—talk to everyone you meet, even if you have to discuss the weather—start going to dances, and get acquainted with the ladies—and above all, make many friends. If you do these things, you won't have to worry about work after graduation—your social contacts will take care of that.

You say you hesitate to start this program—well, here's an opportunity to get going with a bang. Make a date for March 10th—the night when every loyal follower of Saint Pat will be at the first annual Tech Frolic. Dance here to the soft strains of an orchestra you have heard many times on the radio—get really acquainted with those boys with whom you have worked and studied all these days—revive those engineers' cheers that were so popular when arc lights lit our campus at night. Just be yourself for once—forget about exams and reports, and you will all have the time of your lives. —L. M.

WHY A FIVE YEAR COURSE?

ARE our Engineering courses out of date? Are we getting as much as we have a right to expect from our four years of technical study? Is the training which we receive at school of such a nature that when we graduate, we shall possess knowledge which is of value to industry? These are serious questions for every student engineer. It is evident from the situation today that the world needs 20th century men with a 21st century education, rather than men with an education ten years old.

Industry today needs men who have the technical background that engineering gives them, plus the fundamentals of business economics, the fundamentals of psychology, and an appreciation of the cultural things in life. It needs men who have foresight—men who are able to combine their knowledge of economics and social conditions with a technical training in such a way as to eliminate over-production and the consequent periods of depression in industry.

There are some men who will never be happy in highly technical work; for these our present four year engineering course is satisfactory. For the remainder, a five year engineering course must soon be offered, if our graduates are to find a place in industry. In this course should be included economics, to teach the holiness of the laws of supply and demand; psychology, to teach those whims of human fancy which are so important in industry; general business law, to help avoid expensive law suits and legal entanglements; commercial geography, to give a bird's-eye view of the location of markets and raw materials; writing and public speaking, to give to engineers the ability to sell themselves; and courses in general culture.

The world needs only a few brilliant engineers for research, but it is today in sore need of executives—men who can co-ordinate engineering and human nature. —H. J.

OPEN SESAME!

THE question of the revival of the "Arabs" has arisen again as it has each year since the last production was staged in 1929, which resulted in financial disaster and near destruction of the organization. As matters now stand there is no organization. There is, however, an outstanding debt of about $175 which is owing to the Engineer's Bookstore, and which should be paid if the Arabs are to go forward on a sound basis.

Whether the possible revival is worth the effort necessary to its accomplishment or not, hinges, I believe, on the question of need, and the question of good to the college rather than on the question of ability and talent. It has been shown over a period of years that students with the ability to write lyrics and music, other students to produce stage settings, and still others to manage the productions were always available. Personnel for the necessary orchestras was always at hand, and this year more than in almost any former year, is the technical group well fortified with orchestra talent. Men from our portion of the campus are members of the University band, and as such have proved by competition that they are ready for the requirements of just such an orchestra as an "Arab" production would require.

Why then, were the "Arab" shows either mild successes or failures? Why were the productions oftentimes ragged and amateurish? Why did the productions almost invariably lose money, when a substantial profit could have been realized?

It is my opinion that lack of success went hand in hand with the lack of appreciation of the stupendous amount of hard and tiresome work involved in staging each show. There was lack of appreciation of the imperative need of a thoroughly organized managerial plan which would include a sustained sales program. Also there was lack of vision which should have pictured the "Arabs" as a going concern which could be of service to the Engineering College and the University year after year, and throughout each year.

What then is the remedy? In my opinion, which I have been requested to express, the following are some of the necessary elements. First, a firm belief among the student body that there is a need for the organization because there is a service which it can perform for the technical campus. Second, a service to be performed for students by providing a means of expression for writers of lyrics and music, for stage designers and artists, for salesmen, and managers. Third, an organization so formulated that its progress and program would be continuous, not only throughout each college year, but from year to year. Fourth, a comprehensive summary of all available talent; musical, dramatic, artistic, and managerial. Fifth, a definite and friendly understanding with the Deans and faculties as to the purpose of the organization . . . this purpose to include, as a major element, a constructive plan of service to the college and university.

Toward the successful accomplishment of the above suggestions I wish to indicate a plan which I have had in mind for many seasons, a plan, which I firmly believe, would make the "Arabs" a useful and appreciated addition to the entire University. This plan contemplates the organization of an "Arab" glee club and orchestra, both to be continuous throughout the college year, and to continue in each succeeding year.

The need for a glee club, particularly, is obvious. There is no men's glee club in the entire University, and a splendid opportunity for pleasure and service is being lost. Incidentally, an "Arab" orchestra could be made a paying proposition to its members. If our technical group could boast of both glee club and orchestra, the musical success of any future "Arab" production would be assured, and the name would be so well known that ticket sales would be appreciably helped.

There is no valid reason why Minnesota's "Arabs" could not be brought to a plane comparable with Michigan's "Mimes" or Wisconsin's "Haresfoot," but it cannot be accomplished by short lived annual outbursts of frenzied enthusiasm. It requires the sustained best efforts of all the talent available.

—O. S. ZELNER.

OUR PLATFORM

Awaken the Arabs

Advance Registration

A Five Year Engineering Course

More and Better Social Activities for Engineers

Let the Milk Companies Serve the Engineers

ON REGISTRATION

A FEW years ago the faculty of the Engineering College abolished the system of advanced registration as it then existed. They gave as their reason for this act, that the students for whom the system was designed, and whom it was to benefit, were not taking advantage of it.

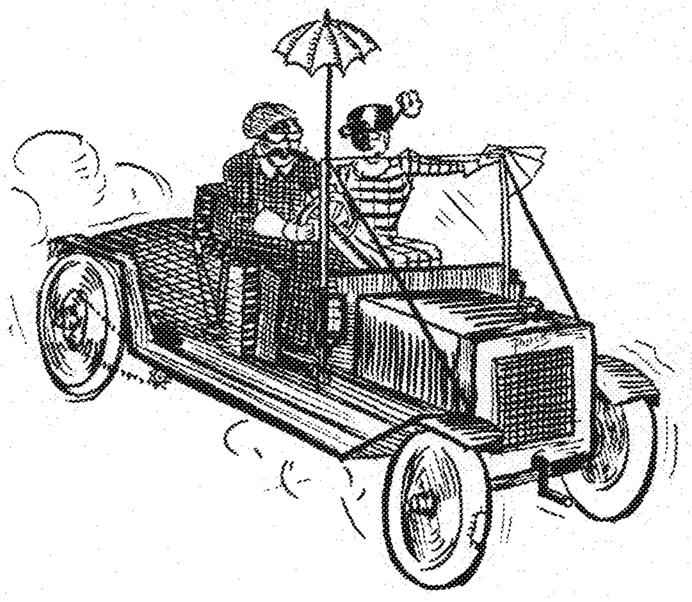
Briefly, the system then used was this. All students having no grades lower than D and not more than one D at midquarter of any particular quarter, were permitted to register for the next quarter several weeks before the end of that quarter. This, of course, gave them several extra days on each Christmas and Spring vacation which we all know are short enough anyhow.

Granted that the faculty were right in their decision, and that the situation as they analyzed it did exist—why was this the case? It is beyond question that students living outside the twin cities (and even many of those living within the cities) would save, not only several days of valuable vacation, but actual dollars of living expenses if they did not have to return to classes until the Monday after vacations.

Although we hear more or less comment about advanced registration it is doubtful whether there are a sufficient number of students who could and would care to take advantage of it, to make it practical to reinstate the system.

A survey, more or less general, must first be made to see whether there is really any desire among engineers for early registration. If it is found that such a desire exists, steps should be taken to prove to the faculty that the plan is worthy of a second trial, and to convince them that if such a plan is adopted, all who have the privilege of taking advantage of it will do so.

—R. E. M.



ALUMNI

What Are You Doing?

Architecture

'22—R. E. Ost cheerfully remarks "I am married and have a future football player now one year old."

'30—Floyd A. Peterson is Junior Engineer with the U. S. Army Engineers at Duluth, Minnesota. Floyd's present address is 1604 East Superior St., Duluth.

Chemistry

'23—L. L. Wyman is at present working in a very interesting part of the General Electric Company. He takes care of the microphotography section of the Research Laboratory. He may be reached in Schenectady.

'27—John L. Beal is continuing his graduate work at the School of Chemistry and is assisting Doctor Mann in the Chemical Engineering Division.

'31—Oscar J. Swenson is continuing as an assistant to Doctor Stoppel in Technological Chemistry this fall.

'31—Ray B. Wakefield received his M.S. in Chemical Engineering this year. During the past summer Ray has been working with the LeSeuer Canning Co.

'31—Charles C. Winding is back, successfully holding down his assistantship at the School of Chemistry, University of Minnesota, this fall.

'32—Kenneth C. Johnson, R. E. Peck, and Edgar L. Piret are among the new appointees to assistantships in the School of Chemistry.

Chemical Engineering

'14—Howard Vincent Merten has his place of work far from the old homestead. His family in Charles City, Iowa, write that Howard is Superintendent of Blast Furnace, Tata Steel & Iron Co., Jamshedpur, India.

'18—Foster A. Burningham, who is a Research Chemist with the Brown Company, Berlin, New Hampshire, cheerfully remarks that he has one son eleven years old on the road toward the University. Foster's present address is 29 Tenth St., Berlin, New Hampshire.

'32—M. B. Hoffman is not discouraged by the scarcity of remunerative positions that the current depression has occasioned but has taken matters in his own hands and is now on an auto trip in the South and Southwest looking for a job. We wish him luck and a pleasant trip.

'22—Herbert A. Pagel, who received his Ph.D. in 1927 and is now an instructor at the University of Nebraska at Lincoln has just written in with great jubilance to announce that he is the father of an eight and one-third pound boy. Congratulations, Herb.

'29—Howard C. Draper it seems has branched out just a little since leaving school and is now a successful electrical contractor in Mankato, Minnesota.

'32—Russel Miller provided the Techno-Log with material for what is perhaps the biggest scoop of the year. The fact is he got a job with the Postum Cereal Company Incorporated in Battle Creek, Michigan.

'32—W. W. Tholstrup is working for a Twin City milling concern, besides doing some graduate work at the School of Chemistry.

Civil Engineering

'03—Frank C. Hughes, who is the Sun Life Assurance Co., 624 Baker Arcade Bldg., Minneapolis, indulges in the gentle art of Contract Bridge playing as his favorite pastime.

'10—George M. Garen is Assistant Superintendent of Construction and Repair in the Department of Public Works, St. Paul. Mr. Garen's home address is 2101 Randolph St., St. Paul.

'20—D. J. Bleifuss who is residing at 3248 Beaconhill Ave., Dormont Pittsburgh, Pa., boasts that he is the world's worst golfer, but nevertheless has two girls, five and one year old.

'27—Gustave C. Brohaugh may be reached at 1246 University avenue, St. Paul, where he is resident engineer for the Minnesota State Highway department.

'28—O. K. Normann dropped into Professor Zelner's office on his return to Omaha, Nebraska, after a nice Christmas vacation with his folks at Hopkins, Minnesota. Mr. Normann is employed by the U. S. Bureau of Public Roads and has been traveling extensively during the past four years. In 1930, while in Red Bay, Alabama, he married Evia Morrow.

'31—Lester R. Anderson is with the Minnesota Highway Department as draftsman. He writes that he was married to Evelyn O. Olsen on May 28, 1932. We certainly wish you lots of happiness and the best of luck for the future, Lester. Mr. and Mrs. Anderson are now at home in their bungalow at Breckenridge, Minn.

'30—R. E. Hertel recently visited Professor Zelner and disclosed the fact that after a pleasant summer and fall in the Beartooth and Shoshone National Forests working on a new entrance to Yellowstone National Park, he is spending a month's furlough in Minneapolis.

Electrical Engineering

'98—E. P. Burch, who has offices as consulting engineer and analyst on the 19th floor of the Foshay Tower, is taking a post-graduate work in Engineering Geology at Minnesota. His home address is 1729 James Ave. S., Minneapolis.

'10—Vernon S. Beck is now the owner of the Combustion Equipment Manufacturing Company. For the past five years, he has been chief engineer for a manufacturing company at Winfield, Kansas. He says that he enjoys the new responsibilities of having his own company. His business address is 4525 Euclid Avenue and his home address is 5463 Delmar Blvd., St. Louis, Mo.

'15—R. Skagerberg, chief engineer of the Blandin Paper Company, Grand Rapids, Minnesota, has a very encouraging message for some of our Mechanical Engineers and others. He writes, "Eleven years' experience in the paper industry has convinced me that this old industry needs young Mechanical Engineers who are willing to learn the business from the ground up." Mr. Skagerberg certainly does not share the opinion of some of the rest of us that the depression is something to cry about. His present home address is in Grand Rapids, Minn.

'17—Ward E. Becker has strayed from electrical engineering to the Ordnance Department of the United States Army. He is Associate Professor of Military Science and Tactics in the Ordnance Engineering at the University of California, Berkeley, California. Letters to Ward may be sent to him in care of the Adjutant General, War Dept., Wash., D. C.

'20—Victor H. Carlson has recently severed connections with the Chile Exploration Co., Tocopilla, Chile, after 12 years of service. His present address is 3538 Colfax Ave. N.

'23—Charles M. Burrill is at present research engineer with the Rogers-Majestic Corp., Ltd., 622 Fleet St., Toronto, Ontario, Canada. His home is 126 Beresford Ave., also in Toronto. He writes, "While at the annual convention of the IRE at Pittsburgh, I saw Henry Forbes (E.E. about '22) who is now with Delco-Remy at Dayton, Ohio. Also saw Robert Gunnell (E.E. about '22) who is now with Union Switch and Signal Co. at Swissvale, Pa. Bob has just recently married."

'24—Chauncey L. Greene is the Sound Picture Projectionist of the RKO Orpheum, Minneapolis. Chauncey recently presented a paper before the Society of Motion Picture Engineers on "Standards and Requirements of Projection for Visual Education." His home address is 2722 Harriet Ave., Minneapolis.

'25—Jeffery L. Lund notifies us that he has recently changed his address to 915 Eddy Road in Cleveland, Ohio. Mr. Lund is at present employed by the General Electric Company of that city.

'25—Harold E. Hammer lets us know that he is Superintendent for the Hess & Monneyham, Inc. people at 507 1st Ave., Dallas, Texas. Home address is 615 First Ave., Dallas.

'25—Roland W. Holmes, Stress Analyst of the Curtiss Aeroplane and Motor company, is getting lonesome, and writes "would be glad to get in touch with my alumni in my vicinity. My address is 60 W. Girard, Kenmore, New York."

'28—Glendon C. Brown is with the engineering department of Cutler Hammer Corp. His address is 925 So. 38th St., Milwaukee, Wis.

'29—Kenneth J. Granbois is one of those few men who can hold two positions, for he writes that he is employed by both the Pennsylvania Water & Power Co., Holtwood, Pa., and Safe Harbor Water Power Corporation, Safe Harbor, Pa.

'30—Harry P. Bruncke writes from 1719 Emerson Ave. So., Minneapolis, that Harry Jr. is now a year old. Harry Sr. is engineering assistant for the Northern States Power company of St. Paul.

'31—Kirk Buchak graduated from the Signal school at Fort Monmouth, New Jersey, last June. His home address is now 534 So. 33rd St., Omaha, Nebraska.

'18—Harold Brooke writes that he is assistant chief engineer with the General Spring Bumper Corp., a division of the Houdaille Hershey Corp. of Detroit. His home address is 15423 Wildemere, Detroit, Mich.

Mechanical Engineering

'12—William P. Brown writes that he enjoyed the football dinner last fall at San Francisco. He is a partner of the Brown Bros. Welding Co. and secretary of the National Welding Equipment Co., both of San Francisco, and is living at 680 Mandana Blvd., Oakland, California.

'19—Raymond J. Bros is with the Wm. Bros Boiler and Mfg. Co. here, and is now secretary of the firm. Ray's home address is 4341 Lake Harriet Blvd., Minneapolis.

'27—Bertram K. Hovey is now studying mathematics over his daily stein of beer at the Georg August University, Goettingen, Germany. Bert received his M. S. degree at the University of Pittsburgh in 1931. His present address is Stegemuehlenweg 57, Goettingen, Germany.

'23—Grant C. Bergsland, superintendent of the Street Railway and Bus System of the Mississippi Valley Public Service Co., writes to let us know that he can still be found at his old address, 1501 Vine St., La Crosse, Wis.

'25—Rolland W. Holmes writes that he is still on the job with the Curtiss Aeroplane and Motor Company at Buffalo, New York—as is also his former classmate John I. Soura '25, who is on the General Motors Engineering staff at Detroit.

'25—Frank A. Morris recently returned from Finland where he works for the Insulite Company of Finland. Temporarily he is located at San Marcos, California.

'26—Paul R. Burt is an exchange engineer with the Northwestern Bell Telephone Co. in Minneapolis. He married Miss Mamie Peterson (Minn. Ed. '25), and they have a 2-year-old daughter, Bettie Joan. His home address is 4536 York Ave. S.

'28—Tyle Cook, who is working with the U. S. Navy at Washington testing ship models, was visiting at the campus during the holidays.

'31—R. C. Jordan, H. C. Herrmann, Anton Schwertfeger, and C. H. Pesterfield, research fellows, are in their second year's research work in heating and ventilation. This project is being sponsored jointly by the University of Minnesota and the American Society of Heating and Ventilating Engineers. When they complete their theses, we have hopes of being able to tell the landlady how to keep that third floor corner room warm enough so that we can study without using mitts and earlaps.

'32—George Hama is working part time for the State Board of Health.

Oscar Spills the Dope on THE TECH FROLIC

YESTERDAY mornin' as I was a comin' thru the P.O., I noticed my old friend Oscar Q. Fegas (himself) standin' in front of the window in the front of the P.O. Says I, "H'ya Ossie, watcha doin' here?"

Says he, "I sees a sign up in the engineering building which says that the Engineers is goin' to have a big party on March 10, and I rushes right over here to get my ticket before they was all sold out—only it looks like they's all sold out already or else maybe they ain't started sellin' yet. Anyhow, since I been hearin' everybody talkin' about what a swell party this is goin' to be, and as how everybody is plannin' on goin', I figures it's best for me to get first in line for the tickets."

Now, as I know Ossie, he never was very much interested in the women folks, or in such things as parties or dances. So, naturally, I'm very much surprised, to say the least, to hear him talking this way. So I asks him, "What kind of a party is this goin' to be, anyhow?"

"Well," says he, "It seems like as how they ain't tellin' everybody all the p'ticulars about it, but from what I heerd it's goin' to be the biggest social doin' which was ever held by Engineers."

Of course, all this secrecy makes me very inquisitive, so I tries my best to get Ossie to tell me some more. Finally he gives in and says, "Now I know you ain't much good at keepin' your mouth shut, and furthermore, you're workin' for the TECHNO-LOG, and I suppose you'll print everythin' I tell you, but I'll tell you anyhow. I was standin' outside the TECHNO-LOG office the other day and I heerd several guys in there talking about a big Engineers ball.

"I heerd them say they had a big 'leven piece band hooked or booked, or whatever it is they call it. They're goin' to hold it in a swell hotel downtown, they said, but it's goin' to be strictly informal."

When Ossie mentioned the swell hotel, I began to get a little scared, on account as how I ain't 'xactly familiar with all the rules of ettiket in a hotel. So I says, "Don't you think that will be kind of too ritzy for the Engineers?"

And he says, "Say, so far as ettiket goes, that hotel ain't no different from the Union, I heard them guys say that. They're going to make this such a swell party, that everybody is goin' to have such a good time, they will forget all about the old hotel, and just enjoy himself like he would at any brawl back on the campus."

That makes me feel much better, so I asks him to go on and tell me some more about the party. So he continues, "Well, the date is goin' to be March 10, I guess you already know, and the price is goin' to be so low that nobody can afford to miss it. In fact all I got in my pocket now is a buck and a half, and I expect to have enough to eat my lunch after I get my ticket."

"That sure is goin' to be a real party," I agreed, "And I'm sure not goin' to miss it. Guess I'll try hitch hikin' to school a couple of days so I can save up enough to go. Only, now I was so interested in you tellin' me about that party that I clean forgot I had a class this hour. Oh, well, I guess it was worth just as much to find out that for once the engineers are goin' to have a real party, as it would have been to listen to that lecture anyhow. So, so long Ossie, SEE YOU AT THE TECH BALL."

Plans For Annual Tech Banquet Are Announced

ARRANGEMENTS for the second annual Tech banquet, to be held in the Minnesota Union February 23, are being completed, and again Prof. Harlow C. Richardson will act as toastmaster.

The sponsors of the Technical student-faculty banquet are the Technical Commission and Alpha Tau Sigma, honorary engineering journalistic fraternity. In 1931 the banquet was held under the auspices of the TECHNO-LOG staff and Alpha Tau Sigma and at that time a mutual discussion of engineering problems with criticism by the students and faculty was fostered to promote a better understanding between student body and faculty members. Contrary to the original policy, the banquet will be open to all students in the College of Engineering and the School of Chemistry.

Entertainment for the fun fest which will follow immediately after the banquet will be furnished by students from the various departments of the college of engineering.

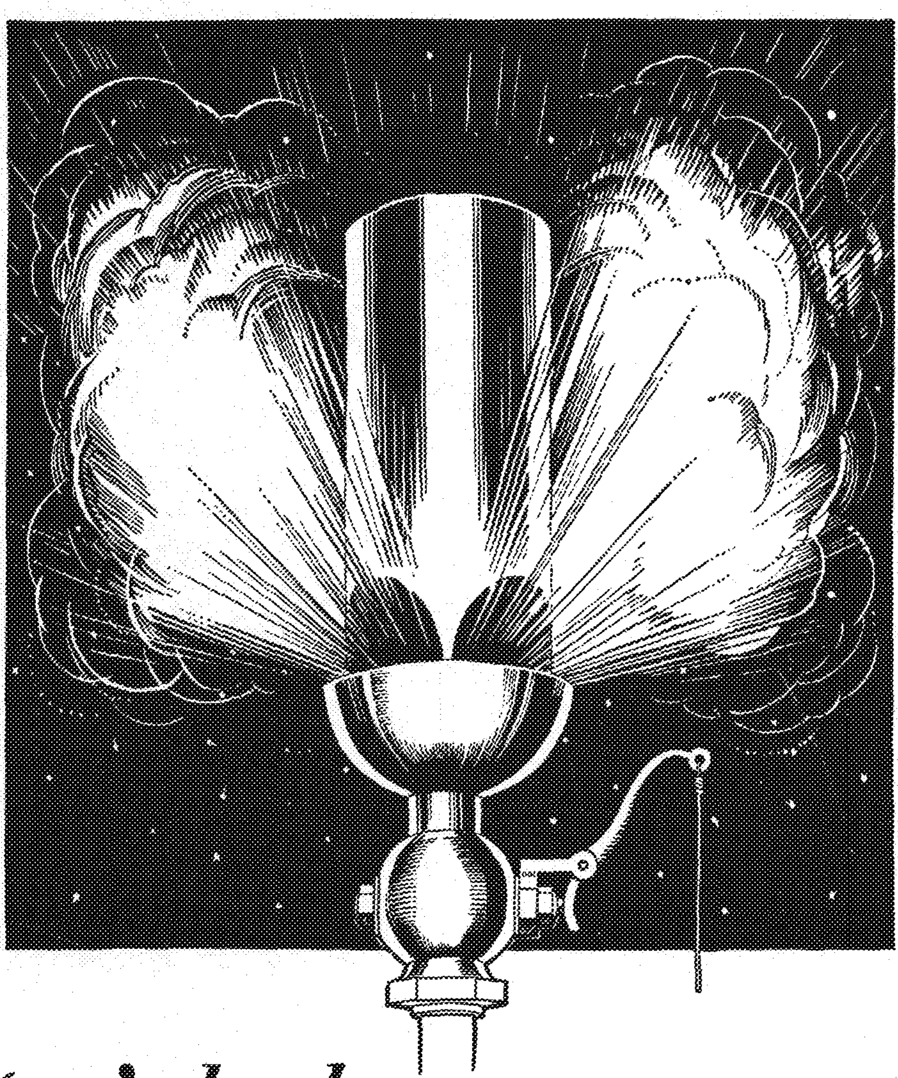
It is hoped that a large number of technical students will attend. A charge of fifty cents will be made for the dinner which will be served at six o'clock. That charge will include the fun fest. If some wish to attend the entertainment program, a charge of twenty-five cents will be made.

George Brimhall, senior in the Aeronautical engineering department, has appointed 45 committee men to make arrangements for the second annual Tech banquet, to be held in the Minnesota Union February 23 under the auspices of Alpha Tau Sigma, honorary engineering journalistic fraternity and the Technical commission.

The following committees were named: General arrangements: Austin Lange, James Nelson, Thomas Rogers and Laddy Markus. Entertainment: Norman Carlson, chairman, Norbert Mengelkoch, Eugene Bundul, Frank Ventura, Donald Childs, Roy Oltman, Herbert Starkey, Mirza Gregg, Eugene Eyster, George Krauch, Donald Starr, and Harry Carlson.

Tickets: Cavour Johnson, chairman; Harry Cottingham, Robert Conary, Marcus Mattison, Glen Swanstrom, Odd Rovick, David Buck, Arvid Turnquist, Kenneth Iverson, Chester Kershaw, Philip Erickson, Chester Larson, Robert Segal, John Cochrane, Gerhard Brandhorst, Frank Leistiko, Clarence Lund and Edward Kierski.

Publicity: Paul Erickson, chairman; Richard Poucher, LeRoy Munson, Robert Marshall, Kenneth Gregersen, William Kaiser and Norbert Sternal. Poster: Weaver Connelly, chairman; James Moore, Julius Ostrow and Robert Hansen.



AROUND THE CAMPUS

A. I. E. E.

The tenth bi-annual Electrical show is to be held this year on April 28 and 29. The committees under the supervision of Parker Lowell, chairman, have already started work, and indications point toward the best show ever. Any students desiring to work for the show are urged to get in touch with John Hancock, who is the students exhibits manager. Any and all ideas for special stunts or exhibits are welcome. Among the special features of the show will be the transmission of pictures by television and the transmission of sound by a beam of light.

The following papers were submitted in the A. I. E. E. prize contest: Non Sparking Devices for A. C. Contactors by Benjamin Axilrod—E. E. 33, Mercury Vapor Turbines by Paul Erickson, E. E. 33, Roast Turkey by Kenneth Gregersen, E. E. 35, Notes on Electrochemistry by John Hancock, E. E. 33, Amateur Radio by Carl Henrici, E. E. 36, Illuminating Engineering and Its Value to Civilization by Phillip King, E. E. 33, Description of W9YC by Kenneth Kirkland, E. E. 34, The Construction and Installation of 115,000 Volt Cable by Adolph Kupka, E. E. 33, The Artificial Larynx by Sam Levy, E. E. 33, An Outline of Photo Telegraphy by R. W. Marshall, E. E. 34, The Manufacture of Luminous Tubing by Laddy Markus, E. E. 33.

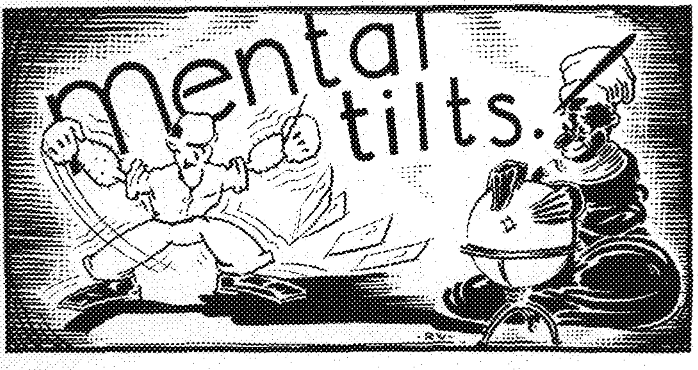
From these eleven papers, the committee of awards will select the best four and these will be presented by their respective owners on February 16, at a combined meeting of the A. I. E. E. section and branch. The section members will select the best two papers as presented and award two cash prizes of fifteen dollars and ten dollars. A television exhibit will also be shown by two graduates, Max Risley and Robert Campbell. A large attendance will be assured since this meeting is most important.

American Chemical Society

Judging from the size of the audience at the last meeting of the Minnesota section of the American Chemical Society at which Dr. Matthews of the University of Wisconsin was presented, Minneapolis and St. Paul police have taken to science in a big way. In his talk "The Application of Scientific Methods to Crime Detection," Dr. Matthews concerned himself first with the application of metallographic analysis. He cited a bombing case in which a conviction was obtained largely because the metallographic structure of a fragment of the bomb and a piece of scrap iron found on the premises of the suspect were exactly identical.

The methods by which it can be determined whether or not a bullet found in the body of a murder victim was fired from a gun found on a suspect were next discussed by Dr. Matthews. The identification is based on the principal that

[*Please turn to page 154*]



THEY'RE easy this month, fellows, so sharpen your pencils and get to work. There's a year's subscription to the TECHNO-LOG waiting for the first correct set of solutions—to be sent to a friend or to the winner after graduation. Nobody turned in solutions to the January Tilts, (could it possibly be that they were too hard?) but this month's puzzles, although a bit tricky, can all be worked in ten minutes.

A BEE AND A TRAIN

A TRAIN starts at St. Paul and goes toward Duluth, 160 miles away, with a speed of 40 m.p.h. At the same time another train leaves Duluth for St. Paul, and travels with a speed of 60 m.p.h. A bee which was on the St. Paul train leaves the train just as it started toward Duluth and flies toward the other train with a speed of 100 m.p.h. The instant it reaches the south-bound train it turns around and heads toward the other train. It flies between the trains until they crash together. If the track is straight and the trains travel with uniform speed, how many miles does the bee fly before it is crushed between the trains?

So simple did this problem appear that Ye Mental Tilts editor neglected to get the solution before he submitted it for publication. As a result, he spent his vacation filling sheet after sheet with computations, all to no avail. Math profs, too, showed a suspicious aversion to working the problem—of course, all avowed that they could work it, but were too busy to try it at the time. At last, an hour before the deadline, Sam Levy, associate editor, turned in a solution which met the exacting specifications of the Mental Tilts editor, and the honor of the TECHNO-LOG was saved.

CRYPTIC DIVISION

SUBSTITUTE numerals in order for the letters of the code word, and you have a problem in simple division. Civils should have no trouble here, for they use the code word every day. What is it?

```
GER ) IIIII ( NSY
      IYUV
      ----
       SERI
       GER
       ----
       ENVI
       EISN
       ----
        SUG
```

GOLDFISH

A CERTAIN young man who was fond of goldfish decided to go downtown and buy a pair. He entered the store and bought his goldfish which were placed in a sealed glass container full of water. He then took the streetcar back home, and when the car started, he was observing his new purchase. It seemed that the two goldfish had an antipathy for each other for one was at the top of the bowl while the other remained near the bottom. Then the streetcar started, which way did each of the goldfish become displaced with respect to the bowl assuming they were previously at rest?

Answers to Last Month's Mental Tilts

A SIMPLE ONE

The exact answer is 9.8 throws, but as we can have only integral numbers, the answer is 10 throws.

MONEY AGAIN

The probability that the coin was a normal coin is the ratio of the productive probability (probability of drawing a normal coin) times the probability of tossing heads successively three times with a normal coin, the ratio of this product to the sum of this product and a similar for the two-headed coin, thus

$$P = \frac{\frac{4}{5}\left(\frac{1}{2}\right)^3}{\frac{4}{5}\left(\frac{1}{2}\right)^3 + \frac{1}{5}\left(1\right)^3} = \frac{1}{3}$$

LEAP FROG

The absolute height of vertical ascent of the frog is

$$h^1 = h \frac{2\, m_1\, (m + m_1)}{(m + m_1 + M)^2}$$

REWARD OFFERED

THE MINNESOTA TECHNO-LOG will give one dollar in cash to the person writing the best letter telling which advertisement in this issue is most effective, with reasons. Letters should be short, and will be judged solely on the merit of the reasons given. The judges will be the business manager and editor of the TECHNO-LOG, and Professor Cutler. Bring all letters to Room 37 E. E. bldg. or to Main Engineering office.

AROUND THE CAMPUS

[*Continued from page 152*]

every gun produces a characteristic set of figurations on any bullet that is shot in it. The apparatus for determining this consists essentially of two microscopes mounted about three or four inches apart with the images produced by each converging in a single eye piece.

For the actual test a bullet is fired into a medium that will not produce any scratches on the bullet—oiled sawdust for example. This bullet is then mounted on one microscope so that the longitudinal striations and rifling grooves of a certain section of the bullet will appear perpendicular to a hair line which divides the eye piece into two parts—thus making it appear that the bullet is cut in half by a section perpendicular to the longitudinal axis. The bullet which has been removed from the victim's body is then mounted in a similar manner on the other microscope so that it appears in the eye piece as the missing half of the test bullet. It is obvious then that if the markings of the unknown bullet form an exact continuation of the markings on the test bullet, the bullet will have been shot from the same gun. The reasoning is somewhat similar to the reasoning that one would follow if he should find two sticks, and being able to make one fit exactly on the end of the other, he could conclude that the sticks had once been the same stick.

The deciphering of burnt documents is sometimes made possible by the use of ultra violet light. The burnt papers are irradiated with the ultra violet and photographed. The ashes of certain inks have the property of fluorescing when exposed ultra violet light thus enabling a photograph to be made.

A. S. M. E.

The second of a series of discussions staged by the student chapter of the American Society of Mechanical Engineers featured the meeting Tuesday, February 14, at the Minnesota Union.

Three technical papers were presented—"Free Wheeling" by Don Leslie, "Locomotive Maintenance" by Chester Sines, and "Modern Anti-Aircraft Artillery" by John Enblom.

Following the discussion, President Norman E. Carlson conducted the regular business of the club and made arrangements for inspection trips to be held on alternate Friday afternoons.

M. S. A. E.

At the January nineteenth meeting of the Minnesota Society of Aeronautical Engineers, Mr. A. G. Kinsman, traffic manager of Hamsford Air Lines, was the chief speaker. Mr. Kinsman spoke on commercial aviation, and described some of the planes that are being built for The United Air Lines. A film "Across the Continent in Twenty-four Hours" was shown.

At a luncheon meeting held February second, Lieutenant K. B. Salisbury, commanding officer of the U. S. Naval Reserve at Wold-Chamberlain Field, was the chief speaker. Lieutenant Salisbury spoke on openings in the Naval Reserve, and about the training that the members of the Reserve receive.

A. I. Ch. E.

Having an odor strongly suggesting linoleum but a taste resembling hazel nuts, flaxseed cake may yet come into its own as a breakfast cereal if the reactions of a group of embryo chemical engineers attending the last regular meeting of the student branch of the American Institute of Chemical Engineers is any criterion. The flaxseed cake was part of a display of flax products brought before the Institute by Mr. J. E. Tyndall of the Minnesota Linseed Oil company of Minneapolis as part of his illustrated lecture on "The Linseed Oil Industry." Mr. Tyndall sketched the economic side of the industry and then concerned himself chiefly with the chemical aspects of linseed oil production. The essentials of seed cleaning, oil extraction, and refining were presented along with a discussion of the chemical nature of the oil. The lecture was augmented by a motion picture entitled "The Manufacture of Linseed Oil" which carried the audience through a modern linseed oil plant and showed each process.

On Wednesday evening, January 25th, the Institute was shown an all-talking film on the manufacture of glass presented through the courtesy of the Libby-Owens glass company. The picture consisting of two parts revealed methods of fabricating window, plate, and safety glass in two of the plants of the Libby-Owens company.

GLEANINGS
FROM THE
WASTEBASKET

E. E. Lab is an exciting place to be in, when the senior electrical savants start running their experiments. Blowing tiny 100 ampere fuses means nothing to these boys, and the building circuit breakers have blown so many times that they're even becoming accustomed to doing it. Johnny Hancock just loves to make starting boxes flash over—Sanford Hanscom has to find the maximum speed of every motor he works with—Ben Axilrod, Bill McNulty, and Joe Getsug got themselves in hot water with the others by taking the best equipment before the other gangs can recover from their noon meal. And hardly a day passes when some playful senior has himself hoisted to the ceiling on the big traveling crane—when the profs aren't around.

Some of the young men up in architecture incurred the wrath of a prominent TECHNO-LOG staffster, so what did he do but march up there and threaten to clean up the whole gang if they didn't show more respect for the interior decorators. Most curious of all, he did talk the truant men into reforming. What a man!

Doc Webb is having a grand time building up an electronics lab on the top floor of E.E. Already his students have seen electrons curl themselves up, and soon, when the new mercury vapor vacuum pumps have been installed and the old radio transmitter has been built over into a high frequency power source, the boys will be able to evacuate their tubes down to around one thousandth of a micron of mercury.

Dave Moscovitz showed decided skill in bat killing the other day, and the result of his forry into the morgue back of the Ventilation room in E.E. was tacked out for several days upon the TECHNO-LOG bulletin board. Many were the students who found time to stop a few minutes to study a real, honest-to-goodness mouse with wings at close range.

Did you notice the swell screen and frame around the A.I.E.E. neon sign hanging on the first floor of E.E.? Paul Erickson spent many hours of his Christmas vacation making this.

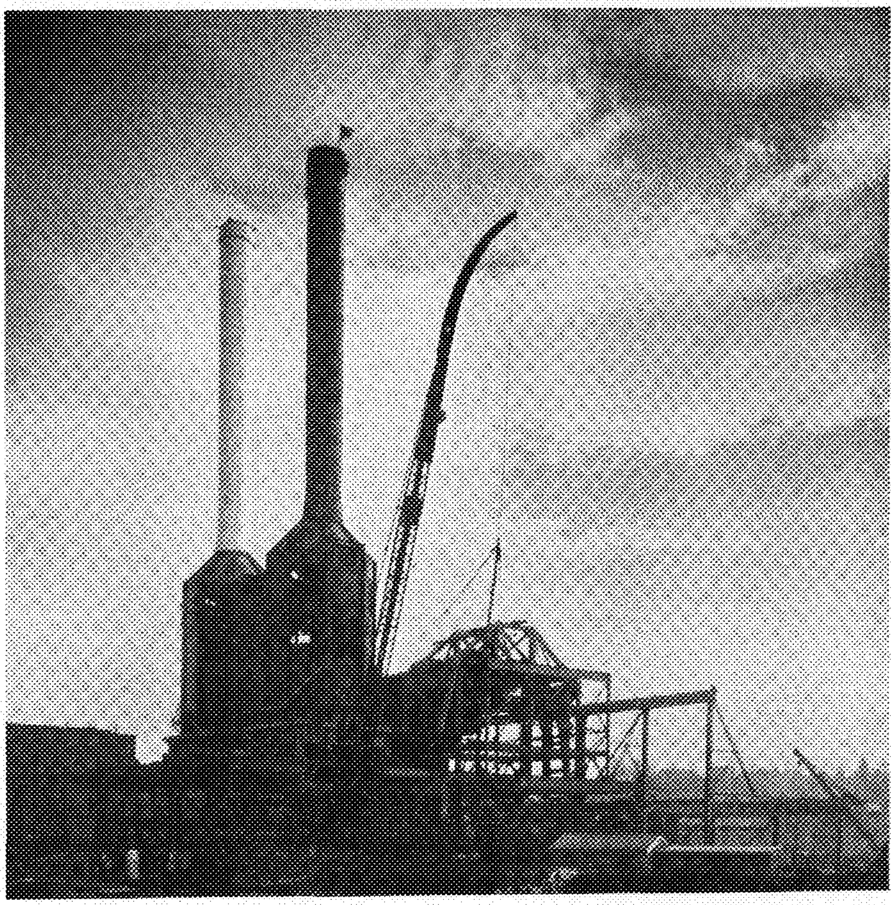
Notice—Professor Leon E. Arnal keeps his nails beautifully manicured and polished. What's that a sign of?

MERCURY VAPOR TURBINES

[*Continued from page 135*]

To eliminate a high pressure shaft packing, the entire rotor of the turbine is overhung from a bearing at the low pressure or exhaust end, which is much below atmospheric. The seal at low pressure end consists of a bakelite ring, pressed against a flang on the shaft, sealed and lubricated by a flow of water delivered through a flexible connection. This arrangement prevents any water or steam from entering the mercury system and provides a perfect vacuum seal whether the turbine is at rest or in motion.

The speed control devices for the turbine are similar in operation and function to the ordinary turbine governor. At the Hartford plant, the method adapted to eliminate unnecessary throttling was to run the turbine in parallel with the steam generating units whenever there is a demand for power. At the end space of the generator where the air pressure varies as the square of the speed, a device is mounted which releases an electric contact when the air pressure rises above an established limit. This contact controls electromagnets which operate the valves of the oil control throttling system on the mercury turbine. These vapor supply valves are held open when there is a demand for power, but if the oil pressure is lost, if the turbine overspeeds or if the current fails, the valves automatically close. The safety valve which controls the flow of vapor into the boiler is also controlled by oil valves. In case the pressure control devices fail, they will act as a simple safety valve and prevent any excess pressure in the boiler. When the plant is started, vapor is allowed to pass through the whole system. Although the amount of vapor admitted into the system is insufficient to start the turbine, it produces uniform expansion and minimizes strains.



Courtesy—Electrical Engineering

A mercury vapor generating plant from the outside.

The chief difficulty encountered in the use of mercury was the adaption of engineering materials to provide for high temperatures and yet use only a minimum amount of mercury in the process. The boiler, valves, condensers, turbine and piping, all of low carbon steel, are welded together to prevent any leakage of the dangerous vapor or any loss of fluid. It is possible to prevent air from entering the system and thus oxidizing the mercury. By using a selesium sulfide sensitized paper strip which passes in front of a photo-electric cell, one part of mercury vapor in twenty million parts of air darkens the strip and causes the cell to give a warning signal.

Two new plants which are being erected, one at Schenectady and the other at the Kearney plant of the Public Service Co. of New Jersey, will be the largest installations ever attempted. The capacity of each will be twice that of the Hartford installation. The increased capacity of the plant is provided by an increase in the length of the drums, increase in mercury pressure to 125 pounds gauge, and installation of mercury bearing surfaces on the upper portions of the furnace walls. An increase of the mercury heating surface increases the possible amount of heat liberated and hence the combustion air can be preheated to a higher temperature and the flue gas temperatures reduced without the use of a water economizer. In these new plants a fuel rate of 8800 B.T.U. per kilowatt hour is expected with a load of 240,000 pounds of steam at 350 degrees F. 400 pounds pressure from the mercury condenser and 20,000 kilowatt from the turbine. If the lower part of the furnace walls are water cooled, the rate is expected to be about 9,500 B.T.U. per kilowatt hour. These figures are based upon conditions similar to those in the Hartford plant.

Because of the great expense necessary for new plants, mercury vapor systems are not likely to replace existing steam plants but will be installed as addition or used in new power stations. In the new Schenectady plant, the greater part of the equipment is to be placed out doors, making it possible to reduce the building costs. Mercury vapor plants are used at present for power production and in the oil refining industry.

FRANKLIN W. SPRINGER

[*Continued from page 135*]

ments, is one of the best either in this country or abroad. Certain other schools may have laboratories that excel in part, as for example, extra high voltage laboratories have been built at Worcester, Purdue, California Institute of Technology and Stanford, but the laboratories as a whole, with the possible exception of Purdue, do not measure up to Minnesota. Professor Springer worked on the principle that "form follows function" and he believed that the "environmental pressure" of a student's surroundings was a very important factor in his education. The functional plans, the unusual adequate and flexible wiring and conduit system, the unusual availability of all power sources at almost any place in the building, the panel arrangements, the availability and transportation systems for the equipment, and the laboratory service organization mark this building as one of the best of its kind in the world.

Beginning in 1906, given considerable study in Europe in 1910–11, and for the last twenty years he studied and wrote numerous articles on the fundamentals of education and their relations to all phases of life. His discussion of "Fundamentals of Education and the Spherical Want System" appeared as a series of eight articles in the *S. P. E. E. Journal* beginning in November, 1912. Several other articles along this same line, for example, "Can and Will" and the "Process of Learning," "Optimum Sized Classes," "The Equation of Life," "Training for Future Problems," and "Problems and Parasites," are very interesting and a distinct contribution to the study of educational methods.

His activities outside of his regular teaching were many, varied and continuous. He was one of a small group of outstanding Minnesota engineers, including such men as the late Max Toltz, who initiated and prepared the plans for the organization of the Minnesota Federation of Architectural and Engineering Societies in 1921. He was a member of the Board of Directors in 1921 and 1922 and helped make this organization a going concern. These outside activities also include several hundred engineering and testing jobs mostly involving electrical measurements, approximately two hundred published articles, sixteen patents actually granted which could well be considered research articles, two patents pending and one patent application in process.

Among his Honors and Societies were the following: Fellow, AIEE; Member S.P.E.E.; Past Chairman, Minnesota Section AIEE; Vice-President, AIEE 1921–23; Member, Minnesota Federation of Architectural and Engineering Societies; Delegate of AIEE to inauguration of President Coffman; Tau Beta Pi, Sigma Xi, Kappa Alpha Sigma, Eta Kappa Nu, Delta Upsilon, Sons of Jove, Campus Club. He was one of the founders of Delta Upsilon fraternity on the Minnesota Campus in 1890.

He will always be remembered by his students as one of their real friends and by his associates as a fine example of a hard, conscientious worker.

From Our Wastebasket

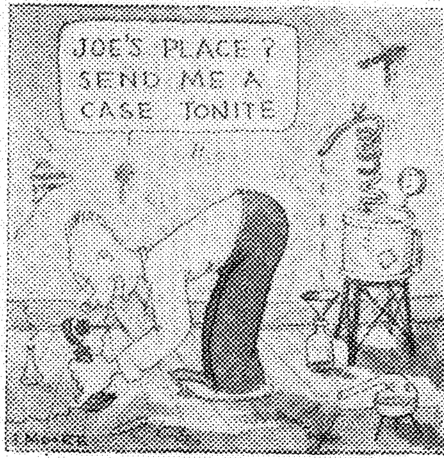
While the rest of us were fretting and complaining about the weather during the recent cold wave, certain enterprising students regarded the situation as a money making proposition. They cruised around in their cars looking for those unfortunates who were experiencing difficulty in starting cold motors. They would offer to give you a push for a small charge, ranging from two bits to one buck. Who said depression?

March 10? Who knows? Two engineers were discussing the big sign above the Minnesota Bookstore. Said one, "I wonder what happens on March 10."

Answered the other, "I dunno. Maybe the bookstore is going to pay dividends then, or somethin'."

A chance for a little "detectiving" has arisen for somebody. In a waste basket in some room in the Physics building there has been found an empty snuff box. Now, what physicist is substituting tobacco for science???

They say the depression is winding up—to get a new start.



The Chemist orders for himself

Everett Young, senior architect, discovered that his hat had suddenly grown too small the other day; he received two mentions on the same day. At judgment on February eighth his long problem was placed first in the competition, and his twenty-four hour sketch problem also received a mention. Kenneth Lundberg also won mentions on both problems.

Who said the medics never have any fun. Some time ago it was reported that two of them got into a fight and proceeded to cut off a leg from a couple of "stiffs" on the third floor of the Anatomy building. Armed with the lower extremities of two dead men, they proceeded to thump each other roundly with the severed limbs.

What campus "humor" magazine freely admits to their advertisers that they have 4,000 paid circulation with 10,000 readers, and how do they accomplish this when only 1,500 copies are printed?

Cheer up, you freshmen, there must have been dumber guys than you at some time or other. If there weren't then where did all the sophs come from?

One nice thing about this cold weather—there aren't any skeeters to pester us.

How Dreams of an

Air Service to the Northwest

Have Come True

[*Continued from page 145*]

drawn for the lighting of the airway from Minneapolis west to Helena and it is hoped that this project will be accomplished this year. These beacons represent one of two necessary aids to night navigation. The second is the communication facilities.

Air transports traveling at speeds well over 125 miles per hour traverse the route so fast that the conditions encountered may be as changeable as the terrain beneath the transport. Consequently to keep the pilot informed of the weather that he may encounter along his route, three different systems of communication are used.

The first is the teletype, which is nothing more than a leased telephone line extending over the entire system with drops at all important stations to which automatic typewriters, called printers, are attached. Every hour a weather observation is made at the terminal and intermediate fields and these observations are carried over the system and printed at each station on the teletype printer. The pilot before taking off on his flight always receives the latest copy of these reports, and he signs for them the same as a railroad conductor signs his orders. While he is in flight, he receives these same reports via his two-way radio, which is the second of the three systems of communication. This is probably the greatest of the safety devices now in use on the airlines, and the Northwest Airways have equipped every ship with such a radio.

In operation the ground station calls the pilot in the air every twenty minutes in fair weather and the pilot must respond giving his name, ship number, location, and the weather conditions about him at the time. In rough and stormy weather the time between calls is reduced to ten minutes, and he must make the same reports as when on the twenty minute schedule. However, while he is called only on these schedules which are very rigid, the pilot can at any time communicate with any or all of the ground stations and with any other ship in the air by simply raising his transmitter and pressing the button on it. Consequently the pilot and his ship are always in touch with the operating office, for the ground operator keeps his headphones on during the entire trip, and it is practically impossible for him to lose the ship.

The third method of communication is the intermediate frequency radio, which is simply and commonly known as the radio beacon. There are two types of such equipment, the aural beacon and the visual beacon. At present the Aural beacon is being installed along these lines. This installation will soon be completed and the lines will then be equipped with the finest and most complete aids to air navigation known at the present time.

Perhaps it would be well to explain the operation of the radio beacon, but many long articles have been written upon the same subject, and while such stories have always been very interesting they have never been complete. Consequently, it would be impossible to go into detail in this dissertation. Suffice it to say then, that the Aural beacon is a beam transmitter generally operating on the same frequency as the

[*Please turn to page 160*]

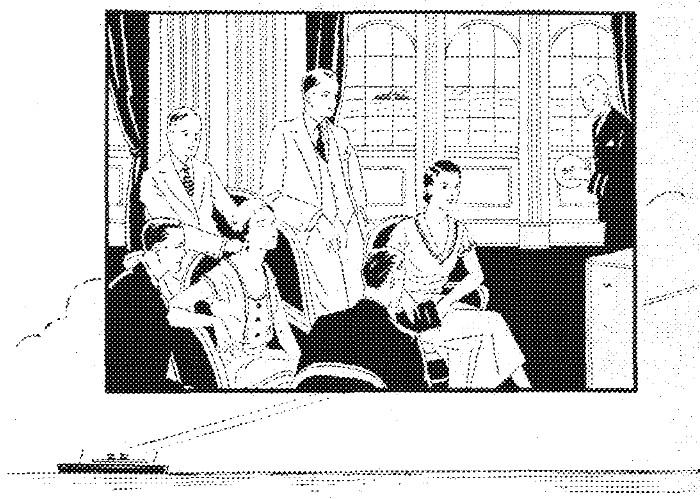
Luxurious service on a huge air liner

weather broadcasting station so as to eliminate the necessity of the pilot tuning the receiver to get weather information. The transmitter transmits two beams simultaneously, one an "A" signal and the other an "N" signal in ordinary code. When the pilot is on the true course the two signals overlap forming a continuous monotone which is interrupted every thirty seconds with the identification signal of the beam. However, if he strays during a bad fog or storm to one side or the other, he picks up the clear code signal of "A" or "N" depending on which side of the beam he wanders, and knowing on which side each signal is, he heads back across the signal until he again reaches the monotone which then indicates that he has once more headed on his true course. The transmitters for this beam are efficient over an airway for about 250 miles after which distance the spread becomes too great and the curvature of the earth causes the beam to carry away from the ordinary channel of flight. Accordingly, transmitters have been already installed at Chicago, Milwaukee, and Minneapolis; and the one at Fargo is now under construction.

Thus with the light beacons, the two-way radio, and th radio beacons, night flying has become perfectly safe an logical, and with comfortable spacious cabins, many pa sengers are transferring to the night planes. To accommodat these travelers, there was inaugurated only this month, Feb ruary 6, a night passenger service to and from Chicago, an already it appears that in time this service will outrank th daylight schedules.

With the inauguration of this night passenger service, th Northwest Airways now operates three daily passenger sched ules to Chicago; two daylight schedules at 8:30 A.M. an 3:30 P.M. respectively, and one night schedule at 7:25 P.M and provides for this territory air transport services usuall found only in such metropolitan centers as New York, Wash ington, and Chicago. In addition, the flights from Bismarck Winnipeg, Duluth and the intermediate points connect di rectly with the afternoon transport to Chicago and those citie are at the most only four hours farther from Chicago an New York than are the Twin Cities.

Verily air transportation in the northwest has made rapi strides forward when it has advanced from nothing four year ago, to a business that operates as many schedules a day a most railroads do. From a business employing two ships and two pilots in 1926, it has advanced,—advanced to a poin where it has twenty-five ships in daily use, twenty-five active pilots to man those ships, four co-pilots to attend to the com fort of the traveler enroute, office and business staffs close t the two hundred mark, and where it flys approximately 4,500 miles a day, nearly 1,000 of which are now at night and with passengers. Verily then air transportation is expanding, and verily the United States are just as inexorably shrinking Twenty-four hours coast to coast, twelve hours border t border—once an impossibility, then a dream, now an actuality



A Light Beam TALKS

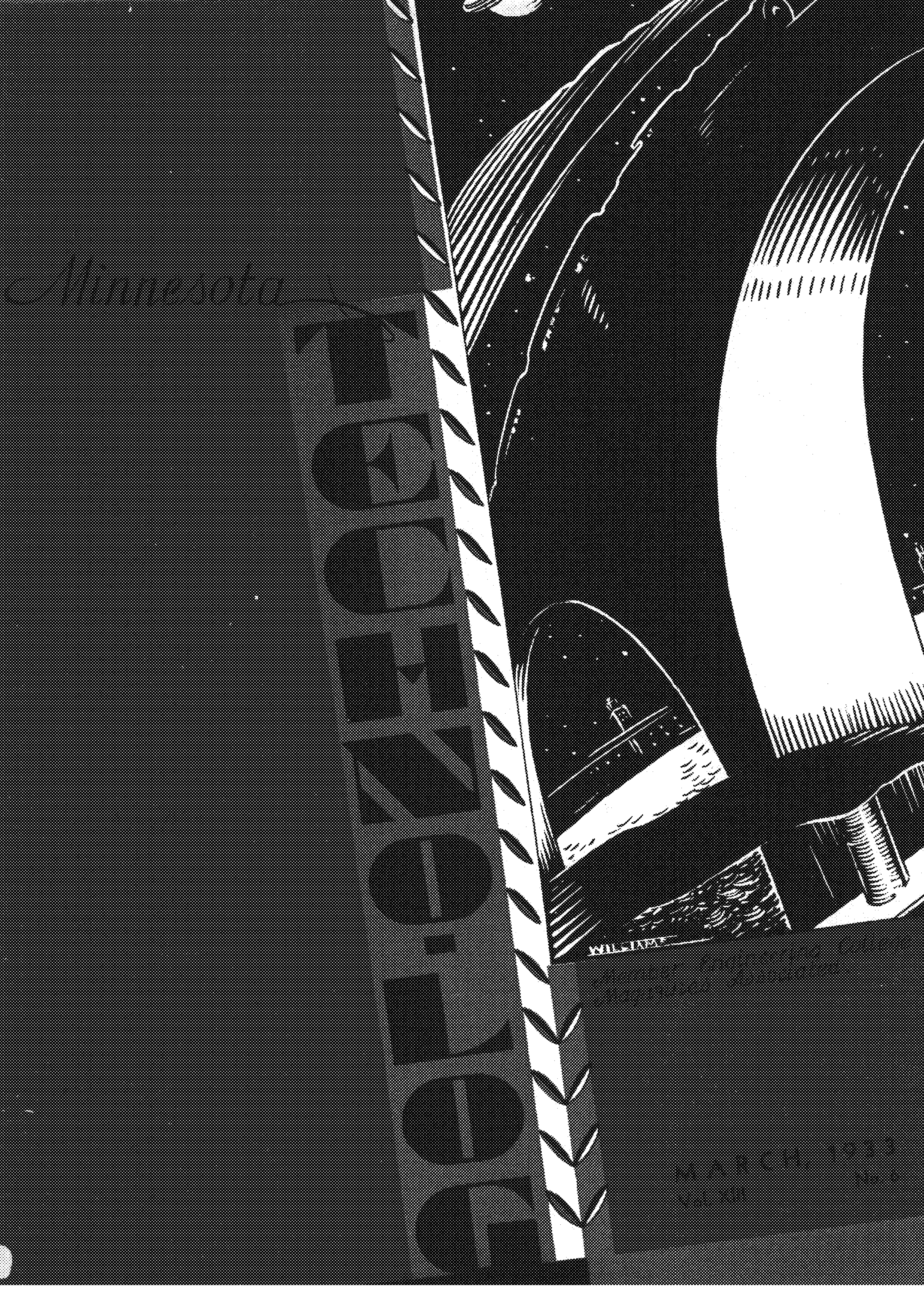
FROM the flickering light of a neon tube on the skyline of New York City, a speech was sent to the *S. S. President Hoover*, 3000 feet away. The small neon tube changed the electric impulses from a microphone into light waves, which were directed to the ship in a narrow beam. A photoelectric tube in the center of a receiving mirror on the ship changed the light impulses back into sound, and the speech was heard on board.

The use of light that can be heard, and of sound that can be seen, has many applications. It can be used for speech communication; it can serve in fog to guide aircraft on their course and into port; and it can be used for radio and television broadcasting.

The development of future forms of transmission, whether in sound or light waves, will largely be the responsibility of college-trained General Electric engineers. To-day, these men are planning, producing, and testing electric equipment which will help maintain General Electric's leadership in its field.

95-928DH

GENERAL ELECTRIC


Minnesota

M. D. BELL, '07 M. E.
Consulting Engineer
President of Minneapolis Engineers' Club

SUCCESSFU

advi

SAVE YOUR

In my experience, the successful engineering graduates have kept with them the textbooks which they used in their college courses. They are tools. They are capital, the stock in trade.

Where we have employed engineering students who have not kept their textbooks, too often these men are inclined to flounder around, and have to be told where they can get the information required to handle specific problems.

M. D. Bell.

ENGINEERS

ou to

NELS W. ELSBERG, '07 C.E.
Minnesota State Highway Commissioner

TEXTBOOKS

College textbooks are as important to the engineer after graduation as a dentist's tools are to a dentist. New books can never take the place of those over which we slaved in college.

My professional progress would have been greatly hindered but for the familiar pages of my old texts. The sight of old expressions brings back a wealth of half forgotten information that would take many hours to find in unfamiliar books.

N. W. Elsberg

ENGINEERS' BOOKSTORE

MARCH, 1933
VOLUME XIII, NUMBER 6

Minnesota Techno-Log

37 ELECTRICAL BUILDING · · · U of M

Published monthly from October to June inclusive, by the students of the College of Engineering and Architecture, the School of Chemistry of the University of Minnesota

Laddy Markus, Managing Editor
Thomas Rogers, Business Manager

THIS MONTH

THE EDITOR SAYS

Another quarter comes near to a close—and there's just one more quarter of study before our diploma is handed to us. Did it ever occur to you that it costs more to get out of this university than to get in it? There's photographs and the Gopher, a new suit and all the fittings, a small $15 graduation fee, (our university just can't resist a last crack at our already sadly depleted pocketbooks), and a myriad of other little things which must be obtained if one is to graduate in the traditional manner. And where are we after we do graduate? We either become insurance salesmen ourselves, or sit at home and wait for all the other insurance salesmen to call on us.

Study becomes more and more difficult as school life approaches its end. We decide to enjoy our last days at the university—to partake of the many university offerings which we have paid for all these years, but never taken the time to attend. And so we cut E. E. lab each week to attend the University news reel—we go to convocation to hear Sir Wilkins tell of his Arctic adventures — we see "Candida," "Amaco," "Babes in Toyland," and all the other dramatic productions —and we go to our first university dance, the Tech Frolic.

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Entered as second-class matter April 9, 1925, at the post office at Minneapolis, Minnesota, under the Act of March 3, 1879. Office, 37 Electrical Building, University of Minnesota. Telephone, Dinsmore 2760. Contents copyrighted and permission must be secured for re-publication. Subscription rate, $1.50 a year. Single copies, 25 cents. Advertising rates upon application. Alumni Directory, 50 cents.

A Beauty Spot of Minneapolis
Loring Park in Winter

PROSPECTING FOR OIL WITH A SEISMOGRAPH

by STANLEY A. WILCOX, A '27
Geophysics Research Student

Mr. Wilcox has worked for a number of years with seismographic parties in the Southwest and in Mexico. He is at present taking graduate work in geophysics here in the Physics department, and at the same time is designing and constructing instruments to be used in locating the great pre-glacial valleys which lie deep down in the ground between St. Paul and Minneapolis. The results of his work will determine the feasibility of a sewage tunnel extending from the Lake street bridge to downtown St. Paul, and will tell if the lakes of the Twin Cities are being drained by artesian wells.

A NEW method of prospecting for oil has been developed from one of our technical experiences of the World War. When attempts were made to locate guns of large calibre by recording their recoil impulses at fixed points, it was found that variations in the geologic structure of the earth were responsible for large errors in the results. After the war Fessenden, of submarine detection fame, and Minthrop in Germany reversed the gun locating problem to investigate what the shock propagation paths of a dynamite explosion might tell them about the possibilities of finding oil.

Doodle Bugs

Previous to this time the only instrument technique claiming the ability to locate oil deposits was in the hands of "Doodle Bugs." A doodle bug is a species of beetle found in our southern states that can be lured from its hole in the ground by a song. Hence the name was applied to that brand of dowsing rod operators and diviners who claimed mysterious and occult powers not bestowed on ordinary men, and who believed they could detect the presence, amount, and color of black gold. Their fame is one of long standing. During the middle ages "Doodle Bugs" were hired to run down witches and heretics, along with their more prosaic duties of witching for water and finding lost articles. In fact the last man broken on the rack in Europe was "detected" by a divining rod in the hands of one of these magicians. We will now leave the "Doodle Bug" for the psychologist and proceed with a method of prospecting more of interest to the engineer.

Salt Domes Are Near Oil

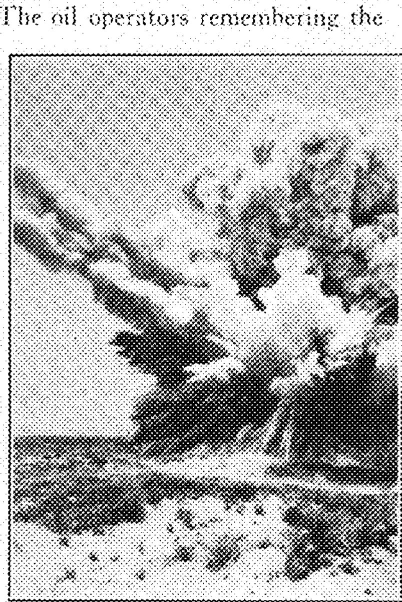
The first experiment made with the seismograph, an instrument already known in the study of earthquakes, dealt with the attempt to locate salt domes. These massive buried plugs of rock salt, sometime one-half mile or more in diameter, were known to have oil and gas on their flanks. The ones near enough to the surface to indicate their presence by salt springs, or by a rise in the topography had already been taken up by the oil companies as prospects. The deeper ones were not easy to find. Conventional geological methods of prospecting were of little value because of the absence of surface indications. Wild cat drilling was stimulated into activity during the early twenties of this century after Spindle Top proved the immense value of a salt dome as an oil field. From 1922 to 1924, 625 Wildcat wells were drilled, hit and miss, and only one salt dome found—one dome for twenty million dollars. The oil operators remembering the "Doodle Bug" with his mysterious chicanery, were rather loath to be taken in on any more oil finding schemes, but they did finally give the seismograph a trial.

Seismograph Locates Domes

The seismograph was a success from the first, not so much because of any particular knowledge of instrument design or theory, but because the salt dome responds so well to this type of prospecting. Sound travels at the rate of 16,000 feet per second through salt and only 8,000 to 12,000 feet per second through the surrounding beds. The time anamoly indicated on a seismograph when the shot ray includes part of a salt dome in its path, is of such order that the existence of this buried mountain of NaCl cannot be denied. In fact, a typical seismograph of the shallow dome is so salty, in the slang of the observer, that he can taste it as soon as he gets his record out of the developer. An undrilled seismic dome has a cash value of one-fourth million dollars. The oil companies operating in the gulf coast lost no time in utilizing this new development in the art of finding oil. Seismic crews were imported from Germany. The Americans answered the challenge by organizing troops of their own—and what they lacked in experience, they made up in enthusiasm. One year after the introduction of the first German Seismic crew into Mexico by the Rogell Dutch Shell in 1924, the first salt dome was found.

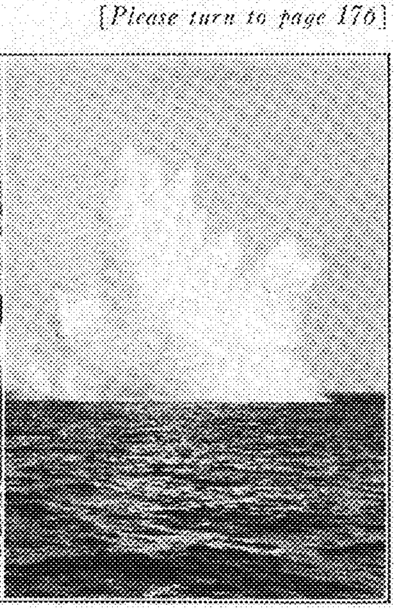
In the short space of three years from 1926 to 1929, millions of pounds of dynamite was shot on a crescent shaped

[*Please turn to page 176*]

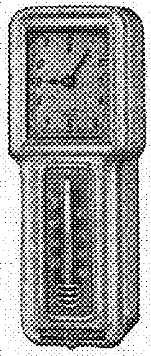


Courtesy—Atlas Powder Co.

Land blasts are used in the refraction method



Blasting on water to locate oil domes below the ocean



A bi-metallic thermostat stationed in some part of the house responds to changes in room temperature. The electric clock may be set to turn heat on or off at any time

You just can't fool an Oil Burner Control System

says JOHN KRIECHBAUM, E. E. '28

As a Production Engineer for the Honeywell Heat Regulator Company of Minneapolis, Mr. Kriechbaum has been actively engaged in design work in connection with the latest types of oil burner control equipment. It is with pleasure that we offer this article covering the more recent developments in the oil burner field.

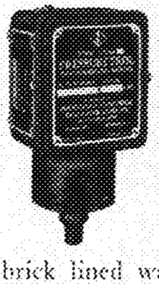
THERE is scarcely an industrial product which has enjoyed so rapid and steady a growth in the last several years as the domestic oil burner. In 1921, only about 21,500 burners were installed and in use; while in 1932, 86,200 were installed and a total of 851,000 were in use. This phenomenal growth has been due in a large part to the development of the control systems which are the "brains" of the burner.

Prior to about 1925 most burners, which were mainly installed on the Pacific Coast, were manually controlled. There was arising, however, a certain demand for an intermittent operating burner which would be entirely automatic in its functions, guarding against its own failure, and assuring of quiet clean heat. It was to meet this demand that the modern domestic oil burner was developed, and hand in hand with the burner advance went the control systems. A burner could not improve radically without radical change in the controls, and similarly, an improvement in control systems meant an improved burner assembly. Control systems in general have been the result of the requirements of the industry and are almost always tailor made.

Types of Burners

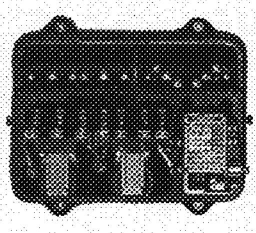
Before going into the description of the various control assemblies available today, it might be well to cover lightly the main types of burners on the market today. The majority of burners installed today are of the forced draft type, either pressure atomizing, vertical rotary, or horizontal rotary. The remainder are mostly "pot" type burners which may or may not have forced draft.

The pressure atomizing or "gun" type burner is generally installed outside the furnace. The oil is sprayed through a nozzle under pressure, atomized, and mixed with the air supplied from a fan. The oil is ignited by a high tension spark at the end of the blast tube or by a gas pilot. The flame is blown out in a straight line and impinges the brick lined walls of the ashpit and the heat rises through the boiler sections.



With the thermostat demanding heat, this boiler safety control will allow the thermostat signal to pass if temperature or pressure within the boiler is below the maximum operating point

The vertical rotary burners are generally installed inside the ashpit with nothing visible but the controls. The driving motor is mounted vertically with a spinner plate on the upper end of the shaft. The oil is fed out on this plate by gravity flow from the tank and whirled off the periphery, being atomized and mixed with the air in the process. A specially made hearth of shaped bricks is built around the spinner plate and the oil is ignited at one or more points in the ring of bricks by either a high tension spark or a gas pilot. The flame spreads around the ring and burns next to the well of the furnace. Both these types of burners are intermittently operating.



This relay, upon receiving a signal for more heat, immediately starts the oil burner and the ignition apparatus

The so-called "pot" type burners consist of a lined cast pot in the ashpit into which the oil flows in a thin film, to be vaporized by its own heat or by means of a fan. These burners are mostly "high-low" type in which the fire burns at all times, but is expanded in size when heat is required.

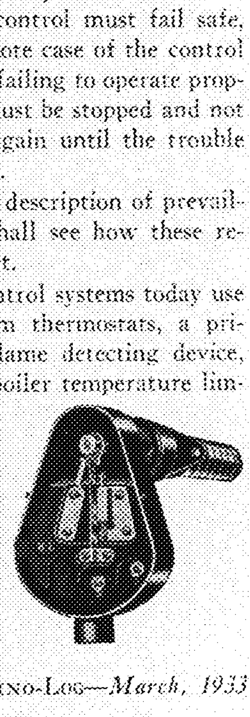
The horizontal rotary burner consists of a spinning cup on a horizontal shaft by which the oil is atomized in a manner similar to the vertical rotary. The oil generally burns in the air in the center of the furnace. The burner generally is mounted on hinges in the fire door and the flame is blown into the furnace. This type of burner is more common on larger installations such as industrial and other large boilers.

Control Requirements

The main requirement for an ideal oil burner control is to maintain the desired temperature uniformly and continuously. In order to fulfill this requirement safely, it must be able to start the burner when required, to provide a proper length of time for the flame to ignite, with any desired program of ignition, such as expanding a gas flame or energizing a spark transformer, to allow the burner to continue to operate when the flame has ignited properly, to shut the burner down when a flame failure occurs for any reason, or if the flame fails to ignite, and finally to stop the burner when the room temperature has reached the desired point, when the boiler temperature or pressure becomes excessive, or when any abnormal condition exists. The control must fail safe, that is, in the remote case of the control or any accessories failing to operate properly, the burner must be stopped and not allowed to start again until the trouble has been corrected.

After a general description of prevailing systems, we shall see how these requirements are met.

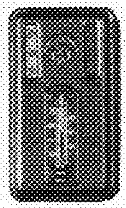
The general control systems today use one or more room thermostats, a primary control, a flame detecting device, and one or more boiler temperature lim-



If the oil burner does not start combustion within two minutes, this furnace stack control calls for a complete shut-down iting controls and low water cutoffs. The majority of the systems today use low voltage control circuits, at about 20 volts, mainly because of the lower cost and greater convenience of installation, and because of the fact that thermostats and other controls may be built more simply and with greater accuracy and sensitivity. Small power transformers are used in A.C. control circuits.

The Room Thermostat

The starting point of any control system is the room thermostat. The actuating means for a room thermostat is generally a piece of thermostatic metal which consists of two metal sheets having widely different coefficients of expansion, such as brass and steel, rolled and welded together on the flat side. This strip when heated or cooled will deflect at one end, in one direction or another, due to the greater expansion of one side of the strip. Within limits this motion varies directly with the change in temperature. This motion is generally magnified somewhat by means of levers or long blades, and serves to actuate a set of contacts, which start and stop the burner. Open contact thermostats are mostly low voltage with low current capacity and the burner is controlled through relays or similar devices. The thermostatic metal is sometimes coiled like a clock spring to give greater length in a small space. By changing the position of the sensitive element in relation to the contacts the thermostat may

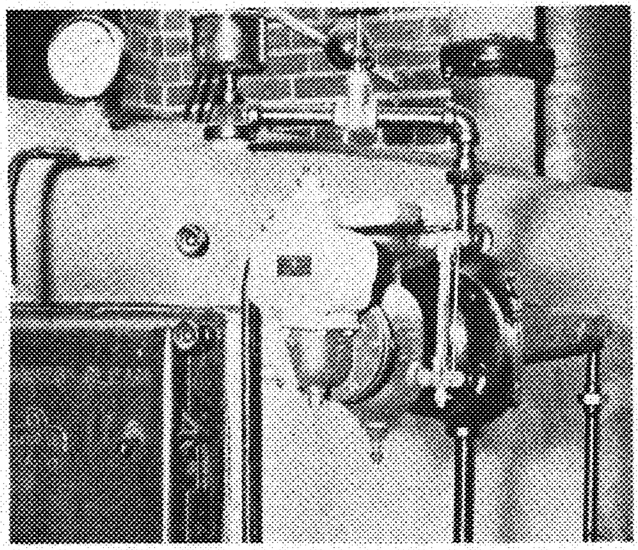


This wafer type room thermostat is used in installations where a more accurate control of temperature is desired

be set to control at any desired temperature. Where greater power and more movement is required, a flexible metal bellows containing a volatile liquid is used, which expands or contracts with changes in temperature due to volatilization of the fluid. The setting of this type of thermostat is by changing the pressure of a spring working against the force of the bellows. This type of thermostat is limited in range for a given volatile fill and is generally somewhat less sensitive to small temperature changes due to its greater mass.

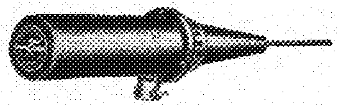
Mercury Switches

Mercury switches are often used in thermostats. These consist of a glass tube with electrodes sealed in one end and containing a small amount of mercury. The tube is generally filled with an inert gas to prevent oxidization of the mercury and the electrodes and also to reduce the arcing when the circuit is made or broken. The tube is tilted by means of the thermostatic metal or bellows, and mercury flows to the contact end of the tube, making the circuit.



The boiler safety control in this installation protects against excessive boiler pressures or against low water

A refinement in thermostats is the addition of a clock, either electric or spring wound, for the purpose of automatically changing the temperature setting at any predetermined time, so as to maintain lower temperatures in the house at night and to raise the temperature again early in the morning. This arrangement generally results in



The Protectoglow detects immediately any flame failure and acts to shut off the entire system if the flame does not return

fuel savings due to the fact that outdoor night temperatures are usually lower than day temperatures. A further advantage is in the case of buildings which are occupied only part of the time, such as churches, schools, etc., for a low temperature may be maintained when the building is vacant and the setting changed automatically on the desired days.

The average thermostat is designed to operate on a temperature change of from 1 to 2 degrees, and will maintain the room temperature at the desired point within that range.

Boiler Safety Control

From the room thermostat, the control line to the burner passes through a limiting device designed to prevent excessive boiler temperature or pressure. For hot water or warm air systems, a coil of thermostatic metal is placed in the furnace and operates contacts in order to stop the burner if dangerous temperatures exist. For steam boilers, a metal bellows is used to expand from the boiler pressure and to shut down the burner. This control is necessary mainly as a safeguard against an excessively high room thermostat setting or against an abnormal condition, such as an open window near the thermostat. It is also useful to prevent over-run of temperature in case the boiler heats faster than the heat can be dissipated to the room. A low water control consisting of a float operating a switch, is also used on steam boilers to prevent firing into a boiler when the water level is dangerously low.

Sequence of Control

We now come to the heart of the controls system, the primary control. This control generally consists of one or more relays, a time delay switch which serves to allow the flame a given time to ignite, and whatever auxiliary devices are required to give the desired program of events. A flame detecting device is always used in connection with the primary control and the two units are sometimes built into one case and mounted on the stack or in the fire door. A typical control sequence of a standard control is as follows:

When the thermostat calls for heat, it closes contact, and if the boiler limit control is also calling for heat, energizes a relay in the control which in turn closes a circuit to the burner motor and to the ignition means. In series with this relay is a thermal time-delay switch which consists of a piece of thermostatic metal heated by a small resistance element also in series with the relay coil. This switch is set to break contact at the expiration of from one to two minutes, unless flame has been established within that length of time. Simultaneously with the starting of the burner motor and ignition, this switch starts heating.

[*Please turn to page 180*]

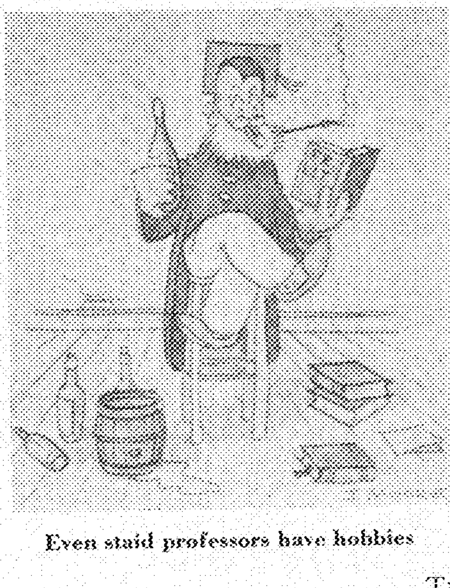
While the Moon Goes Over the Campus

By RODERICK WM. SILER

WELL, spring is here I see. Or at least it was here yesterday. The feel of spring is in the air. Spring is usually regarded as turning the thoughts of young men to love and of old fossils over forty years of age to fishing. It certainly has a tendency to turn thoughts away from whatever is dispensed in classrooms. There recently died in England a man in the teaching business who would probably have sympathized with the springtime tendency to wander off in search of other things. His name was George Edward Bateman Saintsbury, Professor of Rhetoric and English Literature at Edinburgh University. But that was far from being all. He was at the time of his death recognized as the greatest English authority on French literature. But neither was that all. He was author of a work, "Notes on a Cellar Book," which is recognized as a classic on wines. Perhaps no teacher ever specialized on two more fascinating subjects, French literature and wines. All his life he preached reason, restraint, thoroughness without haste, enjoyment of life without abuse of it. And he lived to be 87 years old. His life was proof of the fact that a diversity of tastes and interests is good for a man. And that is why I am certain he would sympathize with that feeling which is going to permeate this college with a great unrest on the first day the temperature gets above 80 degrees, Fahrenheit. Among other things spring is responsible for is the lust for travel. A student of today with that feeling in his bones will probably take to an auto. Twenty-five years ago the victim who suffered from a complication of wanderlust and poverty took to the railroad, either to foot it along the track, or to ride—in a box car.

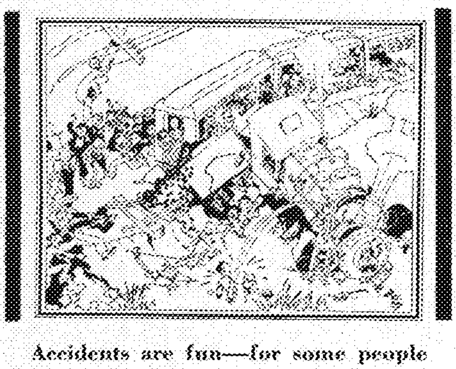
Railroads do not mean to people today what they did twenty-five years ago. But I suppose one would have to go back fifty years to get the full flavor of what might be called "the railroad era" in this country. Looked at from the engineering and operating standpoints the railroads before 1880 were far different from the present. I wonder how many people traveling in the safety and comfort of present day trains appreciate the hardships and perils of the men who operated the old railroads. Think of this: that as late as the 1870's trains were braked by hand. What happened in 1870, and for a good many years after, when the engineer of a freight gave the single blast that called for "Brakes on!", or the five short blasts, "The train has parted!", which gave warning that a coupling between cars had broken? Out from the engine and the caboose scrambled the brakemen, to run along the tops of swaying cars, jump from box car to box car, and set each brake as they came to it. This was no child's game in the best of weather, but when it is remembered that the trick had to be done at all hours and all times of the year, on the blackest nights in rain, wind, cold, snow and sleet, the surprising thing is that men could be found to follow this line of work for a livelihood. Of course the mortality among trainmen was very high, a large proportion of the deaths resulting from brakemen tumbling from trains or being crushed in coupling cars with the old link and pin.

I think every man in engineering, no matter what branch it happens to be, is interested in the history of the railroads and in the problems they have met. Take, for instance, this matter of brakes. From the historic ceremonies opening the Manchester and Liverpool railroad in England on September 15, 1830, down to 1870, trains ran without any system of brakes operated from the locomotive. In this time trains had attained speeds of 60 miles an hour, and 45 miles an hour was by no means unusual. Yet when in 1875 experiments were made in England to determine the effectiveness of the old system of braking by hand it was found that a train traveling 45 miles an hour could not be stopped in less than a minute or before having traveled half a mile. This inadequate braking resulted in some costly accidents, one of the most fearful of which was that occurring near the little town of Angola in western New York on December 18, 1867. Here the last car of a fast traveling passenger train became derailed a quarter of a mile from a bridge crossing but the train could not be stopped in time, with the result that the car fell end first into the ravine fifty feet deep, tumbling all the passengers in a mass onto the heating stove at the end of the car, and ending by roasting or suffocating forty-one of them. Besides being handicapped by poor brakes almost all roads in those days were single track, the block system had not yet been introduced in this country, and while passenger trains ran on schedule all other trains literally ran by telegraphic orders whenever they had a chance. Getting to statistics we find that for the ten years ending December 31, 1883, there were reported in the newspapers of this country 10,887 railroad accidents. This means, of course, a far greater number of minor accidents of which there is no record. Of the reported accidents, derailments numbered 6,778, while there were 1,086 head-on collisions and 2,15[illegible] rear end collisions. Then in 1869 appeared the first brake operating from the locomotive and putting trains under the engineers' control. However, it took years to perfect these brakes, and more years to have them universally adopted. And it may be added that English railroad practice, which then led the world in many respects, hung back in accepting the brakes. The American inventions in brakes were superior to the English and finally won the greater share of the business over there. In later competitive tests in England between Westinghouse automatic and Smith vacuum brakes, both American inventions, trains running fifty miles an hour were stopped in fifteen seconds and within 650 feet, results so superior to anything possible with the old hand brakes that they could no longer be ignored.



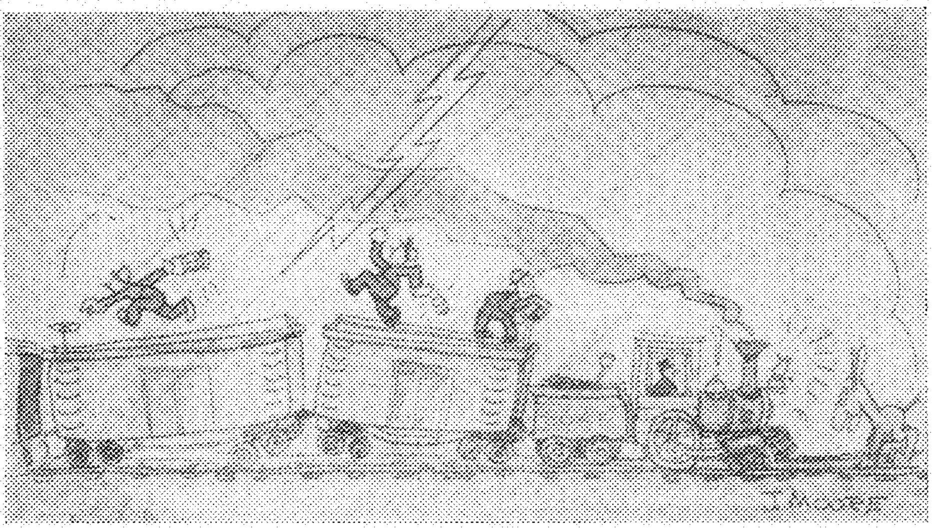
Even staid professors have hobbies

Yet in spite of all mechanical devices accidents will occur. I think one of the most remarkable accidents I have ever read of, illustrating the fact that safety is after all more dependent upon the human than the mechanical factor, w[illegible] that one taking place at Abergele, Wales, on the London and North Western road, August 20, 1868. The train was the "Irish Mail," a crack train of those days, running in about six hours the 250 miles from London to Holyhead, Wales, where connections were made with boats going to Ireland and elsewhere. Abergele was not a very large place, and the railroad here followed the coast, the Irish Sea visible to the north, the Welsh hills inland. There was an upgrade beyond Abergele, and a short time before the Irish Mail came along six cars of a goods, or freight train were standing at the top of the incline. The engine of the goods train, shunted some cars onto a siding, then came back with the rest of the train to the six cars on the main line to pick them up and go on. These six cars were loaded with oil, and the brakes, because of an employe's negligence, had not been set.



Accidents are fun—for some people

When the engine and remainder of the train struck them in making the coupling the six oil cars started to roll down the hill before the coupling could be completed. The trainmen ran after them but could not overtake them, and on they rolled to meet the approaching Irish Mail. The engineer of the Mail saw these cars only when they were a few yards off suddenly looming into sight around a turn of the track, and he jumped, landed unhurt, and had presence enough of mind to rush to the rear of his train after the collision and draw out a coupling releasing the last six passenger cars, which were carried back down the hill and thus escaped. But the oil cars, the locomotive and first seven cars of the Irish Mail, with every living soul in them, were utterly and almost instantaneously destroyed. Survivors likened it to a lightning stroke: there was the shock of the collision, a flash, and then a flame enveloping and destroying all so quickly that not a cry nor a sound of any kind was heard from the passengers in the carriages. Thirty-three people died, most of them of prominence in England.



One toot of the whistle in the good old days, and train men jumped from car to car setting brakes by hand as fast as they could in all kinds of weather

As there was hardship and danger in the old railroading so there was also a glamor and romance. No doubt this existed in the careers of the old time civil engineers employed by the railroads. First went the C E's, meeting Indians, sickness and fleas, then came the railroads. Then the other branches of engineering. Then the rest of the professions. We admit that doctors and lawyers and ministers and aggies are useful, but not glamorous. And teaching—who ever heard of any romance in the teaching business? I have seen movies in which school ma'ams in the old days went out West and fell in love with cow hands, causing a certain amount of gun play and excitement, but I never have heard of anything like that happening to a man teaching. If one is unprejudiced one will have to agree that though these other professions have their good points and probably bring in more money, engineering is where the romance lies. But truthfulness forces me to add this: that though being an E E or an M E or an Arch E or an Aero E or an Ag E is, all things considered, preferable to being a lawyer or a doctor or a teacher, none of them is quite as glamorous as being a C E. Statistics support me here. Did you ever hear of a novelist or a dramatist, looking for a hero to put in a book or on the stage, use an E E or an M E? The hero, if he has any job at all, is always a C E.

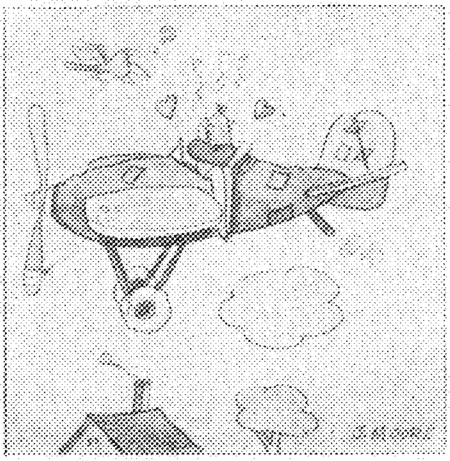
Talking of railroads, and in the spring of the year, reminds me that a year ago last summer I drove to Florida and was surprised to find how pleasant a trip it could be at that time. I crossed the mountains by the road through Asheville, North Carolina, and I remember this part of the route as one of towering and wooded peaks, blood red rivers, deep chasms, sharp turns and steep grades, and lonely cabins. Then came a shoot straight south through the flat and apparently endless cotton fields of South Carolina and Georgia, by the small frame houses of that region, houses usually unpainted and often with windows gone, and always with verandas, brick chimneys at the ends, and cocked up above the grounds on stilts of brick or stone. Jacksonville, Florida, was a busy town, but busy towns are pretty much the same everywhere, and not to be compared with St. Augustine, forty miles away from Jacksonville on the coast. St. Augustine was a delightful place. St. Augustine faces an inlet of the sea; there is old Fort Marion near at hand and overlooking the water, while the narrow back streets of the town, bordered and shaded by tropical trees and vegetation, provide very pleasant walking. The spot which most impressed me in St. Augustine was a secluded and shady one at the edge of town where stands a small shrine commemorating the landing there of the Spaniards under Pedro Menendez de Aviles in 1565.

Well, I had better close here, or I'll be leaving for Florida, myself. May I suggest that if you long for Florida or South America or China, but can't quite spare the time to travel just at present, you do the next best thing and visit the movies shown on Fridays in the Music auditorium. Here, in travel pictures, you can view the various places of the earth, from Spitzbergen to Timbuctoo. Here is a news reel. Here is other good stuff. And the price—believe it or not—is nothing!

THE PICKLED CATALYST

gives some inconsequential reactions

by OSCAR QUACKENBUSH FEGAS, I. O. U. '36.40



An aeronautical makes contact

My, my. Here spring came, and the midquarters went, and Lent came. Which causes your old delegate to the herring packers convention to rise up and inquire if the exponents of St. Pat made any sacrifices during the season. For ourself, we gave up wearing a palm beach suit. *(Never had one, too, also, either.)* But we know of people who have sworn off watermelon and corn on the cob.

With the sidewalks dry and old Sol casting warm beams of his famous ultra-violet down upon us, we couldn't help but amble as slowly as possible *(without seeming to stop altogether)* while passing groups of youngsters engaging in that joyful juvenile gambling game *(say that fast)* of marbles. And when we got home, some magnetic impulse drew us down in the basement to hunt up a box of marbles won not so many years ago. Being all alone, we couldn't help just setting down a couple agates and shooting at them. And for a solid half hour did we have the fun!

page the baron

One prof tells us that there are over 100,000,000 pounds of copper wire laid above and under the ground in Minneapolis alone.

How about pulling up the wires, starting a copper mint, and going back to kerosene lamps?

such extravagance

It is reported that over four thousand dollars worth of quiz paper is used per year in one of the engineering departments. When a bundle of fifty blue books are handed out to a class of ten, that's one thing. But when these books do not last till they get to the end of the class, that's another thing.

Being one of the unlucky things that didn't get one before a quiz, none other than Paul Felt blurted out, "Say, doesn't your conscience bother you at all?" This to the part of the class in front of him.

did you ever wonder

Why Bowers always fills his pipe before the lecture is over?

What a man thinks about when he laughs to himself?

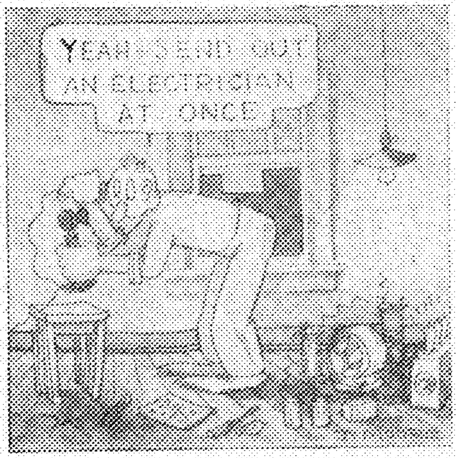
Why you can think of all the formulas but the right one during a quiz?

Why one girl is so much nicer than all the rest?

Why Lindner lights a cigarette at the end of the hour even if the prof keeps on talking?

If Anthony Zelney will take up smoking seriously?

If, as a grad, you will really get an honest-to-henry real bona-fide job as an engineer?



Our electrical show chairman encounters difficulties in repairing a doorbell

THE time of the year has rolled arounc when it is altogether fitting and proper to observe the customs of our fathers as set down some nineteen hundred years ago. Consequently we dug down into the musty files and presto, we presen in distracted paragraphs:

The Engineer's Ten Commandments

1. Thou shalt not wait for something to turn up, but thou shalt pull off thy coat *(if thee hast any)* and go to work that thou mayst prosper in thy affairs and make the word failure spell "success" *(if thou canst spell).*

2. Thou shalt not be content to go about thy business looking like a bum for thou shouldst know that thy persona appearance is better than a letter of recommendation *(the kind thou wouldst get).*

3. Thou shalt not try to make excuses nor shalt thou say to those who chide thee, "I didn't think." *(Which wouldst be the truth.)*

4. Thou shalt not wait to be told wha thou shalt do, nor in what manner thou shalt do it, for thus may thy days be long in the job which fortune hath given thee *(If it has.)*

5. Thou shalt not fail to maintain thine own integrity, nor shalt thou be guilty of anything that will lessen thy good respect for thyself. *(If thou has any.)*

6. Thou shalt not covet the other fellow's job nor his salary, nor the position he has gained by his own hard work.

7. Thou shalt not be afraid to blow thine horn, for he who failest to blow his own horn at the proper occasion findeth nobody standing ready to blow it fo him. *(If he hast one.)*

8. Thou shalt not fail to live within thy income nor shalt thou contract any debts when thou canst not see thy way clear to pay them.

9. Thou shalt not hesitate to say "NO" when thou meanest "NO," nor shalt thou fail to remember that there are times when it is unsafe to bind thyself by a hasty judgment. *(If thou has any.)*

10. Thou shalt give every man a square deal. This, the last and grea commandment, and there is no other like unto it. Upon this commandment hang all the law and the profits of the business world. *(If there are any.)*

plus and minus

"What's this?" said Dr. Geiger "Doesn't a plus sign always mean on more?"

"Not always," chirped Leon Grozov sky. "In a graveyard it means one less."

in the chem lab

Experiment 1.—Vapor Pressure

(1) Clean out large flask with alcohol.
(2) Rinse out alcohol with ether and pour out.
(3) Immediately dry flask over bunsen burner.

Remarks: Compare noise with (a) Bursting of toy balloon, (b) Firecracker on July 4, (c) Eruption of Mt. Vesuvius.

Experiment 2.—Chemical Warfare

(1) Procure large sample of iron filings.
(2) Get good supply of sulfuric acid.
(3) Mix thoroughly and remain to watch reaction.

Remarks: Would you not rather be in a limburger factory? Or have you no sense of smell? *(You probably won't have after this experiment.)*

Experiment 3.—Prohibition

(1) Procure a few cubic centimeters of absolute alcohol from stockroom clerk.
(2) Repeat every day for one month.
(3) Take whole quantity out in hall and drink it.

Remarks: Write on back of postage stamp what you can remember. *(If you can remember that much.)*

Experiment 4.—Instantaneous Reactions

(1) Dip large pieces of cotton into a very concentrated solution of nitric and sulfuric acids.
(2) Dry and roll solidly into paper bundle.
(3) Light match to paper and run like Satan.

Remarks: Compare flash to lightning, sound to thunder, the hole in the ground to the Pacific ocean. *(Providing you ran fast enough.)*

that's the rub

The doctors say that plenty of exercise will kill all the germs. Ralph Peck wants to know how do you get them to exercise?

what price brains

The results of a short intelligence test have been made public. How smart are you? Here is how smart others are:

Horse power is the distance one horse can carry one pound of water in one hour.

An angle is a triangle with two sides.

Gravitation is that of which if there were none we would all fly away.

you go your way

Speaking of city power transmission, Prof. Kuhlmann told his class that in Minneapolis, the electricity sent to the residential districts is at a very high potential. Racing along in a manner fit to make Floyd Gibbons blush, Mr. Kuhlmann concluded, "—and if you look on top of the telephone poles, you will find 4,000 volts."

But, my dear professor, we would rather not go up there to look for them. In fact we would rather not find them at all. If it's all the same to the 4,000 volts.

buttons

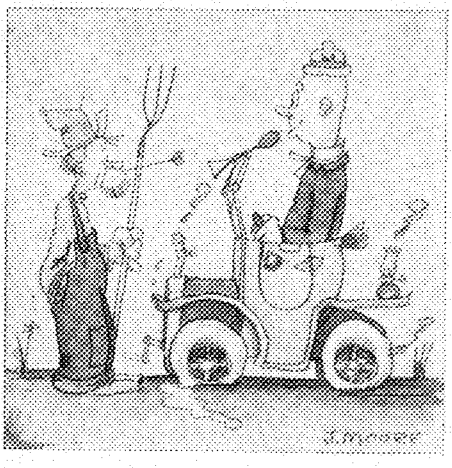
While drawing some of those intricate colored pictures in Prof. Ryan's "Design" class last week, Cliff Sonnesyn happened to notice some fancy buttons which were an essential part of "Oscar's" raiment. In case you don't know, "Oscar" is one of the best known of the M.E.'s and she obligingly displayed them.

After a close scrutiny Cliff remarked, "Are there any other buttons you can show us?"—And was somebody's face red.

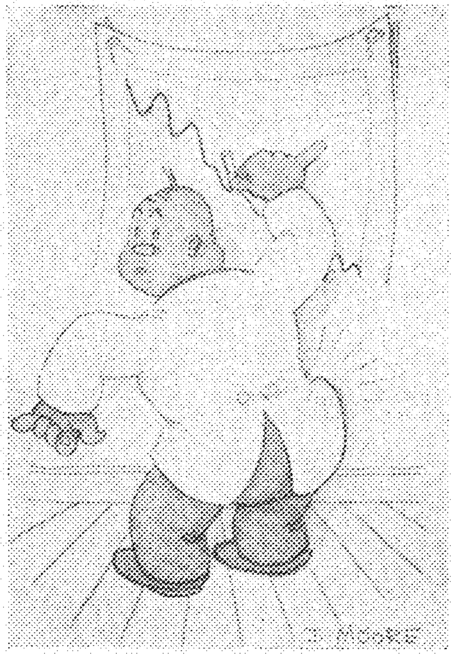
▾ ▾ ▾

In a class on Motor Transportation various problems confronting amateur autoists are discussed. The question arose one day as to how a self starter could be disengaged from the flywheel (is my face red) in case it became jammed. Major Shippam most emphatically contended that trying to crank the car would do no good since he had tried it once, even to the point of jumping on the crank until he bent it.

Can't you just see the Major bouncing on his crank and only ten minutes to make a train or something?



After the rain, a civil tries to find the road which he built a few days back



There are curves—and curves.

the question box

Dear Oscar—I see by the papers that life insurance companies advertize a college education is worth a hundred thousand dollars. Where can I sell mine for 15c?—*Doctor of Philosophy.*

Dear Doc—I'll sell mine for ten.

▾

Dear Oscar—I have cut a three credit course four times and flunked all the quizzes. Is this the reason I am getting a flunk?—*Happy Go Lucky.*

Dear Hap—No. You would flunk anyway.

▾

Dear Oscar—I hear that tennis is an old game—so old in fact that it was played even in Biblical times. Is this true?—*Charles Britzius.*

Dear Chucky Boy—Most of a certainty, Charles. In the Bible it says that Moses served in Pharoah's court.

classified cars

It was a learned discussion in Dr. Dachtrer's Econ. 9 class about what constituted capital goods, and somebody wanted to know how a car would be classified. The official decision was that it would not be classified as a capital good, since it wasn't being used for further production. Then there was heard a gallery voice from the back row—"But, Professor, you don't know *my car.*"

▾ ▾ ▾

Doc Mann tells his chemists that the inside of the earth is a molten mass of rock and flame.

Isn't that hell?

The MINNESOTA TECHNO-LOG

UNIVERSITY OF MINNESOTA

OUR PLATFORM

▼

Awaken the Arabs

Advance Registration

A Five Year Engineering Course

Social Activities for Engineers

Milk for Engineers

WHAT PRICE ENGINEERING?

DURING ordinary times when everything runs smoothly along in its conventional manner the engineering student, busy in his technical studies, is content to ignore the activities of the rest of the world. During the last few weeks, an unusual condition has arisen. Everyone has been disturbed by the financial crisis which has involved our country. When the banks close and financial difficulties inconvenience the engineering student, he confusedly looks around and wonders "Why?" He is dimly aware of what is going on, but does not understand it. It is then that he is envious of the fellow who happens to have taken some economics courses and can intelligently discuss the matter at hand, and know what to do and when, if there is need for any individual action.

Thus it is with many things in our lives; occasions often arise when knowledge of the essentials of business, law, and the finer arts are necessary. These should be studied by all, but most engineering students unfortunately neglect them. It is a great cost—that of sacrificing these studies so that we may become specialized technical men, undoubtedly very valuable in that one field of work, but worthless in any other. That is the price we pay to become engineers. But is it necessary? Why does not the engineering course broaden and require some of the essential non-technical courses in its program—thereby turn out not only good engineers, but good men!

—M. C.

MILK

ACCORDING to a ruling made many years ago, the sale of food products of any sort is prohibited in the engineering colleges. This ruling, designed primarily to keep cigarette and candy sales out of the college buildings, has been interpreted recently in such a way that a milk driver selling milk to engineering students has been driven off the campus.

The sale of milk to engineering students can be considered a real service, for a surprisingly large number of us are now bringing our noon lunches from home. In fact, for many of us a pint of milk is our only lunch.

With every engineering student and the majority of the faculty of the engineering colleges favoring milk sales, the department of Buildings and Grounds and the administration have seen fit to prohibit the sale of milk. Surely the question of bringing commercialism into our schools is absurd when every engineering student considers the sale of milk a real service, and when commercialism in other forms is in evidence daily in our campus buildings. Without this service students have to walk two blocks to the nearest store, carrying their bottles with them, in order to get their milk. Many have not the time to do this, and therefore must go without.

Raising of this ban will be gratefully received as a recognition of the students' needs.

—L. J. M.

THE TECH FROLIC

TWO hundred and fifty loyal engineers with their guests celebrated the innovation of an annual Tech Frolic which promises to be carried on as a tradition of our school. Notwithstanding the unfavorable financial conditions, the engineers have clearly shown their desire to have here a large social event similar to those held annually by other engineering schools of the country. Undoubtedly in more prosperous times the Tech Frolic will have to be held in a place which will accommodate at least 800 people.

The loyal spirit of friendliness among the engineers was much in evidence as the dance proceeded under the cheerful tunes of Dick Long's eleven piece orchestra at the Curtis Hotel, Friday evening, March 10. A spirit of new and solidly cemented friendship seemed to prevail everywhere as students who had scarcely known each other heretofore joined in the fun. Although this was the first engineering dance for some time that was held at a downtown hotel with a large orchestra, the turnout conclusively showed the students' willingness to support their college activities. They are to be commended for the willing support given in a time of financial stress.

Too much credit cannot be given the Engineers' Bookstore for their co-operation in making it possible for those who desired to delay payment for the dance until later to obtain tickets. The loyal spirit of the engineers, the willing cooperation of the bookstore, and the hard work of the committees was but another evidence of the unity of our engineering colleges.

—T. A. R.

AMACO

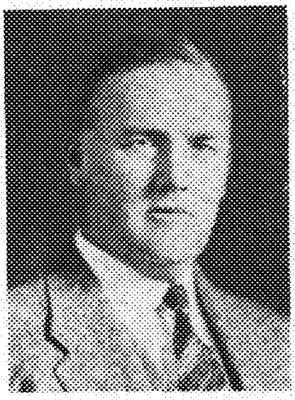
IN tracing the rise of Amaco (the American Manufacturing Company) from 1907 until 1933, Martin Flavin has portrayed vividly the rapid development of machines and their effect upon civilization. The action of the play portrays the demand for speed in present day industry, and everything in this drama accentuates the impression of speed and of the mechanization of the men who operate machines. There are seven changes of scene which indicate seven stages in the development of this huge company and which signify climaxes in the life of Jim Burke, an Irish immigrant, who starts in feeding the machines for Amaco and who rises step by step to be president of this gigantic corporation.

The last and most thrilling scene, representing in time the year 1933, is a prophecy of what is to come to our industries in the future. The Amaco machines have been idle since 1929 and the workers are starving—the corporation is near bankruptcy. Up to this point the action of the play may be likened to the situation existing today in any one of our large industrial corporations. The next step, where the workers, made frantic by hunger and want, invade the factories and smash all the machines, forms a fitting climax to this play of men and machines and makes us wonder what will actually happen if present conditions continue much longer.

To the University Theatre we extend our congratulations; first, for having selected a really worthy engineering play for this premiere; second, for staging in such impressionistic style the action of moving machinery; and third for going on with the play in spite of adverse economic conditions.

—L. J. M.

DEAN LELAND SAYS - - -



The Five Year Course in Engineering

NO one would contend, I am sure, that an education consists of four years in college, or any other specific period. Such a statement would imply, first of all, that a certain amount of *something* would constitute an education and second, that all students have the same initial preparation and ability. Nevertheless, when we speak of a college education we refer to the completion of a course of study leading to a degree. The number of years normally spent in the course is largely a matter of tradition—usually four. Probably this number was established in the beginning in order to include a list of subjects which were regarded as essential for a college education. In this connection, it may well be remembered that up to about fifty years ago college curricula were made up almost entirely of required courses without electives.

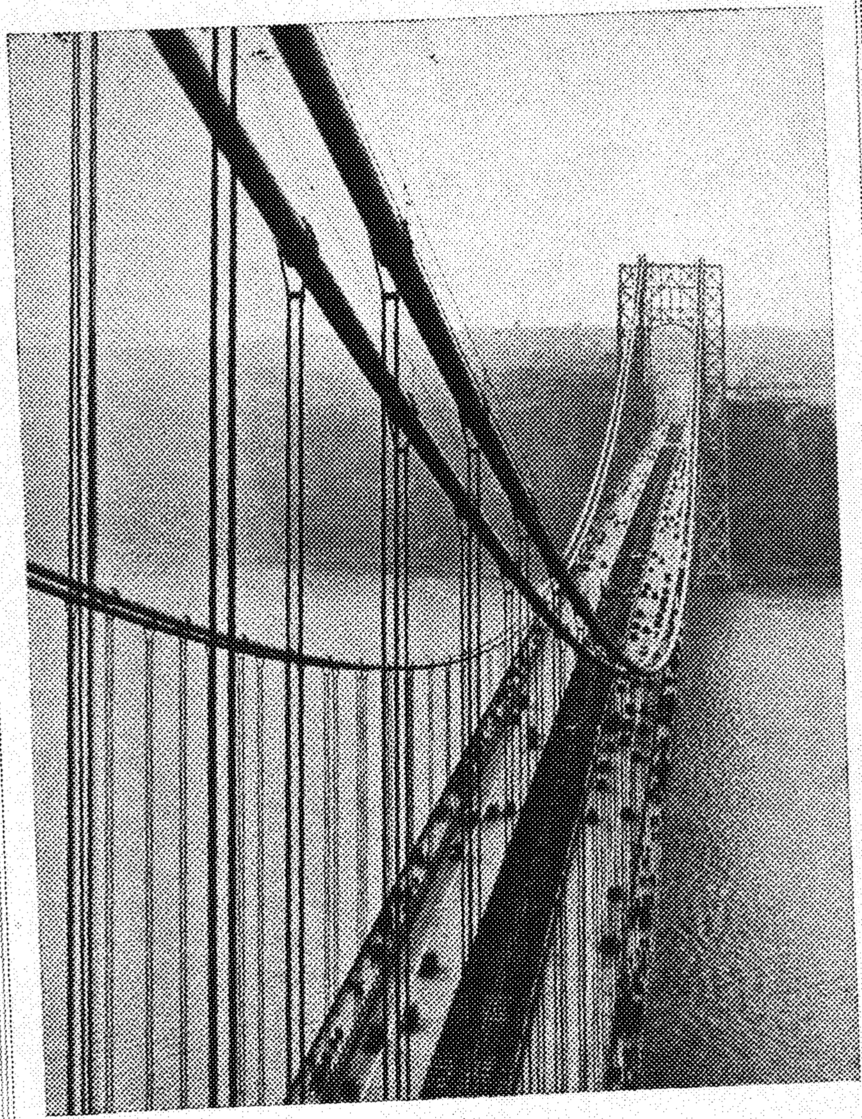
The four-year course in engineering has survived almost universally although it has been increased to five years at a few institutions, especially those using the co-operative plan. For a number of years, prior to 1922, five-year courses existed here at Minnesota with a bachelor's degree at the end of four years and the engineer degree (C.E., E.E., etc.) at the end of five years. The professional work of the curriculum was extended into the fifth year with the expectation that all of the best students, at least, would remain for the fifth year. Gradually the number of those remaining for the fifth year diminished and it was realized that for almost all of the students the course had become one of four years. The four-year course was then re-established upon a professional basis and the advanced work was placed in the Graduate School.

The acceptance of the four-year course as a standard is based upon the opinion that this period is sufficient to embrace those subjects fundamental to engineering which all graduates should have, such as mathematics, chemistry, physics, drawing, mechanics, and materials, together with the necessary technical courses preparatory to the chosen field and some time for electives. It provides adequate instruction for the great majority of engineers and a foundation for those who may have the special qualifications, interests, and means to continue with post-graduate work in some field of specialization.

The far-sighted student who is able to give five years instead of four to his course is indeed fortunate. He can so distribute his required work through the five years as to afford him the opportunity to carry a program of elective courses beginning with the sophomore year. In particular, he will profit by courses in economics, finance, government, business, and industrial management, and it should be a source of lasting enjoyment to take some short courses in those sciences which he did not take in high school, such as geology, biology, physiology, astronomy, and psychology, and, perhaps, some art appreciation and music. Cultural breadth involves some familiarity with many subjects — a smattering, perhaps — rather than much knowledge limited to a single subject.

Briefly, then, my answer to the question of a five-year

[*Please turn to page 181*]



Courtesy—Wire Engineering

Mighty cords of steel support the roadway of the George Washington bridge which spans the Hudson river.

CAMPUS NEWS

American Chemical Society

On March 22 the local section will present Dr. McLaughlin, chief chemist of the B. D. Eisendrath Tanning Company of Racine, Wisconsin. Dr. McLaughlin will speak on the subject, "Chemistry of Tanning." The talk will be illustrated by slides and histological specimens showing hides in various stages of leather production. This lecture holds much appeal for students generally and everyone is invited to attend.

A. S. M. E.

Due to exams the regular semi-monthly meeting of the student chapter of the American Society of Mechanical Engineers is postponed until Thursday, April 6. According to Norman Carlson, plans will be organized at that time for arranging a joint dinner with the local A.S.M.E. senior chapter, and the selection of a representative for the National Convention which will be held in Chicago on April 28 and 29. Mr. A. A. Potter, national president of the A.S.M.E., is scheduled to visit the local chapter before the national convention and plans will be made for his entertainment. Frank Ventura announced that the pins and magazines are now available to members.

Eta Kappa Nu

After much deliberation and discussion, Eta Kappa Nu decided to have a tobaggan party several days ago, whereupon all the snow obligingly melted away and left the hilltops clean and dry. And with the trials of the last initiation still haunting the new members, selection of candidates for the spring quarter pledging arises for consideration.

Boeing Scholarships

For the fourth consecutive year aeronautical scholarships valued at $7,500 are being offered by Mr. W. E. Boeing, head of the various Boeing aeronautical manufacturing and operating companies, to aviation-inclined students of universities and colleges. To the four college undergraduates who submit the four best essays on aeronautical subjects will be given flying and ground courses at accredited flying schools.

Tau Sigma Delta

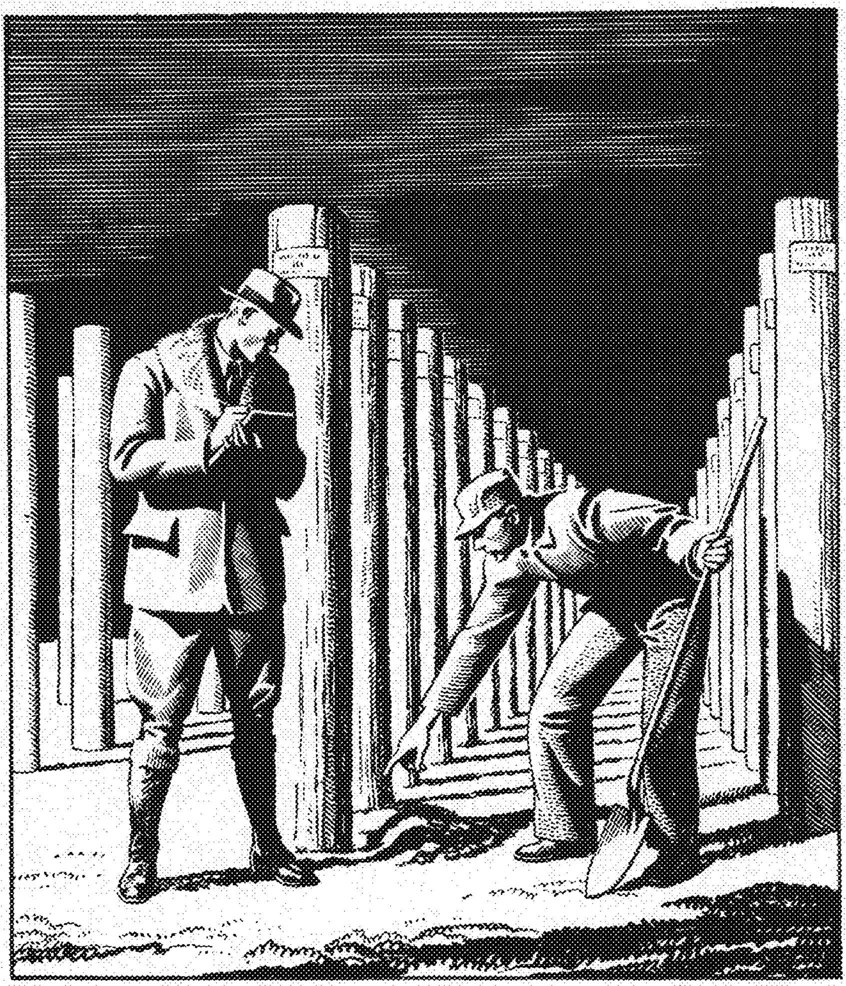
Tau Sigma Delta, Honorary Fraternity in Architecture and the Allied Arts, initiated Helen S. Hammond, N. Hillis Arnold, and Hubert H. Swanson into its membership on Tuesday, February 21, 1933, at the Skylight Club. After the banquet, Professor Leon Arnal gave an interesting talk on his Mediterranean Travels, which was followed by a general informal discussion on the problems of architecture.

Dr. Mann Lectures Before Sigma Xi

The second of this year's series of four lectures sponsored by Sigma Xi, honorary scientific fraternity, was delivered on March 1 by Dr. Charles A. Mann, head of the department of chemical engineering, on the subject "Chemistry in the Service of Man." As his first example of the tremendous benefits resulting from chemical research, Dr Mann cited the discovery of pain re lieving compounds in medicine, first ether in 1846, then the discovery of th desirable anesthetic properties of ethy lene gas, and finally the production o local anesthetics and harmless sleep pro during drugs.

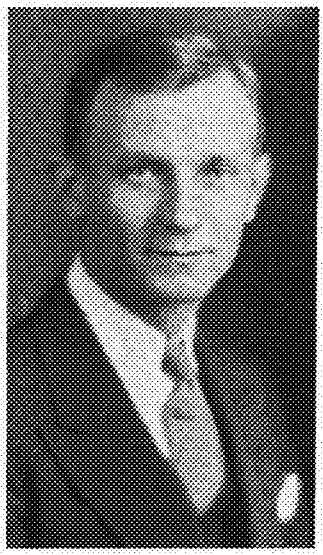
Dr. Mann devoted a good portion o his lecture to a discussion on the appl cation of chemistry for the utilization o farm wastes. Insulating boards are no being made from cornstalks. Straw, lon considered a nuisance by farmers, h been made to yield valuable produc through destructive distillation amo which is a gas of good-heating quali and an excellent grade of charcoal, the conversion of cornstalks into boa the cornstalks are shredded by mach and are cooked in a weak solution of

[*Please turn to page 184*]



FACULTY SKETCH

PROFESSOR JOHN D. AKERMAN



THE announcement of the Institute of Aeronautical Sciences that Professor John D. Akerman, head of the Aeronautical Division had been chosen as one of the founder members of that Institute has led us to pick him for our faculty sketch this month. The Institute of Aeronautical Sciences is a society of men who have distinguished themselves in Aeronautics in the United States and compares with the famous Royal Aeronautical Society of Great Britain.

Professor Akerman was born in Courland, Latvia, (formerly Russia) on April 24, 1897. As a child he was intensely interested in flying and manifested this desire by building and flying models and watching all the early flights he was able to. At the age of nineteen he graduated from the Reäl School at Mitau, Russia, and in 1916 enlisted in the Aeronautical School of Professor N. E. Joukovsky at Moscow, Russia. During the war he flew with the Russian Imperial Air Service and served as scout pilot with the Russian Aviation Mission in France and Italy. He was co-pilot and in charge of technical preparations for the flight from Italy to Russia in a Caproni C-2.

As to the dangers of air travel he thinks that his best chances to meet Saint Peter or the other fellow are in automobiles and that the greatest possibility in getting injured in air travel is in going to and from the airport on the ground.

Professor Akerman possesses an International Pilot License No. 7492 issued by the Aero Club of France. He has the military rating of Pilote de Chase of the French Army. He graduated from the University of Michigan in 1925 with a Bachelor of Science degree in Aeronautical Science, and from this time on his engineering experiences have been very numerous. From 1925 to 1927 he was busy with the shop and engineering work on the Ford Trimotor, 14 place transport of the Ford Stout Metal Aircraft Company. The University of Michigan claimed his services during 1927 and 1928 for the design of the equipment for their extensive aerodynamical laboratories. During 1926 and 1928 he taught aerodynamics in the Detroit City College and the Cass Technical High School of Detroit, Michigan. In 1928 the Hamilton Metal Plane Company of Milwaukee, Wisconsin, put him in charge as chief engineer of the design and construction of Hamilton 8-place all metal transports, both sea and land planes. The Hamilton metal planes were the first all metal commercial planes approved by the United States Department of Commerce, and are now in operation in South America, Canada and the United States.

His views on air transportation are that aviation is not displacing other methods of travel by satisfying needs that cannot be met by any other means. The airplane is not displacing autos and railroads because in no way could they take care of the service offered by the air. In 1928 to 1930 he was Chief Engineer of the Mohawk Aircraft Corporation during which time they produced their two and three place, open and closed, low wing and low powered monoplanes and their three place closed twin motored low power low wing monoplane.

Professor Akerman believes women can give aviation a big boost when they become airminded, for now the mother doesn't want the son nor the husband to fly and the sweetheart dreads her boy friends' flying. On Technocracy he has nothing to say. He believes when all other sources of power are gone man will have to turn to the wind for its power. It was with this in mind that the Madaras Rotor Power Corporation of Detroit called on Professor Akerman to be in charge of design of the Madaras Power plant rotors during 1931 and 1932. He is firmly convinced that the potential power of the wind is greatly in excess of the average person's idea and is a much more regular source of power than hydro-electric plants.

The University of Minnesota gained his services in 1929 when he came here as Associate Professor of Aeronautical Engineering and later became head of the department and Professor of Aeronautical Engineering in September, 1931. It is his belief that the Minnesota Daily does cover campus and fraternity balls and political activities very well. To him reporters are honest and sincere but as in all other things there are found blacksheep among them who not only print or report what they have been given but add their own observations as being more plausible than those of the men interviewed.

Children are among his favorite companions for it is in them that he realizes the limitless potentiality of minds that are open to the four winds and not set in any direction. Cats and dogs share his life and winter sports and dancing are among his favorite pastimes. He likes shows of all kinds, and is interested in art, for his work is creative and involves art. Cards he dislikes, but golf shares his spare time and fiction without murder stories entertain him at times.

Professor Akerman is a member of Iota Alpha, an honorary Engineering Research Society, of the Beta Chapter at the University of Michigan. He is a member of the American Academy of Air Law, the Minnesota Engineering Society, Northwest Aviation Society, and the Society for the Promotion of Engineering Education.

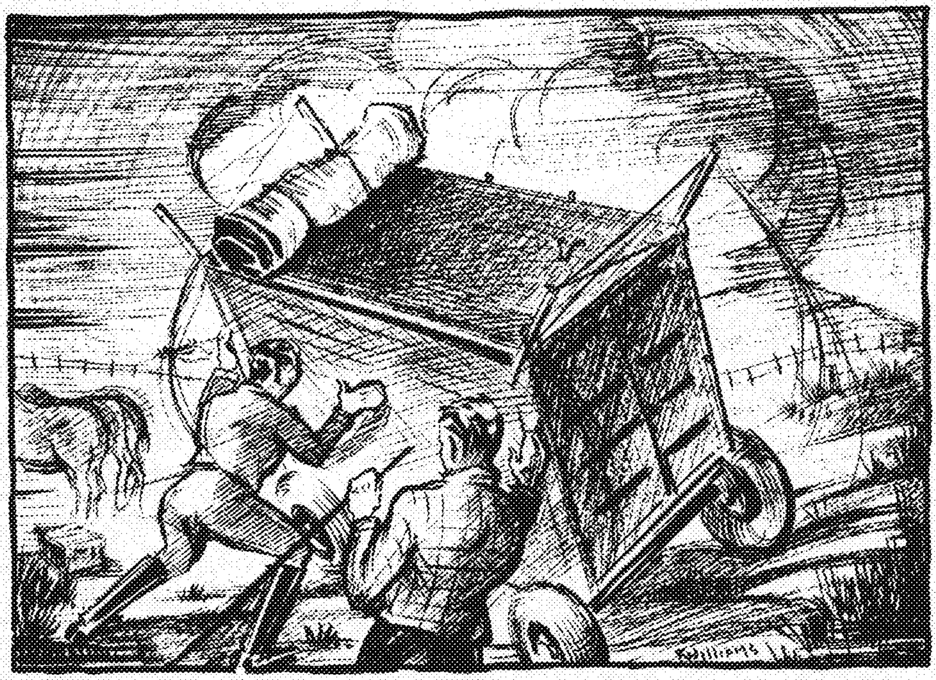
Prospecting for Oil

[*Continued from page 165*]

area surrounding the Gulf of Mexico, from the Mississippi River to Tampico. This territory was quite completely covered both on land and on water, even out into the ocean, not once, but in some places several times—each time with improved equipment and more accurate methods of interpretation. The search for salt domes, except for very deep ones of questionable value, has practically come to an end in this country. Fortunately the seismic method is not confined to exploration for this type of structure. Most of the oil deposits of the world occur in non-salt structures, as for instance in anti-clines, faults, sand lenses and in various other structures known to petroleum geologists. It is the mapping of these sub-surfaced features that comprises the major activity of seismic prospecting at the present time.

There are two methods of seismic prospecting—by refraction and by reflection. The refraction method is the original one and has the widest application. For this type of shooting the recording units, or seismographs, are placed at a considerable distance from the shot point. The geologic structure is interpreted from an examination of the behavior of the "least time paths" between these points. This least time path is the route through the earth that the beam of shock energy uses in traveling to the recording point and depends only on the sound velocities through the beds, and their relations to each other in the geologic column. It is possible by this type of shooting to reconstruct a good picture of what the earth's crust would look like if we were able to cut a vertical slice out of it, as we could in the case of a piece of cake.

The reflection method is simpler in theory. The time for the "echo" from an explosion to travel down to a reflecting bed and back to the surface again is measured. Knowing this time interval and the vertical velocities of the overlying beds, the depth to the reflecting point can be calculated.



Recording trucks of a seismographic party, pulled by from four to eight mules, encounter difficulties among the sand dunes of Texas

Let us now visit one of these exploration crews and see how they carry out their interesting work.

We climb aboard a Ford Tri-motor of the Pan American Airways at Brownsville, Texas, and three hours later arrive in Tampico. Here the oil company, whose property we are to visit, provides a guide to see us safely to the Imperial Hotel amid hawking cartadors anxious to carry our bags. The remainder of the day and part of the night is spent "doing" this once notorious city. In the morning we ferry across the Panuio River to the State of Vera Cruz, where a motor car is waiting to carry us over the El Aguila Road toward the south field. This road some sixty kilometers long, is paved with a foot or more of tar in an attempt to keep it open during the rainy season. At San Geronimo the road ends. We can proceed no farther south by motor car as the rainy season has made a mire of all unpaved trails. A motor launch of the order of a sea-going barge, with a mixed cargo of oil well supplies and native Mexican families, offers to transport our party down the El Tamiahua Lagoon. The barge near the end of its cruise runs aground, forcing us to abandon it for a ride along the beach in a motor truck that comes to our rescue. Late that night at the oil loading terminal near the mouth of the Tuxpan river, our diet of shrimp procured along the lagoon is supplemented by a substantial meal. Beds are scarce in the American colony, so we pass the night in the company's malaria hospital. The next morning we go up the Tuxpan by boat to Zapatal, then inland by a crooked narrow gauge railroad to Alamo, where the seismograph party is operating.

A Seismic Crew

The seismograph crew is composed of five men: a shooter, two observers, a computer, and a chief of party. The shooter has the honor to show us his part in the work first. We ride for three hours in a heavy rain on a Mexican burro, zig-zagging up and sliding down the slippery hills and arrayas along the jungle trail. We meet Frisco, an ex-bandit leader, with his train of peons transporting dynamite on their heads. At the shot point twenty foot holes have been dug for the charges by natives. Over the shooter's radio equipment a neat palmetto hut has been built to keep off the rain. The shooter winds a wire, leading from his radio transmitter, around a five pound stick of 60% ammonia gel dynamite—primes it, and then buries the charge. Soon he is in radio communication with the observers. They inform him by code that they are ready for the shot. They signal shoot. A peon pushes the plunger on the blasting machine, and it's all over. The explosion, buried to a depth of twenty feet, makes only a dull thud, greatly in contrast to the 1,000 pound surface shots used in refraction shooting.

Results of a Shot

It is with considerable effort that we climb the steaming hills along the narrow "becha" leading us to the first recording unit a few hundred feet from the shot point. Here we find, as before, a shelter erected over the instrument. The various devices, consisting of a radio transmitter and receiver, amplifying units, a camera and batteries are all mounted on a raised platform. During the night natives place hot coals under this platform to keep the instruments dry in spite of the long continued rains. A number of heavy cables lead away from the stations, at the ends of which we find the sound pick-up units, or geophones. These very sensitive instruments are buried in the ground, and it is their function to convert the ground movements into electrical energy. The amplifiers multiply this feeble current a million or more times and send it through oscillographs in the camera where a photographic record will be made of the incoming wave train. An electrically driven tuning fork operating a light shutter supplies the necessary time units on the film. A few moments before the shot the observer orders a peon to stamp his foot. We observe the resulting disturbance through a red window in the camera. In this way the observer tests the sensitivity of each seismograph circuit. The other observer, a few hundred feet further away from the shot than we are, sends the signal to shoot on his radio. Our observer bids us be quiet. He also signals shoot while turning the crank on his camera until he can hear the muffled explosions. In a few minutes more the photographic film is developed. On it we see the time break telling us the instant of the explosion, as well as the five oscillograph lines with their violent disturbances. The electrical constants of the geophones and amplifiers are such that these violent oscillations produced by the transverse and surface waves are quickly damped, permitting the feeble reflected waves or "echos" to be recognized. We wait until the second observer reports his luck, and then return to camp with the records.

The computer scales the time interval for each reflected wave on the records. With this data he calculates the depths of the reflecting points on the buried ridge. He also tells us that this ridge is really an ancient buried mountain slowly rising from under the Gulf of Mexico on the east, to a depth of two thousand feet at its crest, and then plunging rapidly to the west to a depth of more than 6,000 feet.

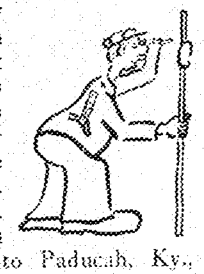
HERE AND THERE WITH OUR ALUMNI

Civils of '25 Hold Reunion

A report recently reached the Techno-Log office entitled "A BRIEF HISTORY OF THE MEMBERS OF THE MORE OR LESS ILLUSTRIOUS CLASS OF 1925 OF THE CIVIL ENGINEERING COLLEGE OF THE UNIVERSITY OF MINNESOTA." As you know, members of this class have been very close throughout the years since their graduation, and hold annual get-togethers to bring back the spirit of their undergraduate days. This year, a committee consisting of Ted Waldor, Harold Peterson, and C. R. Peterson have compiled an itemized list of the activities of each of the class members. Here's the first part of the history.

W. L. AUXER has been contacted for the first time since graduation. Bill is an inspector with the U. S. Engineers at Helena, Arkansas, and gives his address as 422 Porter St. He complains of the heat in his neighborhood during those days last winter. He has been married for the past seven years and has one son, Bill Jr. He sends his greetings to the rest of the gang.

JOHN A. BANOVETZ is now Superintendent of Mining for Foley Bros. at Colestrip, Mont. He is also head of a family. John stepped up to the altar last July and acquired a wife, the former Mary M. Doyle of Duluth. "Not yet," says John to the inquiry about children. He was with the N. P. Ry. Bridge Dept. two years on construction in the Twin Cities and one year in Montana.



NEAL BARTHOLOMEW is now instrumentman with the C. M. St. P. & P. Ry. He has been married to Edith Nelson of River Falls, Wis. for six years and has one son, Dale Charles. Worked with I. C. Ry. on construction in Illinois. Then moved to Paducah, Ky., where he worked for a year on a new $9,000,000 shop. Then in Chicago for a time and in California for a few months. Since September, 1929, he has been on his present job. Neal's address is 2868 N. 57th St., Milwaukee, Wisconsin.

CLARENCE BLUE is selling brick and tile for Ochs Brick & Tile Co. His temporary address is Y. M. C. A., Rochester, Minnesota, while his permanent address is 204 S. 9th St., Minneapolis, Minn. He is still holding out as far as single blessedness is concerned.

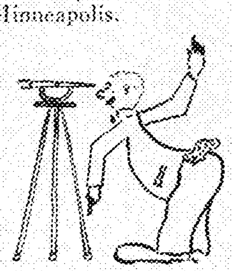
DWIGHT T. BURNS is an instrumentman with the Minnesota Highway Department. He married Rae Shreves in 1929 and now has a son, Thomas Allen, and a daughter, Audrey Ann. He was with the Santa Fe Ry. as Building Inspector previous to his present employment. His present address is 326 Vasa Ave., Fergus Falls, Minn.

L. H. CARLBLOM is also an instrumentman with the Minnesota Highway Dept., and is the proud father of a boy and girl. Len was with the I. C. Ry. two years on construction work previous to his present employment.

HAMILTON CRAIG was last heard from at 9644 Winston Ave., Chicago.

ARNDT DUVALL is the Construction and plans Engineer with Tultz, King & Day, a St. Paul engineering firm. He is married and has one son and tells us that he spent two years with the Missouri Highway Department before his present connection. Arndt is at home at 250 S. Syndicate, St. Paul, Minn.

EDWIN G. FULTON is doing contracting work with Peppard & Fulton of Minneapolis and has spent his time since graduation traveling for his firm in Wyoming, Utah, Colorado, and for the past five years, in Quebec. He has been married eight years to Helen Hunting of Minneapolis, and has one daughter, Janet. Ed may be reached in care of his firm in Minneapolis.



MARK HAIMA is at present with the U. S. Engineers Office of St. Paul working on the dam sites at Alma and other places. He is still single. He spent five years after graduation with the N. P. Ry. on construction work in the State of Washington.

ARTHUR HANSEN has strayed somewhat from strictly engineering work and is now with the Hartford Accident & Indemnity Company at Nashville, Tenn. He is married and has one daughter.

PHILIP HARTMAN is now in New Zealand with the Goodyear Rubber Co.

HAROLD JONES is selling Chevs with Bert Baston in Brainerd, Minnesota. He is married to the former Ann McKenna.

ARTHUR J. KROLL is valuation clerk with the Soo Line and sends in his greetings and salutations to the rest of the class. He has been married to Dorothy Erickson for six years and has one son, Gordon, and a daughter, Mary. Since graduation he has spent three months with the Minnesota Highway Dept., one year with the I. C. Ry. and four and one-half years as a draftsman with the Soo Line. His address is 2211 Queen Ave. N., Minneapolis.

HARRY C. MCANDREWS is with the Adjustment Service Bureau at 619 Andrus Bldg., Minneapolis and writes, "No more Engineering." He is married to Ursula Quinn, also of this civil class, and they have one daughter, Patricia Ann, who was born October 23, 1932. Harry and Ursula are at home at 580 Warwick Avenue, St. Paul.

NORMAN MOORE has been with the Ohio Dept. of Highways for the past two years and is now Assistant Engineer in the Bureau of Construction. He married Esther Hult of Minneapolis seven years ago and has one daughter, Jean Kathryn. Since graduation, Norm has worked with various railways and with the Dayton Morgan Engineering Company. Norm's address is 807 Chestnut Ave., Sidney Ohio.

GEORGE NELSON, JR. H. & G. Engineer with the U. S. Coast and Geodetic Survey, was married on March 2 of last year to Marguerite Carpenter. George has been doing quite a bit of traveling lately and spent last year on Kodiak and Alognak Islands in S. W. Alaska. He says the hunting and trout fishing were excellent. George may usually be reached by addressing 202 Burke Bldg., Seattle.

Aeronautical Engineering

'30—LLOYD KERNKAMP has recently returned to the Twin Cities. Lloyd until recently has been working with the Empire Oil Company of Pampa, Texas.

Electrical Engineering

'15—E. S. TALMADGE is at present experimenting with various types of spring steels to determine their rusting properties. He is chief engineer with the Sanitas Spring Company of St. Paul where the springs used in railroad coaches are made. Mr. Talmadge's address is 2327 Wyhoff Ave., St. Paul.

'25—IKEL C. BENSON has recently been doing some special work for the Electric Machinery Company of Minneapolis in connection with a patent of theirs. He is working part time for them. His address is still 718 Fourth Street S. E. here in Minneapolis.

'29—WM. D. MCILVAINE was over to the gang in Electrical Engineering recently. As you remember, Mr. McIlvaine was an assistant in the Elec. Eng. Dept. back in '30. At present he has drifted somewhat from electricity and is doing drafting in the local Highway Department.

'30—M. O. C. JOHNSON has just completed his thesis for his Master's degree. He has developed a device similar to an ordinary telephone repeater circuit which can be used in the school laboratory for observing the voltages of the direct and reflected waves on a telephone transmission line.

'30—JOHN ROE is again back in the Electrical Engineering Building to complete his work on the photo-cell. Johnny is determining the variation in the sensitivity of the photo-cell with the time of exposure and with the intensity of the light beam to which it is exposed.

'30—DON KENDALL, who has been a teaching fellow in the Electrical Engineering Department for the fall and part of the winter quarter, recently obtained employment with the Toledo Scale Company. His work will involve the use of Thermionic tubes for accurate measurement of weight.

WITH OUR ARCHITECTS

The Beaux Arts School

by LEON ARNAL

IN the early years of the XVII century, according to Brantôme's "Vie des Dames Galantes," Marguerite de Valois, divorced wife of Henri IV de Navarre, became very pious and fond of Gregorian choir singing. As a tangible token of this new frame of mind, she founded, on the south side of the river Seine, just across from the Louvre Palace, a monastery for which she provided ground and money. This happened in 1609.

In 1793 the Revolutionary Government took over the monastery. The monks fled to foreign shores. Then the buildings and courts began to be filled with fragments and relics saved from chateaux and churches wrecked by revolutionists.

Soon students of arts were allowed to wander and sketch in this sort of informal museum. This was the start of the present Fine Arts School. Since then almost all the old buildings have given way to new structures, except for the monk's chapel and the cloister, but in spite of it the new arrangement has preserved enough informality and character to give the school a charm of its own, a spirit entirely in communion with its purpose.

Today, the most liberal education in the fields of Architecture, Painting, Sculpture, Engraving, is given in the School to about 2500 students, and this with an amount of administrative machinery so small that it is almost unbelievable.

Practically all students do their technical work outside the school, in "Ateliers," under the direction of their own chosen master. In the school they attend lectures pertaining to art and science, pass oral examinations, and make preliminary sketches for future development on a given work. The final works are judged in the school by a jury of competent men. The spirit of these judgments is competition, meaning by that a selective high standard, for competition is the rule of the school throughout, from start to finish. (For the architects, two entrance examinations a year, one held with about 500 applicants in each session. Through a process of elimination only 50 are definitely admitted.)

It is easy for one to visualize the results obtained by such an education. It is so liberal as to require almost no regular attendance, except for a minimum of work to be handed in during the school year, but it puts on the student the responsibility of his school career. It is up to him to decide whether he prefers to forge ahead and compete every minute with his fellow students for better results or to waste time and fall by the wayside.

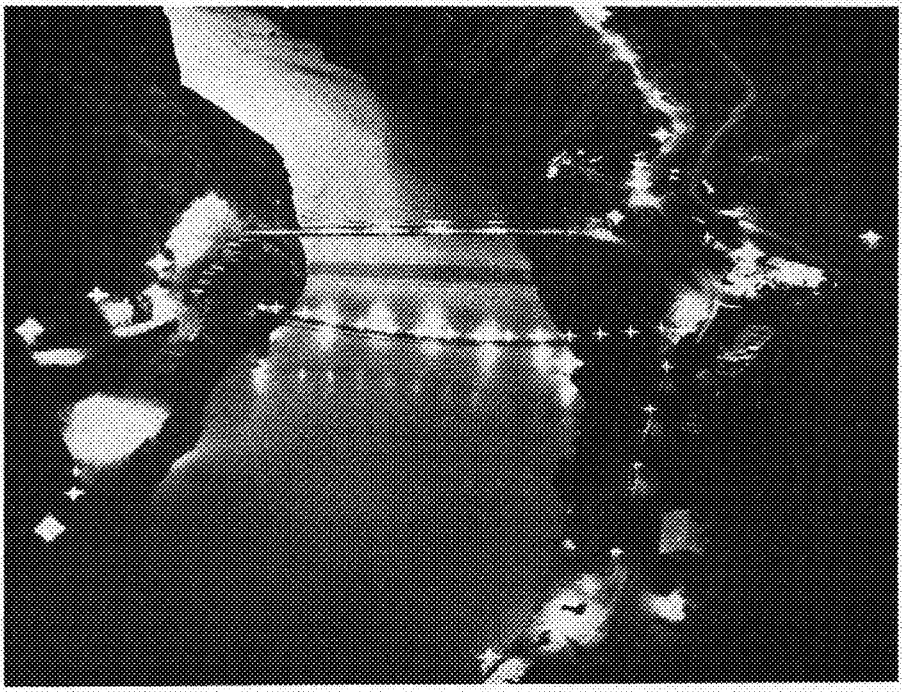
May I venture to state that, after all, this kind of education does not look so bad to me?

Persian Art Exhibit Recently Displayed Here

THE two thousand camera studies that Arthur Upham Pope made of Persian architecture make up a complete study of the art and architecture of the land of the Shah's. To make these two thousand studies was the Gargantuan task assigned to Mr. Pope by the American Institute of Persian Art and Archaeology. Outstanding photographs from this collection were recently displayed on the third floor of Main Engineering.

Mr. Pope reflects after his sojourn in the east, that "such buildings are endowed with personality, such architecture has character and spirituality. The buildings play a vital role in the life of the faithful and have a precious contribution for all who are civilized." Mr. Pope is sure that these buildings and ruins are the most imposing relics we of this century have of the period of 2500 years ago.

Several times during his trip Mr. Pope risked his life by entering holy places to record in his camera the wonders that these mosques or mausoleums contained. Modeling in stucco, all-over designs worked out in tiny tiles, painted frescoes, wonders worked in bricklaying; these are some of the many mediums employed in the buildings.



Courtesy—Electrical West

With the waters of the Colorado River now flowing through the four 50-foot diversion tunnels of the Hoover Dam project, work is a year ahead of schedule. The coffer dams are now being completed, and soon uninterrupted attention can be given to the main dam. The two spillways, involving excavation of 600,000 cubic yards of rock have been completed and are ready for lining. Only by using the lighting facilities shown above has progress at such a rapid rate been possible.

OIL BURNER CONTROL

[*Continued from page 167*]

If flame is produced normally, the stack temperature rise actuates a flame detecting device called a pyrostat. This pyrostat has one contact made when the stack is cold, and another contact made when the stack is hot. These contacts are so arranged that on temperature rise, the "hot" contact makes before the "cold" contact breaks while on temperature fall, the "hot" contact breaks before the "cold" contact makes. The "hot" contact on closing pulls in a second relay in the control which maintains a parallel circuit to the burner motor, and shuts the heating element of the time switch. On continued stack temperature rise, the "cold" contact breaks, dropping out the first relay, and cutting off the ignition. The burner is now in normal operation.

If for any reason the flame should be extinguished, the reduction in stack temperature opens the "hot" contact of the pyrostat and the control relay drops out shutting down the burner. As the stack continues to cool, the "cold" contact is made, after a suitable delay, and the control is recycled completely. If the flame ignites the program is as above, and the burner continues to operate normally. If, however, the burner does not re-ignite, the time switch strips and drops out the relay, shutting down the burner. This time switch then requires manual resetting before the burner can be started again.

A Grid-Glow Tube Control

There has been developed within the last few years a radically different method of flame detection. At present all other means depend directly upon heat from the flame. These devices may therefore be partially affected by the incandescent brick walls or by an expanded gas pilot. The new system utilizes the conductivity of the oil burner flame only. A cold cathode tube which has potential impressed upon the anode and cathode has a grid connection brought out to an electrode which is arranged to be impinged by the flame. The small electrical conductivity of the flame drains the charge from the grid and allows it to flow through the flame to ground. This current is of the order of a few micro-amperes. When the charge on the grid is removed a considerably larger current can flow between the anode and cathode. This current is used to energize a relay to control the ignition. Since this device operates by the passage of an electric current, its speed of action is nearly instantaneous, thereby making it ideal for the detection of flame, particularly on larger burners where many gallons of oil are burned per hour. Unless flame is impinging the electrode the ignition is present to re-start the flame.

From the above, we can see that the control system for a modern intermittently operation burner is in truth the "brains" of the burner. The thermostat is more sensitive to temperature variation than the human body. The primary control does what only a skilled operator in constant attendance on the burner could do, and protects against its own failure. Thus the time switch, if it burns out, opens the circuit to the relay coil, since it is in series with it, and prevents the operation of the burner. The thermostat and limit controls working on a closed circuit, prevent the starting of the burner if the contacts are dirty. The light duty of the thermostat contacts practically precludes the possibility of their sticking in the closed position. The various flame detectors are so arranged that a short circuit or open circuit will either prevent the control from starting the burner or will cause a "safety" shutdown if the burner does start.

All of these features add together to make control systems which have placed the modern safe oil burner within the reach of every home owner.

A LETTER OF MERIT

***Editor's Note:** The following letter to the dean was found in our mail a few days ago, and we take pleasure in passing it on to you. Who wrote it, we know not, but Oscar Fegas has his suspicions. After covering the letter many times with lampblack and other messy powders, he has at last discovered a fingerprint. Oscar's Detective Manual tells him that this print is very unusual, and characteristic only of those who are known as instructors of mathematics—further results are expected hourly.*

Deer mr. deen,

Ay ban taking a course in your college all fall quarter, and ay ban going to class every day 'cept when ay having to work, which is only tree or four days a week in these hard time. But, it don't making no difference bout class, cause ay working nites.

Vell, dis instructor he get up front de class and talk and draw all over de bord pictures, and talk some more, and then maybe bell ring. Sometime room he ban mighty hot and ay yust close my eyes for vun second (shure ay vas dere Sharley, lak my pardner Ole Jacobsen he always say) but my instructor he say Ay ought to go to bed nites. What he tink ay am?—crazy? Corse ay go to bed nites.

Den he gave us quiz—and boy vas ay mad. He ask questions different from what he draws pictures about on the blackboard, and what ban in book. My brain he get so tired trying to think cause it not like in the book, and ay get zero in quiz. Instructor he say ay must use my reasoning power and ay ask him vat he mean. He telling me to use my noodle and figger it out. By golly, mr. deen, ay ain't got no noodle, so ay ask instructor where I could buy one and he say—ay guess you're rite—and he walk away. Mr. deen, was dat rite? Shouldn't he tell me where to buy a noodle? Another time he say ay should use my head in working problem, and ay tell him in my country we are taught to only use a pencil with our hands, and he says—don't get smart—and ay say—what you mean, Ay thot everyone come to University to get smart. He laff den, and say—you ought to mix concrete—and ay say that ban what ay am going to do when ay graduate cause you know mr. deen, ay ban a civilized engineer.

Vall, mr. deen, ay forgot ay was going to rite bout zaminations. Vall, ay vent tru all quarter and one day ay see on the bull bord in a hall a list of final zamination, and, by golly, mine vas dere too. So ay set up late last two nites trying to find what vas in book. Ay got awful sleepy, so ay rap cold towel round my head and drink lot of coffee, and by jimminy ay found lot of tings in book, I didn't know was dere, and vat you tink, mr. deen, ay find some pictures the instructor draw on blackboard. Vall, ay shure learn everything in book—almost, and ay say to myself, ay bet instructor don't know much and can't fool me in zamination. Ay tell Ole, my pardner,—you watch me fool that instructor—and ay tell instructor ay shure know all.

So mr. deen, ay went to zamination and instructor he make us sit in every other seat—ay mean he made us leave a chair between me and the next felllow. Do you tink dat vas fare? How can a fellow check his work when he sits so far away? The instructor he rite and rite lots of question on blackbord for we should answer and after ay red dem I got awful mad about dem when ay couldn't remember how to start on any of dem. Ay no ay could answer dem if ay could get start. There ant ban nothing yust like in the book that ay could remember. Vell ay worked tree hours and ay tried to tink and by golly ay couldn't do it.

Vell, mr. Vest he rite me letter and say ay get F in corse, and ay go to instructor and ay say to him why ay get F—didn't ay told you ay red hole book and understand subject, and he take paper ay rite and show me he rite O on every question and O on cover. Now do you tink that fare after ay tell him ay no everything in book—almost?

Mr. deen, it make me mad and ay want you to tell instructor he should giving me nother zam and don't ask anyting ay don't no. Ay tink ay will be willing to study till 12 o'clock the nite before.

Ole he say he tinks it ban a dirty shame for the instructor to give me F.

Goodby,

Eric the Engineer.

P. S.—Next time I rite about student work commit.

DEAN LELAND SAYS - - -

[*Continued from page 173*]

course in engineering is that it is a good plan for the student who can afford it but unnecessary as a requirement for all. It would increase the cost of the college course and postpone the time when the student would graduate and enter the practice of the profession. The student who desires the additional elective studies before graduation can readily get them and the one who wishes to proceed directly into graduate specialization can do so in his fifth year. At the same time, the majority of students will complete their essential training for professional work without spending a fifth year at college. Withal, it should be recognized that in the years immediately following his graduation the young engineer may pursue systematic reading courses which would correspond to some of the electives he was unable to get in his four-year course in college, and this would be to his permanent advantage.

—*O. M. Leland*

Winter Quarter Engineering Enrollment

As of March 1

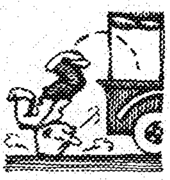
	Fr.	S.	Jr.	Sr.	Total
Electrical Engineering	43	83	86	60	272
Chem. Engineering	47	64	70	43	224
Mech. Engineering	40	62	64	52	218
Civil Engineering	44	66	57	43	211
Aero. Eng.	44	58	47	30	179
Chemistry	27	32	33	27	119
Architecture	26	32	24	21	104
Eng. Pre-Business	23	26	2	..	51
Arch. Engineering	..	15	11	14	40
Agricultural Eng.	2	11	7	2	22
Interior Arch.	..	..	4	6	10
Total	296	449	405	298	1,448

Whispers from the Campus

Thanks to various anonymous contributors, we have been informed of the dirt being spilled around our campus. However, gentlemen, it is your column and in order to get the low down on your contemporaries you must do the peeking under the doorsteps. Then slip your findings into the Techno-Log office or drop them in P. O. 5365. We'll do the rest. Never mind how much they effervesce—we have to deodorize most of them anyway.

Well, here goes.

The barbed wire back scratcher that is awarded with each issue of the Techno-Log to the brightest S. L. A. student, is given this month to Bernard Belzer. It seems that when B. B. went under the Milwaukee R. R. bridge on Washington Avenue, he pointed to a 12 x 12 timber and remarked, "My, what a fat 2 x 4."

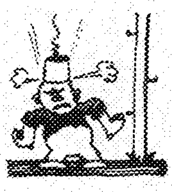


Ten little linemen
starting on time,

One fell off the truck,
then there were nine.

Seen around the campus: One nutty Junior Chemical Engineer, Philip Frisch, wearing one spat.

What world's largest college newspaper runs big glaring ads just to obtain a few tiny want ads? Can it be that these are the Daily's versions of the "Compliments of a Friend" ads so popular on the campus?

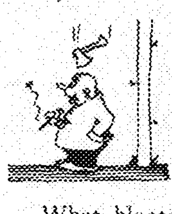


Nine little linemen
raising up a weight,

One let go his hand-line,
then there were eight.

Dave Eolkin, Ch. E '35 went to visit his girl friend. The G. F., not wanting to be pestered, sent her german police dawg to chase him away. The son of St. Pat was not to be foiled, made a friend of the dog, and walked in. Ask Dave for the rest of the story.

And what Ch. E. answering to the call of Ralph Rutz has a failing for dizzy-looking cross-eyed blonds? Pay up, Ralph, (P. O. 5365) with a story on the pal who turned this in, or we run the rest of the story next month!



Eight little linemen
climbing up to heaven,

One dropped his hand axe,
then there were seven.

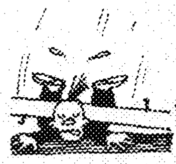
What bloated chests have appeared on the anatomies of ye Tech Frolic operators. With the final check-up on tickets, it has been revealed that well over 200 couples attended, which, ladies and gents, is very very successful. Considering the fact that this thing called lucre was very scare.

But with the pawning of tires, floor lamps and the like, and subsequent redemption of said articles when the spondulix will flow more freely, who couldn't attend?

And where did radio announcer Gordy Rosholt get that wad of gum he was chawing on during the announcing?

But those dancing gals—ahhhh—weren't they quite well clothed from the hips down, though. But in the other direction—remember?

Hoot Mon. Now we gotta wait till next year before our little evening for frolicking rolls around. Wotta party, wotta party.



Seven little linemen
putting up sticks,

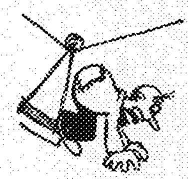
One let go his pike pole,
then there were six.

And when that party rolls around again, we sure hafta go. (If ya hafta go—ya just hafta go, y'know.) Especially if the dancing nymphs don't wear anything on their—um—backs. By the way everybody and his brother liked the entertainment, you'd think they hadn't seen a green frock for a long time.

Oh—those acoutrements!!

What grad Chemical engineer does a little tutoring on the side in a certain room in the basement of the Chemistry building—and does it to fair maidens who apparently desire more knowledge — in chemistry? And where did he get the calendar that hangs on the back wall of his subterranean vault, portraying a woman in all her beauty—*all* her beauty? Furthermore, what colleague of said instructor deemed it wise to cover the infamous picture in order that a knowledge of mathematical rather than human curves be absorbed?

Four senior M-E's (commonly referred to as the four horsemen) have recently formed a new organization to be known as the Royal Order of A. P. As we go to press no new members have qualified for membership, but D. C. R. has only a few more points to obtain for this honor(?) The original members are said to have first formulated plans for this organization last year after they all succeeded in obtaining identical marks in a final examination. The fact that identical mistakes were made was explained in a joint statement issued by the group which said, "Minds of great men always run in the same canals."



Six little linemen
forgot they were alive,

One stood on the
messenger, then there
were five.

A certain sophomore mechanical recently was absent from school for two days. Investigation by our staff reporter revealed that he was detained in the city jail for assault and battery. In reply to numerous questions he was heard to say, "Well you see I didn't like the guy so I popped him with my left hand. He was out for two hours; when I use my right they never come back." Our policy is to not publish names of offenders but we might say his initials are S-T-E-I-N.

Haven't you wonderingly noticed the marked decrease in the number of all-day inhabitants of the P. O.? But when the fair young things with bright flowing dresses parade by, and the lifting March wind blows up the *avenue*—why be in P. O.?

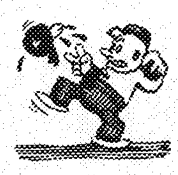
Our electrical friend forgot to disconnect the leads from the motor-generator set before he shoved it away from the bench, and then wondered why he piled up half his apparatus on the floor.

The efforts of Electrical Engineers at present are concentrated upon the coming Tenth Biennial Electrical Party scheduled for April 28-29. Many are planning to work all during spring vacation on their chosen stunts and exhibits under the direction of John Hancock and Sam Levy. A very interesting series of manufacturers' exhibits is being planned by Bob Carlson, including an X-ray demonstration which will enable guests to "see through" themselves.

Perhaps the most interesting demonstration projected so far is that of "Narrowcasting" or talking over a light beam, on which Robt. Haxby is working. A speedy midget electric auto designed by Prof. Kuhlmann will create much excitement, with the possibility of revolutionizing the automobile industry. The House of Horrors is expected to be a big drawing card as it will utilize the latest electrical devices for producing weird effects as used in mystery movie pictures.

As has been the custom in the past, admission on Friday will be by invitation, on which night will be held a special Alumni Reunion, while Saturday the show will be open to the general public. A special invitation will be extended to school children to attend on Saturday during the day.

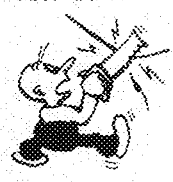
The annual fall freshmen architects' mixer was recently held this winter. It is reported that the Architects' Jubilee will be an outdoor affair to be held on the 4th of July. This is only a rumor, as no meetings of the architects' society have yet been held. Last year the society was the most active of all the engineering groups but this year it's about as lively as Lakewood Cemetery at midnight. There is one reason for this. Who is he?



Five little linemen on the ground once more,

One upset the soldering pot, then there were four.

Taking part in the Minneapolis Bridge Tournament at the Leamington Hotel, Ed Litkenhouse and Win Foster seemed to walk off, or rather sit off, with first honors in the playing section by using a modified Reiter and Simmon system. We're glad to see old pal Reiter has developed a successful system of bridge. But what will Mr. Culbertson say?

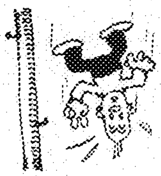


Four little linemen trimming up a tree.

One trimmed the high line, then there were three.

Just a few more days and spring is here. Spring—beautiful spring—with its soft warm breezes whipering through the freshly budding trees, lovely colorful flowers opening amid the patches of new green grass on wooded river banks. Gosh, pal, doesn't spring make your fancies turn to—aw—do I have to tell you—a canoe, phosphorescent in the pale light of a golden moon, floating on a lulling and languishing lake—doesn't it get you, pal? Oh! To hell with final exams! Sweetheart—here I come!

On arrival at the Wold-Chamberlain Field Feb. 4, Amelia Earhart Putman, famous aviatrix, was introduced to Jean Barnhill, aeronautical engineering student and Flying Club member. Among the group that welcomed Mrs. Putman were Profs. John D. Akerman and Howard Barlow of the aeronautical department.



Three little linemen hustling to get through,

One forgot his safety belt, then there were two.

What foursome of electrical engineers, while attending the matinee performance of "Babes in Toyland," nonchalantly took possession of the box on the balcony, after being expressly told that box seats were reserved for more distinguished gentlemen?

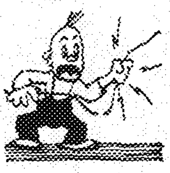
It is a custom of engineers, when the first signs of spring appear, to stand at the class windows and appreciatively observe those signs of spring go by. Who,

[*Please turn to page 184*]

WHISPERINGS

[*Continued from page 183*]

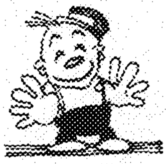
walking by the front of the main engineering building just before fourth hour, has not been attracted by the noise (or perchance by a whizzing piece of chalk)



Two little linemen,
job almost done,

Tapped in the wrong line,
then there was one.

from a dynamics class, a typical medley of engineers, leaning far out of the window, absorbing the radiance of every passing flower, blossoming out in all the color of spring. The mechanical engineer comments upon some especially choice specimen, "Body by Fisher—." "What streamlines," adds the aeronautical. "What contours," marvels the civil. "How I would like to get her on a watch glass," sighs



One little lineman
felt his life he owed,

To playing Safety First
according to the code.

the chemist, "and just watch." Dreamily says the electrical, "What magnetic personality?" Thus they all learn that the fundamental principle is "f = m a," that is, "female = main attraction."

MENTAL TILTS

TO Leander Fischer, a junior engineering student, is awarded a year's subscription to the TECHNO-LOG. Many solutions were turned in before his, but all slipped in figuring the movements of the goldfish. We were greatly pleased with the interest shown by engineers in last month's Tilts, and regret that we cannot offer more puzzles this month.

The position of Mental Tilts Editor is now open to any engineering student who is interested in looking through old mathematics books each month for unusual problems, and in making up puzzles for this column. Students who wish to apply for this position should leave their names in the TECHNO-LOG office.

Answers to Last Month's Mental Tilts

A BEE AND A TRAIN

The bee flies 160 miles before it is crushed between the trains.

CRYPTIC DIVISION

The code word for this problem is SURVEYING, where S=1, U=2, etc.

GOLDFISH

Since the density of the fish at the top of the bowl is less than that of the goldfish at the bottom, the upper fish will move forward and the lower fish will move backward with respect to the bowl when the streetcar is started.

SIGMA XI LECTURE

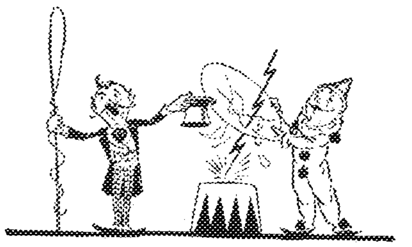
[*Continued from page 174*]

which transforms a part of the stal into an adhesive. After the cooking, th mixture is pressed into boards. By modi fying the process in various ways th final product can be made to yield a sof board or a board that is harder tha ebony.

The lecture was brought to an en with an experimental demonstration o water softening and an explanation o the manufacture of zeolite. To make zeolite, a solution of water glass and an aluminum salt, such as sodium aluminate, are brought together. The resulting gel is then dried, causing a considerable shrinkage. The dried gel is then thrown into water, which causes it to break violently into particles about 1/32 inch in diameter, which becomes insoluble after drying. Exhibits illustrating the various chemical processes augmented the lecture and were furnished through the courtesy of the United States Gypsum Company, the Casein Manufacturing Company, The Du Pont Company, American Plastic Corporation, the University of North Dakota, and Iowa State College.

(4)

G-E Campus News



TAMING LIGHTNING

A crackle, a deafening crash—and a gigantic streak of man-generated lightning leaped 30 feet. Thus, was 10,000,000 volts, the largest artificial flash ever produced by man, discharged at the G-E high-voltage laboratory.

To produce this enormous voltage, a 50,000,000-kw. lightning generator imitates nature. Hundreds of small capacitors take the place of nature's clouds. They are charged by transformers. When the voltage is built up, the capacitors are discharged in series to produce 10,000,000 volts. Sounds simple, doesn't it? However, the power output of the generator—during the infinitesimal period of the flash—is nearly twice that of all the generating stations in the United States.

F. W. Peek, Jr., a Stanford grad of '05, was chiefly responsible for this achievement—incidentally, he is now the chief engineer of the G-E Pittsfield Works. "Lightning tamer," his old classmates would probably call him. And rightly proud of him they should be, for in the field of transients and dielectric phenomena he is second to no one.

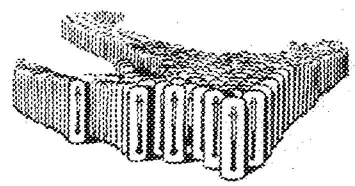
ATOM CHASER

On December 10th last, a mild-mannered scientist stood in the Great Hall in Stockholm and received the Nobel Award in Chemistry for 1932. Then he went skiing with his wife and daughter, seemingly unmoved by being the second American chemist in 31 years to be so honored.

In 1909 Dr. Irving Langmuir, a '03 graduate of Columbia University, came to Schenectady, to the G-E Research Laboratory, to ask questions about tungsten wire, its behavior in a vacuum. He stayed, just "looking around" and wondering why the bulbs of incandescent lamps blackened so easily. He found out, and thus developed the gas-filled lamp. It saves Americans a million dollars every night.

Then he wondered about atoms coöperating with electrons and produced the high-vacuum electronic tube, making possible radio broadcasting, which created an industry. Incidentally, he contributed a new type of welding—atomic-hydrogen.

They call him atom chaser, electron driver. The Swedish Academy of Science rewarded him — not for lamps, radio tubes, or welding methods, but for achievements in pure science. For just "wondering."

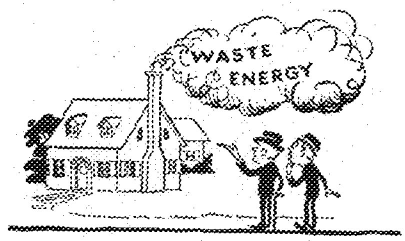


25 MILLION THERMOMETERS

You may have heard about our new power plant at Schenectady—the first of its kind ever built. In it there's a 20,000-kw. mercury-vapor turbine. The plant uses mercury vapor for power, the exhaust vapor producing superheated steam.

270,000 pounds of mercury will be needed for the boilers. That's enough for 25,000,000 thermometers. Perhaps you wonder why we don't use water. Well, the new process makes possible some thirty per cent more power from coal than heretofore. And we don't expect that those boilers will be refilled.

W. L. R. Emmet, an '81 graduate of the U. S. Naval Academy, is the inventor of this mercury-vapor process. That isn't all he's done, either. In his capacity as a consulting engineer at G. E., he developed the steam turbine from a small beginning to a place of dominating importance, and he first applied electric power to ship propulsion.



FLAME WITHOUT SMOKE

Smoke and soot mean wasted energy. That's what our engineers thought, too. They rolled up their sleeves and began to work. For five years they studied electric control of oil combustion. And they developed progressive impact combustion; they broke a single drop of furnace oil into a hundred million parts.

In this process, oil and air collide under pressure, and each drop of oil breaks up into millions of particles. Application of heat further breaks down the oil into gaseous hydrocarbons; and when the latter encounter air, the entire energy of the fuel is converted into hot flame without loss of carbon in smoke.

This is just one of the features of the radically different G-E oil furnace — another G-E achievement. And such men as E. D. Harrington, a '16 grad of Beloit College, helped to chuck tradition to the winds. He was closely associated with the entire development of the oil furnace. He's now Engineer of the new Air Conditioning Department.

GENERAL ELECTRIC

Minnesota Techno-Log

Member Engineering College Magazines Associated.

APRIL, 1933
Vol. XIII No. 7

CAMPUS
STORE

"SUPER - TWENTY - FIVES"

2-Trouser Suits and Topcoats

Matchless distinction, character, comfort —three qualities that make men keep well dressed in these suits and topcoats

$25

Others $15 and Up

MAURICE L ROTHSCHILD & CO

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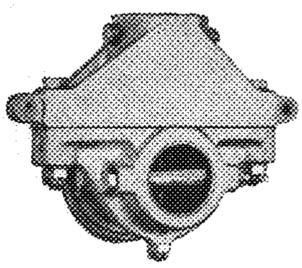
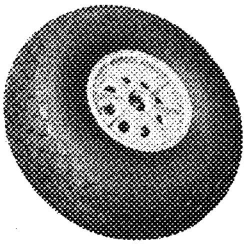
DOWMETAL

ideal for aircraft manufacture

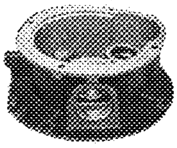
★ LIGHT ★ STRONG ★ DURABLE ★



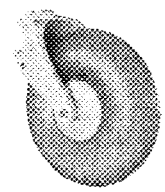
This airplane wheel support assembly by the Northrop Corp.

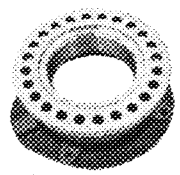


Airplane landing wheel of Dowmetal

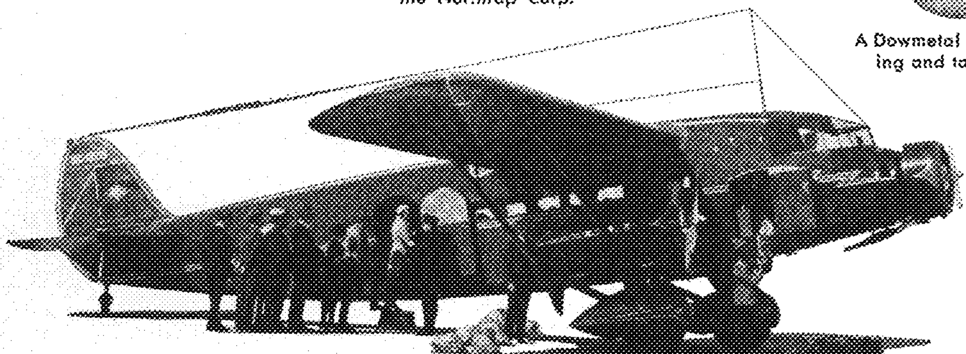


These Dowmetal castings are manufactured by the Eclipse Aviation Corporation in building their starter equipment

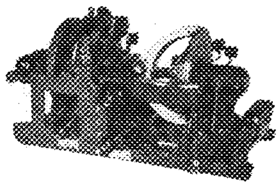




A Dowmetal yoke casting and tail wheel



This Stinson Model U monoplane has a number of Dowmetal parts



Dowmetal Navigation Instrument

Take Useless Dead Weight Out of Your Products

THE lifting power of aircraft motors has increased every year. Present interest centers in the problem of utilizing this power to lift pay load instead of dead weight. It has become increasingly evident that dead weight pays no profit.

Dowmetal, lightest of all structural metals, is finding increasing favor with airplane designers and builders. Taking out a few pounds of dead weight here and there is resulting in greater pay load capacity and lower operating costs, without loss of strength or endurance.

The Stinson plane shown has a number of Dowmetal parts. Motors, instruments, wheels and starting equipment in other planes have been made much lighter with Dowmetal. Greater weight savings will be made in the future by a wider use of this lightest metal, since it is so easily machined and may be had in the various forms of die castings, sand castings, forging, sheets and extruded shapes.

Dowmetal in its various forms will be found equally useful in other industries where weight reduction is an important factor. Write for the Dowmetal Data Book, which gives full information.

NOW YOU CAN MAKE IT OF

DOWMETAL

MAGNESIUM ALLOYS

DOWMETAL DIVISION · THE DOW CHEMICAL COMPANY · MIDLAND · MICHIGAN

APRIL, 1933
VOLUME XIII, NUMBER 7

Minnesota Techno-Log

37 • ELECTRICAL BUILDING • • • U of M

Published monthly from October to June inclusive, by the students of the College of Engineering and Architecture, the School of Chemistry of the University of Minnesota

Laddy Markus, Managing Editor
Thomas Rogers, Business Manager

THIS MONTH

THE EDITOR SAYS

Back to thirty-two pages again this issue—after a long tussle with our business manager. Did you know that your magazine is the largest self-supporting engineering college magazine is this country?

Our entire Easter vacation was spent in planning this issue — we think it is the best issue of the year. Do you agree?

A brand new year's subscription to the Techno-Log, mailed to any place in the world, will be given to the first reader who points out to us the engineering error showing in one of the illustrations in this issue. It's only a little detail, called to the editor's attention by one of the staff members, and we wonder how many of our readers are keen enough to catch it.

Again we bleed the cuts—after letting our printer recuperate from his struggle with the December issue. A departure from the conventional magazine makeup is this, but we consider it worth the extra work (and expense). Why, oh why, do printers love to make life miserable for editors?

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Wisconsin Engineer

Entered as second-class matter April 9, 1925, at the post office at Minneapolis, Minnesota, under the Act of March 3, 1879. Office, 37 Electrical Building, University of Minnesota. Telephone, Dinsmore 2760. Contents copyrighted and permission must be secured for re-publication. Subscription rate, $1.50 a year. Single copies, 35 cents. Advertising rates upon application. Alumni Directory, 50 cents.

■ In the land of the Dacotahs.
There the Falls of Minnehaha
Once did flash among the oak trees,
Laugh and leap into the valley.

■ Came a time when Hiawatha
And his brothers made departure
And the waters stilled in mourning.

■ The engineer, the Toandoah,
Grieved to see the feeble waters,
Longed to hear the cataract's laughter,
Turned the valve, the pump he started;
Gave new life and joy and vigor
To each sparkling drop of water,
To the mirthful Laughing Water,
To the Falls of Minnehaha.

Green? Red? Blue? White? Gold?

WHICH GAS —AND WHY?

By DR. RALPH E. BREWER, Ph.D. '28

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(Charts Through Courtesy of University Press)

PERSONS interested in a suitable and economical fuel for motor use frequently ask, "Which gasoline shall I use and why?" Many individuals, unintentionally perhaps, show partiality to a particular brand or brands of gasoline sold by a certain company of their choice. Some of these individuals are often unable to ascribe any valid reason for this claimed superiority of these fuels over competitors' products. Such partiality may be due to real or imagined merits of a particular gasoline, its selling price, to operating conditions in the motor, or to other causes.

That there are a number of suitable, and indeed some excellent gasolines, is well recognized by persons familiar with the situation. The fact that there are some gasolines which are not so desirable, and a few even harmful to satisfactory motor performance, is less common knowledge. But how is the consumer "to separate the sheep from the goats"? This moot question, we hope, may be answered, at least in part, in the present article.

The material presented in this paper is based upon a recent publication[1] by the writer and his co-authors. In that study the authors describe the development of gasoline retailing in the Twin Cities and test the economy with which this has been accomplished. The aim of the present article is to condense that material so as to meet the demand for brevity and the desirata of a fairly complete picture for the immediate reader. It is hoped, therefore, that some of the more important conclusions arrived at in the original ninety page publication may be summarized sufficiently well for the purpose. For greater details, the attention of the interested reader is directed to the original work.

Marketing Agencies

In the year 1931 the seventy-one Twin City oil companies received at their bulk storage plants over 121,000,000 gallons of gasoline for wholesale and retail distribution. This was in addition to the 6,000,000 gallons purchased in tank car lots by bus, truck and other commercial organizations for their own use.

The seventy-one oil companies may be classified into four general groups of distributing organizations. Such a division causes some overlapping, but the distinguishing characteristic of each group will aid in understanding the part played by each type in its relationship to the quality of gasoline sold, the retail selling price and service to the consumer.

1. *Sectional and national chains.*—These so-called major oil companies or their subsidiaries own and operate their own filling stations. Their outstanding characteristic is complete integration in all their activities, from the production of crude petroleum and its manufacture into refined products to the final sale to the consumer. Even the transportation of crude oil and refined products are sometimes controlled by this class of company. They also act as wholesalers to single station independents, curb pump operators and other users of gasoline entitled to buy gasoline at wholesale prices for retail sale or personal use.

2. *Local multi-units.*—Such companies assume only wholesale and retail marketing functions. They buy their gasoline direct from one or more refiners or their sales representatives. Well known nationally advertised brands are often marketed by local multi-unit firms. Some of these companies operate one or more bulk filling stations. The methods of distribution and costs of these particular local multi-units are comparable with those of other local multi-units, although their price policies may correspond with those of bulk filling stations. As wholesalers they are similar to national chain companies.

3. *Bulk filling stations.*—These companies may be defined as those who operate one or more filling stations, usually located on railroad property adjacent to a well-traveled highway or street. They usually buy their gasoline from various jobbers, but may buy in the open market. Their location permits the unloading of gasoline directly into their filling station storage tanks. This makes it possible for them to sell their gasolines at prices below that of the correspondingly classified equivalent grades of Groups 1 and 2, whose stations are more widely distributed and are, therefore, more conveniently located for all of the motoring public. Moreover, the free service afforded by bulk filling stations is often less than that of Groups 1 and 2. They usually do little or no wholesale business.

4. *Wholesalers.*—This classification refers to firms who act strictly in this capacity. They neither own nor operate any filling stations or other retail distributing outlets, but sell only to retail dealers and commercial users.

The four groups just named receive all of the gasoline sold in the Twin Cities and retail a considerable portion of it. The first three are of direct interest to the average motorist. An explanatory word concerning the single station

[1] Roland S. Vaile, Alvin L. Nordstrom, and Ralph E. Brewer, "Gasoline Distribution in the Twin Cities," University of Minnesota Press, Studies in Economics and Business, No. 6, February, 1933.

independents, garages and curb pump operators, most of whom might be classified as sub-dealers under Groups 1 and 2, will complete the picture of the retail outlets. These small firms operate as individual firms on a retail basis exclusively. In almost all cases the firms from whom they buy their gasolines furnish the storage tanks and dispensing pumps and the small retailer, without much direct investment in equipment, sells the advertised product of such firms on a certain guaranteed margin of profit.

Importance of Distributors

Space will not permit a discussion of the relative importance of the types of retail distributors of gasoline in the Twin Cities. A summary of the material presented in the original publication shows why competition has been ineffective: (1) in order to maintain brand representation, many companies continue to operate stations with submarginal volume of sales; (2) emphasis on total volume of sales by wholesalers has encouraged the entry of new outlets faster than the expanding demand could maintain them profitably; (3) overcrowding of the field has discouraged the entry of more efficient operators and has encouraged cut-price competition that capitalizes upon the high cost of present distribution methods; (4) filling stations, once built, are suitable for no other purpose and are, therefore, kept open as long as they pay a subsistence to the operator or until his limited capital is exhausted; and (5) overproduction in the refineries and decreasing costs in the manufacture of better gasolines have demanded a market which each refiner endeavors to obtain by increased pressure upon the retail distributor, oftentimes at a sacrifice in economy to all concerned.

This much abbreviated summary should aid in visualizing the part that each type of retail outlet plays in marketing gasoline to the consumer and suggest reasons as to why the quality and selling price of gasolines may vary with the type of distributor.

Laboratory Tests

Laboratory tests were made upon 69 samples of gasoline representing twenty-six different commercial brands marketed in the Twin Cities. Twenty-two samples were collected on June 8, 1932; a second set of twenty-two samples representing the same brands, with one exception, (company C had changed its brand of premium-price gasoline in the meantime) was collected on June 24, 1932; and a third set of twenty-five samples, representing the same brands as the second set and three gasolines sold by a mail order house, was collected on November 22, 1932.

For ready reference and comparison the samples are classified according to "grades"; namely, third-grade gasoline, regular-price gasoline and premium-price gasoline. The term "regular-price gasoline" is applied to those motor fuels which are sold at the generally recognized local base price and, also to those motor fuels sold at a slightly lower price but represented as of equivalent quality. The term "third-grade gasoline" is used to describe those motor fuels sold by the respective companies at prices lower than their "regular-price gasoline." The term "premium-price gasoline" defines those gasolines sold at a price usually two to three cents a gallon higher than "regular-price gasoline." Such gasolines in clude Ethyl gasolines, benzol blends "high-test" gasolines, and those moto fuels that owe their "anti-knock" ratin to the process of manufacture rathe than to the addition of an "anti-knock" compound.

Two national chain companies (A and B), two local multi-units (C an D), three bulk filling stations (E, F an G), and a mail order house (H) eac supplied samples of the three respectiv grades, except company D, which fu rnished four samples, — two of the classified as "third-grade gasolines. Table I summarizes this information fo one company in each group. (The con plete table may be found on pages 8 and 89 of the original report.)

The laboratory tests included in th survey were (1) distillation range, (2 corrosion test, (3) Reid vapor pressur and (4) knock rating expressed as o

TABLE I

Classification of Companies and Gasolines with Tests Reported as Failing or Passing Specification Requirements

Company	Sample No.	Price, Cents per Gallon	Federal Specifications of Motor Fuel V			Vapor Pressure (Not Over 10 Pounds per Square Inch)	Octane No.
			158° F	257° F	356° F		
THIRD-GRADE GASOLINES—(Octane No. below 57)							
A. National Chain	1*	12.5	F	F	P	P	P
	1a	13.0	P	F	F	P	P
	1b	13.4	P	F	F	P	P
C. Local Multi-Unit	7	12.5	P	F	F	P	P
	7a	13.0	P	F	F	P	P
	7b	13.4	P	F	F	P	P
E. Bulk Service Station	14	12.0	F	F	F	P	P
	14a	13.0	F	F	F	P	P
	14b	13.4	P	P	P	P	P
H. Mail Order House	23b	12.4	P	F	F	P	P
REGULAR-PRICE GASOLINES—(Octane No. between 57 and 65)							
A. National Chain	2*	17.3	P	P	P	P	P
	2a	18.4	F	P	P	P	P
	2b	15.4	P	P	P	F	P
C. Local Multi-Unit	8	17.3	P	P	F	P	P
	8a	18.4	P	P	F	P	P
	8b	15.4	F	P	F	F	P
E. Bulk Service Station	15	15.0	P	P	P	P	P
	15a	16.0	F	P	P	P	P
	15b	14.4	P	P	P	P	P
H. Mail Order House	24b	15.4	P	P	F	P	P
PREMIUM-PRICE GASOLINES—(Octane No. above 65)							
A. National Chain	3*	20.3	P	P	P	P	P
	3a	21.4	P	P	P	P	P
	3b	18.4	P	P	P	P	P
C. Local Multi-Unit	9	20.3	P	P	P	P	P
	9a	21.4	P	P	F	F	P
	9b	18.4	F	P	P	P	P
E. Bulk Service Station	16	18.0	P	P	P	P	P
	16a	19.0	P	P	P	P	P
	16b	16.9	P	P	P	F	P
H. Mail Order House	25b	15.4	P	P	F	F	F

* Samples purchased on June 6, 1932, are indicated by a whole number; those purchased June 24, 1932, by the suffix "a"; and those purchased on November 22, 1932, by the suffix "b." Of the above gasolines, only No. 16 failed to pass the corrosion test.

tane numbers. Standard apparatus and procedures were used throughout the work, and the results obtained were compared with gasoline specification requirements of the State of Minnesota and the United States government. By this plan we may accomplish the objects of the survey, namely, (1) to compare, grade for grade, the commercial brands of gasoline sold by the different types of marketing organizations; (2) to determine the variation in quality of identical brands of gasoline at different times; (3) to measure the difference in quality between the three generally used commercial grades of gasoline and to compare these differences with the respective differences in retail prices; and (4) to determine what changes are made in the gasolines for summer and winter temperatures.

Significance of Tests

For the benefit of those readers who are not familiar with the significance of the laboratory tests and gasoline specification requirements, a condensed interpretation of these as they relate to the quality of motor fuel will be given.

Distillation test.—The purpose of the distillation test is to show the range of volatility of a gasoline. Volatility is generally recognized as the most important property of a motor fuel. Experience based on road tests and laboratory work has shown that the volumes of distillate corresponding to certain temperatures are reliable criteria of the ease of starting a motor in cold weather, the danger of vapor lock, the probability of smooth and complete burning, and the likely extent of crankcase dilution. Proper temperature limits upon the 10, 50, and 90-per cent volume points of a motor fuel will insure good performance under all conditions so far as volatility is concerned. Other temperature points are of some importance. If the initial boiling point occurs at too high a temperature, the probability is that the starting of the motor will be difficult, particularly if the motor has been idle for some time, or if the weather temperature is much lower than that appropriate for such a gasoline. The initial boiling point should, therefore, be adjusted for seasonal changes. Some motors start more easily than others, but in general cold weather gasolines should have an initial boiling point at least 10°F. lower than the corresponding point for summer gasolines. The end point, or temperature of final vaporization, should not be too high, particularly in winter weather, otherwise excessive carbon deposits may result and crankcase dilution will increase. For satisfactory engine performance the various volume fractions of the gasoline volatilizing at different temperatures should be combined in such proportion that the motor fuel will burn smoothly, completely and powerfully.

The three sets of 1931 distillation specifications[1] are (1) minimum legal requirements for gasoline sold in Minnesota, (2) contract requirements for U. S. Government Motor Gasoline,—"the grade of gasoline used by the U. S. Government and its agencies as a fuel for automobile, truck, tractor, motor boat, and similar engines," and (3) contract requirements for Federal Motor Fuel V,—"a grade of fuel which is suitable for ambulances, fire engines, emergency vehicles, military and naval equipment, and for other equipment under adverse conditions of starting and acceleration."

High vapor pressure gases cause backfires, temporary stalling, and hood fires.

Corrosion Test.—The presence of free sulfur or corrosive sulfur compounds in gasoline may be detected by completely immersing a polished copper strip in gasoline heated at 122°F. for three hours under atmospheric pressure. Corrosion or discoloration of the copper strip indicates that such a gasoline would likely injure the cylinders of a motor. Only one gasoline, a benzol blend, showed a positive corrosion.

Reid vapor pressure.—This test indicates the extent to which highly volatile compounds are present in a gasoline. When the results are interpreted in connection with the data found for the distillation range of a gasoline, particularly at the lower temperature points, it indicates the extent to which vapor lock may result. When high vapor pressure is noted along with a high percentage of distillation at low temperatures, a part of the gasoline may volatize before reaching the carburetor. Back firing, temporary stopping of the motor, loss of power, and even serious hood fires may result. A Twin City commercial company operating a fleet of cars recently had a number of hood fires, caused by ignition of escaping gasoline vapors from the carburetor and feed line. Test of the gasoline used showed a vapor pressure of over seventeen pounds per square inch absolute at 100°F.

The State of Minnesota has no vapor pressure specifications. The 1931 specification for Federal Motor Fuel V is not to exceed ten pounds per square inch at 100°F. absolute. For 1931 U. S. Government Motor Gasoline the maximum vapor pressure allowable varies from eight to twelve pounds per square inch, absolute at 100°F., depending upon the normal mean temperature of the locality at certain times of the year. In the present study ten pounds per square inch absolute pressure at 100°F. is the vapor pressure specifications used as a basis upon which to pass or fail a gasoline.

Knock Tests.—Motorists are frequently aware of a knock in the cylinder head of their motors. This knock may result from mechanical troubles, such as, carbon deposits, imperfect spark plugs, or improper timing. If not due to these causes, the fault probably lies with the gasoline used. For example, a gasoline may have such a fast burning rate that, especially under conditions of heavy load and low speed, the knocking produced will result in reduced engine efficiency, in overheating, in additional noise, and in increased stress on various engine parts causing more wear and depreciation. This situation may be overcome in part by the manufacture of a gasoline with a rate of distillation so highly regular that it will insure a smooth rather than an explosive burning in the cylinders. The trouble may also be overcome by the addition of the proper amount of an "anti-knock" compound, such as "Ethyl Fluid" or of benzol, or by cracking and refining processes designed to produce a fuel with anti-knock compounds in the gasoline.

[*Please turn to page 210*]

[1] Federal Standard Stock Catalogues, VV-G-101 and VV-M-571 use the word "evaporated" instead of recovered. These specifications state that "per cent evaporated shall be found by adding the distillation loss to the amount collected in the receiver at each specification temperature." While it is likely that the largest portion of the distillation loss takes place in the early part of the distillation, it cannot be said that all of this loss always occurs at the lower temperatures. To avoid possible errors by correcting for "distillation loss" in the manner recommended, we have chosen to follow the plan usually employed, namely, use the volume percentages recovered in the receiver instead of the "per cent evaporated" as defined above. The reason for the change of wording was overlooked in Table II of the original publication by Vaile, Nordstrom and Brewer.

AROUND THE WORLD IN SEVEN DAYS

with a minnesota engineering grad

By ROSS MAHACHEK, E. E. '26

On May 25th, just one week before the gates of the Century of Progress Exposition in Chicago open to the public, a speedy sea plane will rise from the waters of Lake Michigan and head eastward on the first lap of an airplane flight around the world.

If present plans are carried through successfully, this same plane will land on the same waters in front of the World's Fair grounds on June 1, heralding the opening of this great exposition and marking another step in the progress of aviation.

Lieutenant Ross Mahachek, the author of this article and an engineering graduate of our University, will have charge of navigation on this flight and will relieve William M. Solberg, pilot, at the controls on the longer laps of the flight.

It is with great pleasure that we present Lieutenant Mahachek's own story of the plans for this daring flight.—The Editor.

THE flight of the seaplane 'Round the World has a number of objectives. A large cargo of souvenir letters mailed by philatelists and by the general public for the round trip will be carried, and in addition letters of invitation from Chicagoans to friends throughout the world to visit the Century of Progress. These letters are now being collected through radio broadcast announcements over several super-power stations in this country. Authority to carry this mail has already been granted by the United States Postal Department. It is further the purpose of the flight to advertise the city of Chicago throughout the world during a "Century of Progress Exposition" and to blaze a direct air trail from Chicago to Europe and Alaska.

A second objective is to complete the first fast seaplane flight around the globe. It is believed that water landing aircraft are inherently safer and more practicable than landplanes over the major portion of the 'round the world route. The performance of seaplanes has been greatly improved through recent advances in design, thus enabling them to compete on a better footing with the lighter and faster land planes.

A third objective is, of course, the land plane record itself. This stands at 208 hours, or less than nine days—the all-time record for speedy globe circling established by Post and Gatty in 1931.

The Seaplane

For this world flight a special long distance monoplane equipped with floats for landing on water—a plane very similar to that used by the Lindberghs in their flight to the Orient—will be used. The pilot and navigator will have dual controls so that they may alternate as pilots. On the longer laps one pilot may sleep while the other is at the controls, and the time lost in rest periods on the ground can be reduced—a most valuable feature in maintaining a high average speed for the entire flight.

Landing on water avoids the possibility of bogging down on soft landing fields, as has occurred on nearly every Asiatic flight by land planes so far. The hazard of striking floating ice or snags exists instead, but these objects can be detected in advance and avoided.

A seaplane, although usually slower and heavier than an equivalent landplane, has a reasonable chance of lowering the present record. Storm, fog, headwinds, darkness, and mechanical troubles are all powerful adversaries of the airplane. The obstacles are best overcome by machines of long cruising radius which are able to make emergency landings or to refuel at short intervals. Here is where the seaplane shines. Thousands of water landing areas scattered along the route are made available for emergency stops for minor repairs, refueling, or because of the original destination being enveloped in fog, as contrasted with the dearth of safe hard-surface airports, particularly in the Orient.

The route as planned may be divided into three legs. The first section is a great circle course from Chicago to Bergen, Norway. Scheduled stops are at Labrador and Iceland on this section, and emergency stops for refueling or shelter can be made along the St. Lawrence River, at Greenland, or at the Faroe or Shetland Islands. This demonstrates how a seaplane can, if necessary, break up the two thousand mile ocean flight into laps of two hundred to six hundred miles.

The second leg is not a great circle course but runs nearly straight east through Leningrad and along the Trans-Siberian railroad to the Pacific Ocean. Lakes and large rivers are strewn along the first three-quarters of this section or up to Lake Baikal. Then for a few hundred miles the lakes are infrequent and the rivers swift and narrow.

From Eastern Siberia the third section of the journey follows an approximate great circle course back to Chicago, the great circle arching up through Alaska. Alternate routes are open from Manchuria to Alaska. The northernmost follows along the Siberian coast and offers clearer skies and fewer miles at the risk of ice-bound harbors and desolate shores. The southern alternative follows the 1500-mile chain of the Aleutian Islands and offers warmer waters at the expense of much fog flying and heavy rains. From Southern Alaska a direct cross-country line is struck through Minneapolis to Chicago, Minneapolis being a scheduled stop for refueling.

Controllable Pitch Propeller

A recent development in aircraft propulsion, the controllable pitch propeller, will add to the speed and safety of the flight. The airplane propeller is an amazingly efficient power converter. In spite of the blustering roar it makes while getting a grip on the tenuous atmosphere it "delivers the goods" without wasting over one-fifth of the power input.

However, the best pitch of the blades for fast cruising is too great for good efficiency at slow speeds as when taking off or climbing. The controllable feature enables the pilot to change the blade setting while underway so that a high thrust is developed during the take-off and subsequent climb. The resulting increase in performance is closely analagous to that obtained by shifting into intermediate gear ratio while accelerating an automobile.

In a seaplane the extra power and thrust developed through reducing the propeller pitch helps the most during two critical periods of the take-off. In smooth waters the greatest thrust is needed to rise onto the step or begin the skimming or hydroplaning phase. In rough seas, a powerful thrust means that flying speed can be attained quickly before continued bouncing from wave to wave can build up the usual terrific pounding action which may stove in the bottom or bend the bracing struts.

Gyroscopic Instruments

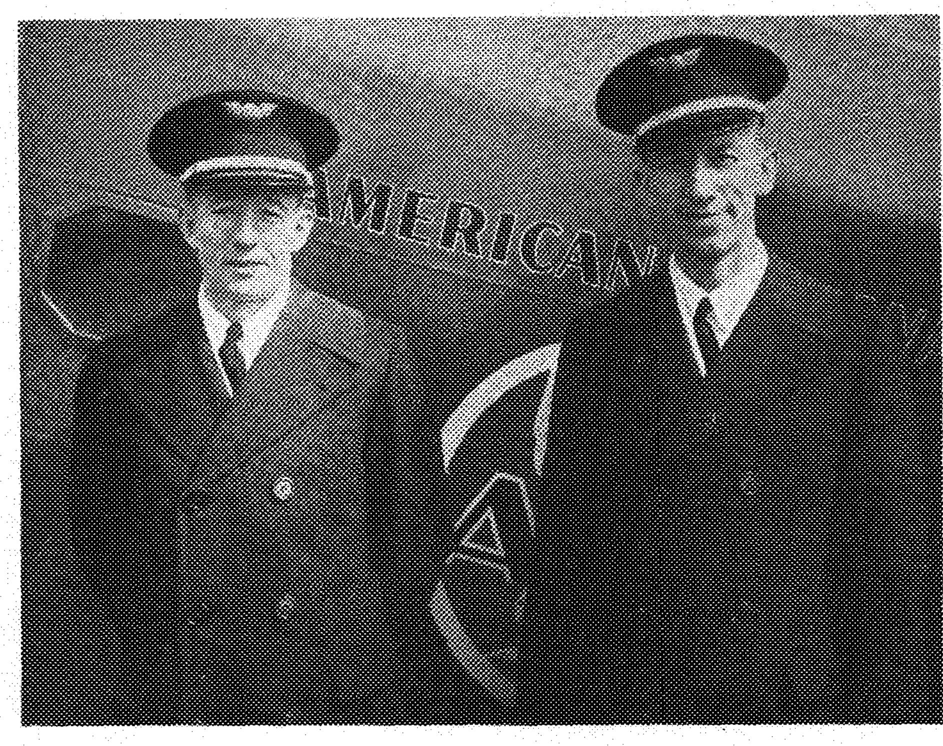
Even over short distances, blind flying through fogs requires a cool temperament and considerable preliminary training. But it is still more nerve racking to try to maintain an accurate compass heading during protracted periods of fog flying such as will surely be encountered on a world flight. Here is where the latest improvements in gyroscopic indicators helps lessen the nervous and physical load on the pilot and navigator.

All magnetic compasses (including the earth inductor) have the annoying fault of oscillating widely in rough air so that the pilot must constantly be striking a mental average of the slow and irregular swings. On easterly or westerly headings slight turns in the vertical plane tilt the compass card and then the vertical component of the earth's magnetism seizes hold for a nice long swing. On northerly headings the compass lags dangerously on a turn or even maliciously shows the opposite turn first. These faults are strongest in northern latitudes such as along the route of this flight where the vertical magnetism is strong and the horizontal weak. Moreover, in a fast airplane they increase as the airspeed rises since it is the centrifugal force of turns and zooms which tilts the compass needle.

Both celestial sights and radio bearings will be used in conjunction with the ordinary navigating methods, namely, dead reckoning from speed and heading and direct observation of landmarks and coastal contours identifiable from charts. Most of the sights for angular altitude will be made on the sun and moon since the period of daylight is long compared to the short summer night or twilight in high latitudes. Moreover, when underway, the period from sunset to sunrise will be further reduced by the eastward progress of the flight so that some nights will consist of only three or four hours of rather bright twilight followed by a daylight period of sixteen or seventeen hours.

Several modifications will be made to shorten the older methods of finding a position line from the measured altitude of the sun or moon. A new Air Almanac has been published this year particularly for aviators. It supplies the sun's angular position east or west of Greenwich directly in degrees and reduces the delays and risk of error in converting from time to arc and interpolating. An improved aircraft octant astigmatizes the sun's image and gives direct reading without verniers or corrections for the sun's semi-diameter. The spherical triangle will be solved usually by Pierce's method which is quite rapid and easily rechecked for mistakes under adverse flying conditions.

A radio transmitter having a wide range of frequencies will be carried. With such a transmitter the several direction-finding stations located along the course can give reassuring checks on the calculations of the navigator. Radio will be used primarily to secure information about changes in the weather conditions ahead so that the fuel tanks can always be filled just before entering storm or fog areas.



Ross Mahachek, the navigator on this round the world flight, seen at the right, graduated from electrical engineering at the University of Minnesota in 1926. Lieutenant Mahachek then became interested in aviation and took the course in naval aviation given by the United States Navy. He is now a lieutenant in the active airplane squadron of the Fleet Naval Reserve, and was for sometime attached to the Minneapolis squadron. He has a clear flight record of 2,800 hours in naval and commercial aviation, and was at one time chief flying instructor at Roosevelt Field in New York.

Lieutenant Mahachek also has the distinction of being the author of the book, "Airplane Pilots Manual," which is at present the outstanding manual on practical flying. He is known throughout the country as an expert in blind flying and in air navigation by celestial sights, radio, wind-reckoning, and map checking.

William M. Solberg, pilot, at the left, is a graduate of the United States Flying School at Pensacola. His first experiences were received with the Navy during the World War, and at the time that he left the service, he was chief aviation pilot of the United States Naval Reserve. Mr. Solberg then went into commercial flying and for a time was an instructor at the Roosevelt Field, New York. He has flown all types of sea planes and land planes without any accidents, and has over 3,000 flying hours to his credit. His experience as an airplane and motor mechanic will be of especial value in the preparations for this flight.

WHILE THE MOON GOES OVER THE CAMPUS

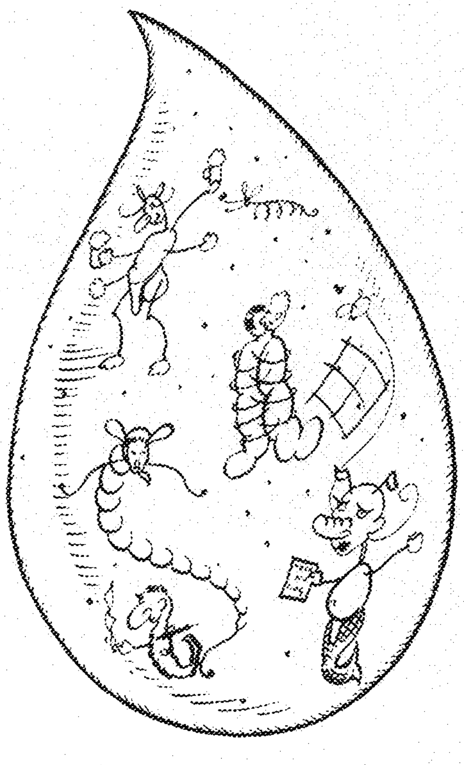
By RODERICK W. SILER

Assistant Professor of Mathematics

WHEN you go to the Chicago Fair this summer you are going to satisfy that craving you have felt all your life to see an amoeba in action without looking through a microscope to do so. At the Fair they are going to have something which will be known as a micro-vivarium. Here, by means of the inventions of Dr. Rommert, a German, they will show to audiences an enormous enlargement of a drop of water with all the life that teems there. Here you will see creatures of fearful shapes, colors and movements, ordinarily invisible to the naked eye, but increased in size sufficiently to make you gasp and think you are suffering from nightmare. They will eat, fight, make love, not entirely unlike the members of a human community, and yet, I imagine, in a considerably more interesting way. I could go on with more facts to startle you, as for instance the news that in the metropolitan area of New York City alone there are at present twelve technical schools busily turning out graduates to make the competition between engineers that much stiffer in the years to come, but as you are probably a bit nervous by this time I will cease with this. You know that in these days a man can hardly expect to find much comfort in anything he reads.

They say that it is an ill wind that blows no one any good, and proof of the truth of this is found in the fact that the depression has caused students in professional colleges to take more interest in economic and social conditions than ever before. This is certainly a trend in the right direction. When I was taking engineering, a dollar bill was just a dollar bill, and the vast majority of us had less idea of, less interest in, the fundamental facts which made that dollar exchangeable for the physical things which students need and desire than we had of why the earth goes round the sun.

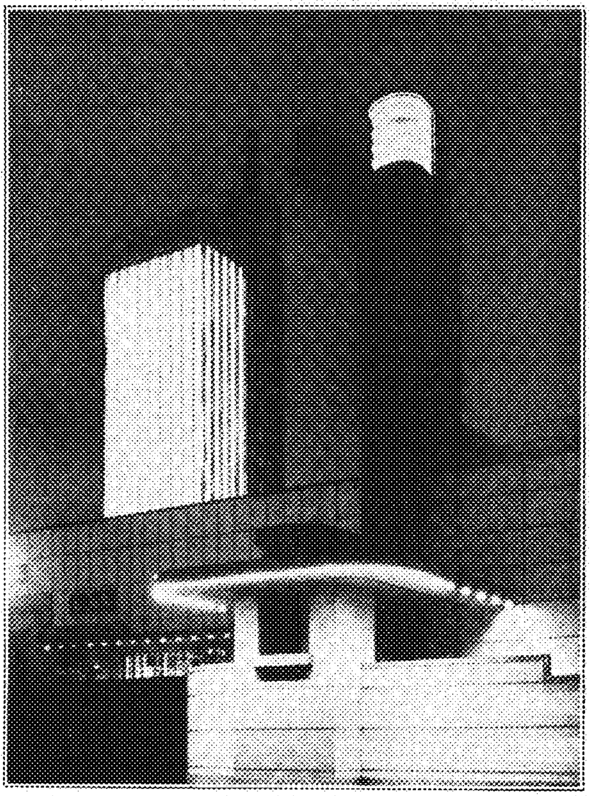
Economic facts are responsible for prosperity, depressions, wars, for human phenomena and characteristics, and ultimately for engineers' jobs or engineers' idleness. A young fellow graduating from college this June and devoid of all knowledge except the strictly professional is not altogether unlike a sheep being led to the slaughter. Comprehension of certain fundamental laws governing economics and human nature is about the only thing that can give a man some inkling of what the future holds in store for the country, and knowing this much he can proceed accordingly and with some chance of profiting by his foresight. Everyone has something to



add to the weight of public opinion in this country, and it is to the *benefit* of every individual that this public opinion be well informed and properly directed. In these articles I have more than once harped on the necessity, never so vital as today, of engineering students hooking up their technical information to a general knowledge which will allow them to recognize their relationship and the relationship of their profession to society, and at the same time learn what that society can do for them and how they can advance in it. It has always seemed to me that a pretty good combination of factors in an engineering education is this: First, technical knowledge, chiefly and necessarily of a theoretical sort; secondly, some knowledge of economics, society, and history, with its broadening and cultural result; thirdly, mastery of the English language, the medium by which all contracts are mad with other men in an English speakin country. This is requiring a good dea of a man. But remember that the com bination is a life saver when a man ha to scramble for a living.

Nothing indicates more clearly th changes that have come over the worl and college life in the last decade or tw than the fact that college men no longe go to Europe on cattle boats. This habi of accompanying steers and mule abroad was once very popular with col lege men. All a man, desirous of travel ing in the old days, had to do was ge to some shipping port, call on the agent of a cattle boat about to sail, prove tha he had a college education, or at least a part thereof, and the job was his. The for a few weeks it would be necessar to dodge steers, mules, the captain mates, very able bodied seamen and th cook. Arriving at port, the collegia would go ashore and look over the coun try, at the same time trying to figur out some way of getting back home. attended high school in Chicago with a fellow who went to South Africa on a mule ship. Joe really wasn't a colleg man, but he told me when I saw hin some years later that mules were not a particular about a man's education a were steers. One thing about Joe tha was much changed when he returned t this country was his nose. It was ver crooked and seemed to have been pushe over to the left. I asked him if a mul had kicked him. He said no, because h had been warned to keep near the fron end of the mules and had followed in structions closely. The way he got hi nose, he explained, was that after he ha been in South Africa for several month he became very hard up, and to raise little money he had fought in a prelimi nary bout at some sort of a pugilisti carnival. All his opponent had was left hook, Joe said, but it has a hun dinger, and this left hook it was th had dropped on Joe's nose and move it out of line. Of course if Joe ha been a college man and been on the bo ing team his nose would not have bee disarranged in this way. Or at least n so much. I tell you this to show yo that men with an education, high scho or college, had a lot of sport in the o days that is denied them now.

SELLING MINNESOTA at the CENTURY of PROGRESS



Concealed neon illumination makes the south view of the Hall of Science a captivating scene at night. In the background may be seen the 176-foot tower bathed in mysterious light. In the foreground is a neon-tinted canopy and a one of the architectural features capped by light.

By DAVID BUCK
M. E. '35

"COME on ovah, folks, we are about to throw open for sale, the greatest bargain which has ever been offered to the buying public—millions of acres of beautiful farm and timber land—thousands of lakes—beautiful cities—unmeasured natural resources—more than you could ask for—and it's all for the cost of—. Ah, but folks, here is where the real bargain comes in. I am offering all of this to each and every one of you free—absolutely free—with each summer's vacation spent in Minnesota."

Not thus, but in a much more impressive manner will the wonders and beauties of Minnesota be "sold" to the world at the Century of Progress Exposition at Chicago this summer. The giant store in which this mammoth sale will take place is the Hall of States, with a floor space of approximately 4,000 square feet, and the auctioneers will be the members of the committee in charge of the Minnesota exhibit at the exposition.

Itasca Park in Miniature

In attempting to sell the state to World Fair visitors by persuading them to route their vacation tours through our land of lakes, by convincing them to invest in our industries, or in some other fashion interesting them in Minnesota, the "salesmen" have provided for huge panoramas to tell the story of our great mines, forests, waterways, and other advantages in the state. They have also planned a miniature reproduction of Itasca Park, a concave picture which effects an unusual perspective view—but wait—we are getting ahead of the story.

As one enters the exhibit from the upper level entrance, he stands on the balcony of a typical Minnesota resort hotel. He walks down a stairway against a backdrop picturing the Superior National Forest spreading away for miles with treetops, lakes and even a waterfall in the vista. In each corner of the room the visitor sees a diorama or niche illustrating recreational and business opportunities in Minnesota.

Dioramas give Perspective

Each of the dioramas is seven feet wide and sixteen feet high. A concave construction with the use of cut-outs gives depth and a remarkable perspective to the picture. The painting is done on basswood, which lends itself to the bending necessary to get the concavity and is also thick and stiff enough for the cut-out construction.

One diorama depicts the ore industry of Minnesota. The mine with its power shovels, locomotives, and ore cars is in the foreground. Behind this is the great crushing plant at Coleraine, back farther the steel mills, and in the distance the ore boats, the ore docks, and Lake Superior. Another diorama shows the Minnesota milling, packing, and creamery industries. Another shows Minnesota agriculture, not so much a portrayal of the products as of the opportunity that farming in Minnesota affords. A fourth diorama is aimed at the investor, the man who might establish in the state a distributing business, or a factory. The immense territory Minnesota serves, the St. Lawrence waterway, the river and gulf hookup, and the general transportation and distribution facilities of the state are portrayed. At the base of each diorama is a plaque on which is written an account of the subject of the picture.

Between the dioramas on either side of the room runs a moving panorama, or cyclorama. Here the scenes are painted on canvas. Each of the moving canvases is 103 feet long and 16 feet high and passes around drums on either side of the stage-like opening, which is 24 feet wide and 16 feet high.

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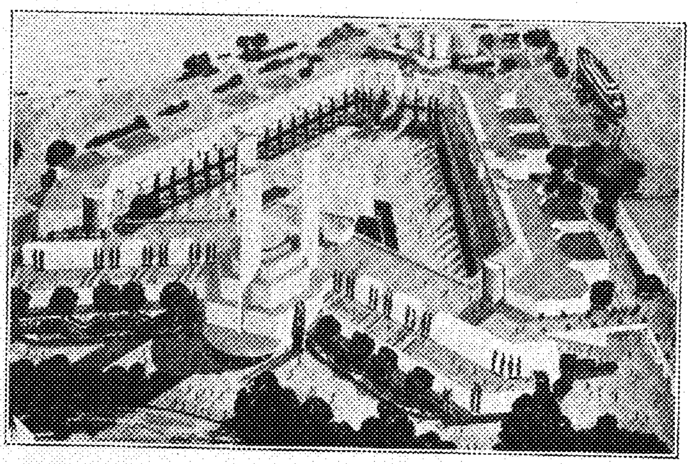


Architect's rendering of the Hall of States and the Federal Building of Chicago's 1933 World's Fair.

The Hall of States which will house exhibits of the various states and territories, will be a great horseshoe shaped structure, two stories high, 500 feet across at the base and with its two arms 500 feet long and 140 feet wide at the widest point.

SURVEYING throu

As described by Harald Flaata, C. E. '3
to Ralph Monson, C. E. '3

The midnight sun casts its slanting rays on the rippling arctic waters—a scene of rare beauty—yet an everyday spectacle to the inhabitants of northern Norway.

"SEEMINGLY rough to us, and yet remarkably precise and exceedingly well adapted to the conditions," is the way Harald Flaata, Civil engineering student, describes the surveying methods which he studied and worked with on his recent trip to Norway. Mr. Flaata returned to the University last quarter after spending six months in Norway where he was employed with the Norwegian highway department in some of the roughest country in southern Norway.

"Norway has perhaps a more temperate climate than any other country located in a similar latitude," Mr. Flaata says. He goes on to explain that although Norway is far north of the United States, and most of it extends beyond the arctic circle, its climate is very moderate because the warm currents of the gulf stream wash its shores. "Of course," he adds, "Most of the country is high and mountainous, and even though the climate is temperate, at the high altitudes it is cold."

One of the projects on which Mr. Flaata worked was the location of a highway between two villages at the opposite ends of a long, narrow lake. His own story of the experience follows. "Our job in this particular case was to locate a highway connecting the two towns, Moland and Sundsli, which are situated on opposite ends of a long narrow lake. The lake is approximately ten miles long and one to one and one-half miles wide. Its banks rose in sheer cliffs straight up from the water's edge to heights of nearly a thousand feet. In our preliminary examination of the country, we attempted to reach certain key points along the shores of the lake from a launch. We soon found, however, that there was not even a chance to set foot on the ground. In fact, a swimmer would have been absolutely unable to find a ledge large enough to support himself for several miles along the shore of the lake.

"Previous to the building of this highway, which may be completed within the next year, the only means of communication and transportation between the two villages has been by boat across the ten miles of lake. Our job was to locate a highway through the mountains along one shore of the lake to make motor transportation between the villages possible.

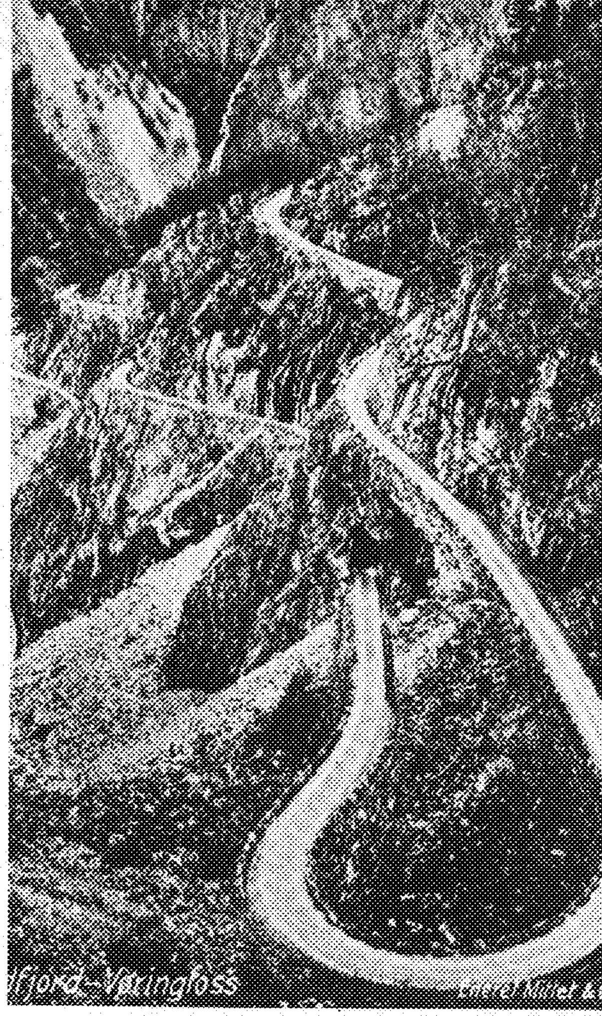
"The chief of our party, herr Edvard Hole, had made the reconnaissance of the country and had selected a general route along the east side of the lake. This reconnaissance was perhaps the most difficult part of the survey, as the reconnoiterer had such mediocre maps to guide him in his decision. Howeve herr Hole's great amount of experienc in just such terrain as this proved to b invaluable in that his preliminary loca tion compared favorably with the fina location. The reconnaissance complete we then went into the field, establishe our camp, and began the job of layin our centerline and cross sectioning th road. Our party consisted of five me two Norwegian engineering students, graduate engineer, the chief of part and myself.

"Our first job was to lay out an stake the centerline. The complete li was laid in without the use of a transi We used a series of lining poles or pick ets which were lined in by eye on tan gent. When it was desired to put in curve, we would line ahead on tangent distance of ten meters and then measu an offset to the curve. We would the propect the chord thus formed to th next station and measure our next offs from this chord. This procedure wa followed successively around the curv until the last chord was reached. Th succeeding tangent was then occupie and the last chord lined in from th tangent.

"Since a large part of the work wa being done on rock ledges and sometim on steep rock slopes where there was a solutely no vegetation and no earth, th problem of setting permanent stakes b came a difficult one. In Norway th highway work is all done by the feder government and with federal fund They work along on a project until the run out of funds, and then stop. Th will again resume the work as soon more funds are available—which m be six months or five years. The stak therefore, must be set with some degr of permanence, since they may not used for several years.

"Because of the absence of means transportation in these mountainous

mountainous NORWAY



A typical Norwegian mountain road winds up the steep slopes with a series of horse-shoe and hairpin turns. The tunnel in the center foreground leads the road back into the solid rock of the mountain, thus avoiding an extremely expensive fill or bridge.

gions, there was little chance of hauling in materials with which to make permanent marks. The local materials therefore, had to be used to the best advantage. Where stakes could be used, they were cut on the job. They were flattened out on one side and the information which it was necessary for them to carry was carved on this flattened side. In places where there was sufficient soil to support them, the stakes were driven into the ground; where there was nothing but solid rock they had to be supported by a pile of boulders. The permanence of this type of marker may seem doubtful, but practice has shown these engineers that under the circumstances it is a practical means of marking their lines.

"Where the rock slopes were too steep to support a pile of boulders, the marks were painted on the rock with white lead paint. The marks were target-like, the bull's eye marking the exact location of the station. From a distance, as from the opposite side of the lake—a distance of a mile or more, these marks could be seen forming a broken line of white dots along the mountain side.

"After the centerline was staked out and taped, the job of taking centerline levels and cross sections began. Both of these jobs were done at the same time. The level man and his rodman would take the centerline levels, while two others were measuring the cross section, and the recorder plotted all of the notes directly on a piece of profile paper.

"Our equipment for this job was just as sturdy and rugged as the hills upon which we worked. Our level was a small affair with the bubble inside of the telescope tube. The bubble was seen through the eyepiece by reflected light. This level was mounted on a ball and socket mounting on a light tripod. There were no leveling screws and no movement of the head except through the ball and socket. This necessitated leveling the instrument for each shot. When a sight was taken, the first thing to do was to look through the telescope at the bubble, level the instrument, and then read the rod.

"We carried no chain or tapes on this phase of the work and all distance, both along the centerline and perpendicular to it were measured by means of horizontal leveling rods. These rods were two meters long and were subdivided into quarter meter divisions. They were equipped with level bubbles at each end, and were operated by one man. Two such pieces of equipment were carried in our field party.

"The equipment of the recorder was no less odd than that used by the other members of the party. He carried no notebooks, and the only real notes he took were a few notes on the character of the ground, the timber, and other resources available. He carried a large sheet of cross section paper and plotted all his notes directly on this paper in the field. The level party would take centerline elevations and call them off to him. He would plot these and get the centerline profile. At the same time the men operating the horizontal leveling rods would call out the elevations and distances out which they took, and the recorder would plot the cross section right alongside the profile.

"In order to understand why this type of equipment was used you must appreciate what difficulties were encountered. In the first place, weight was a most important factor. At times we were working as far as five kilometers from our camp. Because of the roughness of the country and the inacessibility from the lake, we were forced to walk from our camp to the top of the mountains, and then along the top to the place of our work where we would walk back down the mountain again. All this travel had

[*Please turn to page 216*]

At times the rock slopes on which the party had to work were so steep that it was necessary to suspend the rodmen by ropes from ledges above. This picture shows the author, Harald Flaata, at work in the Norwegian mountains.

Our University WIND TUNNEL

THE aeronautical engineering department of the University of Minnesota can now pride itself in having a wind tunnel for the purpose of designing and testing airplane models. Professor Boehnlein of the aeronautical engineering department was the originator of the idea of constructing a wind tunnel at our University. Dean Leland was very eager to co-operate and lent a great deal of assistance in the project which confronted the department. A decision on the type of structure to be built was the result of Dean Leland's visits to the various universities in the country and Professor Boehnlein's previous experience with wind tunnels both in the United States and abroad. The trouble which confronted these two men was the lack of funds and space needed for the construction of a tunnel which would prove of any practical use.

The latter problem was solved by building the wind tunnel in Room 201 of the experimental engineering building. The design decided upon was the Prandtl type of tunnel for the reason that a larger tunnel could be built in the available space and less noise would be produced by this type than the so-called non-return type. The Prandtl wind tunnel is a horizontal return type tunnel with the section at which the tests are to be made open to the atmosphere.

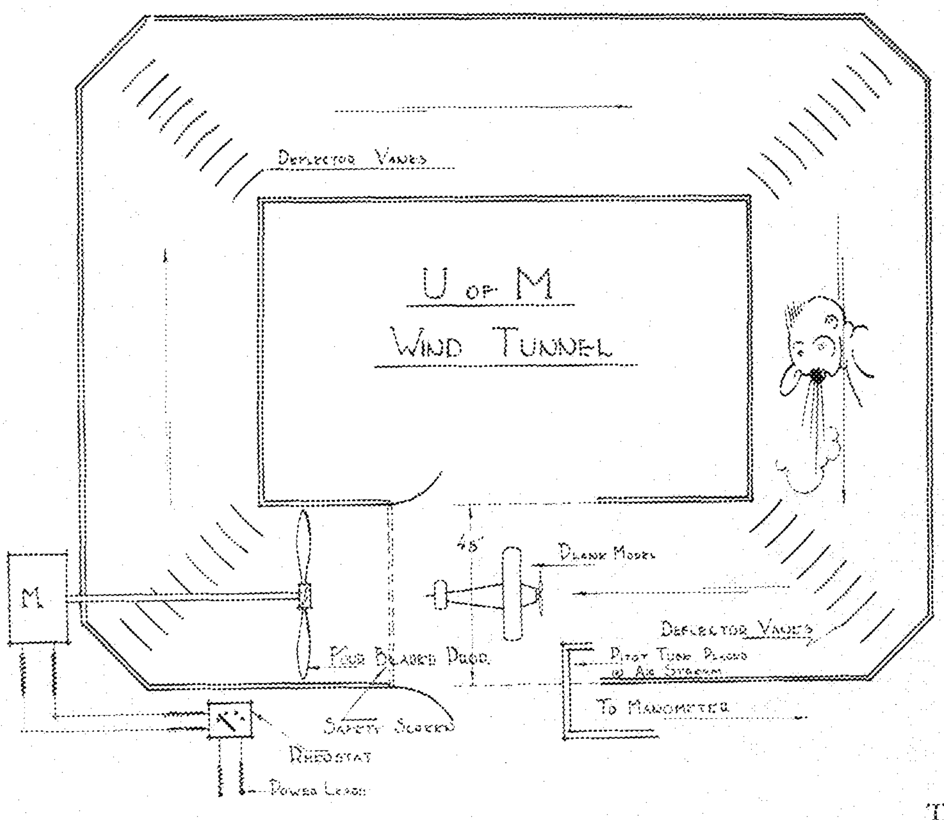
The tunnel is of wood construction with a forty-eight inch square test section. A square section is more cheaply and easily constructed than the circular type. The tunnel walls, which are of plywood, lined on the inner side, are supported by wooden frames. The air is caused to flow past the corners with the lowest possible loss in energy by means of deflector vanes which change the direction of the air flow. The power plant consists of a thirty horsepower direct current variable speed motor capable of turning 1800 r. p. m. This motor drives a four-bladed laminated wood propellor which circulates the air in the tunnel. The specifications as set forth by Professor Boehnlein were drawn by I. R. Dawson, Aero. E. '30. The construction of the wood tunnel was the work of Mr. C. C. Valeboe, foreman machinist, and Mr. Lauritz Clausen, machinist, of the experimental engineering division. They were assisted in their work by Joe Blackshaw, a graduate engineer at the Un[iversity]. The frame of the structure wa[s] cut and partially assembled in the sho[p] as the space where the wind tunnel wa[s] to be placed was rather limited. A num[ber] of aeronautical students assisted i[n] building the balance systems that ar[e] used to hold the model in position.

As soon as the three-view drawing ha[s] been completed sufficiently to determin[e] the external shape of the airplane, [a] wind tunnel model is constructed. Th[e] wind tunnel tests will predict the per[formance] of the plane under actual fly[ing] conditions and demonstrate its prac[ticability]; defects in the design can the[n] be noted. This will serve to reduce th[e] cost of designing the plane as revision[s] and changes need only be made in th[e] specifications and model instead of altera[tions] in design after the plane has bee[n] completed.

The results of the tests made in th[e] school wind tunnel have proved quit[e] satisfactory. This tunnel cannot be com[pared] with those used at the Massachu[setts] Institute of Technology or Lelan[d] Stanford University, since these institu[tions] have had unlimited funds and as[sistance] provided by government and pri[vate] foundations. The tunnel was buil[t] for the purpose of teaching the student[s] wind tunnel test methods.

Professor J. D. Ackerman, head o[f] the aeronautical engineering department has seen to the inclusion of a smoke tun[nel] for the purpose of observing th[e] paths of air streams as they pass certai[n] bodies. This tunnel is installed in th[e] aeronautical museum and has a diamete[r] of eighteen inches. The air stream i[s] made visible by the addition of smoke o[r] powdered aluminum. The section a[t] which the model is placed is glass en[closed] to facilitate the viewing or photo[graphing] of the air streams. A photo[graphic] record is made of each set-up and the picture obtained is exhaustivel[y] studied.

Models may be tested quickly an[d] cheaply in the wind tunnel and suc[h] tests give accurate results. Changes i[n] the model may be made and modifica[tions] tested at a very small expense. Th[e] desire for speed which has gripped th[e] era has led to the use of the wind tun[nel], not only for aeronautical work, bu[t] to speed up other modes of transporta[tion] as well. The wind tunnel has lon[g] been used to test models of high spee[d] racing cars, while the last few years ha[ve] seen the trend toward streamlining au[tomobiles], resulting from wind tunn[el] tests of stock model automobiles.



ELECTRONS DANCE

at Tenth Biennial Electric Show

SPECTATORS will gasp and stare in amazement while electrical students snicker and chuckle under their breath as they view the exhibits and demonstrations at the Tenth Biennial Electrical Show which will be held April 28 and 29. According to Parker Lowell, chairman of arrangements, this year's show will be the most elaborate and unusual ever presented here. As we go to press there are more than 200 electrical engineering students and faculty members working on exhibits and stunts which are to be featured in the show, and their united efforts promise to produce an entertainment unequalled in interest and originality.

Open house for students will be held Friday afternoon April 28; admission Friday evening will be free to all alumni and to others who have received invitations. The show will be presented from 7:30 to 9:30 in the evening and after that the guests will gather in the Armory to dance until 12:30. The tricks and novelties of the electrical engineers will even be carried to the dance floor where an elaborate system of changing colored lights will give weird and beautiful effects.

The general public is invited to attend Saturday afternoon and evening, admission free, and the committee is making preparations to take care of a crowd which they expect will exceed 8,000 people. At both of these performances, the electrical engineering laboratories will be so cleverly lighted and decorated that the guest will not even recognize the true nature of the "show house."

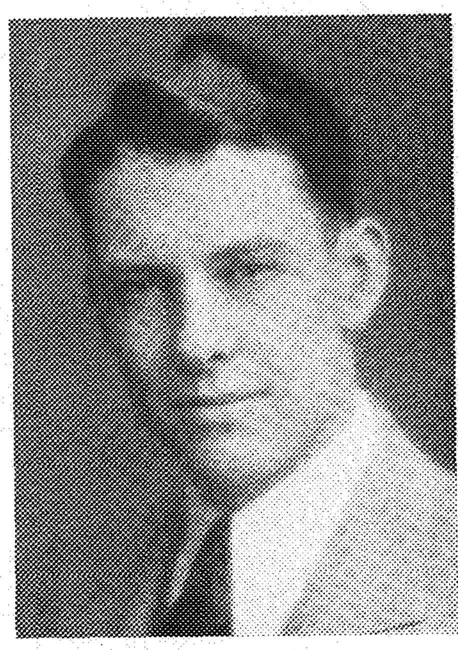
AS one enters the building on the evening of the show, his presence, although he may not even be aware of it, is being counted by a fool proof electric counter. After entering the building the guest will become so interested in his surroundings that he will forget everything but the wonders and marvels of electricity which he sees portrayed. A completely new and different "house of mystery" will give you cause to doubt your sanity. The exhibits in this branch will actually make cold chills run up and down and back and forth across your spine. After this experience, perhaps you had better test out your mentality by using the lie detector. If the lie detector indicates that you do not know the correct sum of one and two, don't be greatly worried. A mechanical thinker located nearby can readily give you the correct sum, and help you with many of your other troubles.

COMMITTEE CHAIRMEN FOR 1933 ELECTRICAL PARTY

Manager	Parker Lowell
A.I.E.E. Representative	Paul Erickson
Electrical Engineer	Sam Levy
Student Exhibits	John Hancock
Manufacturers' Exhibits	Robert Carlson
Publicity	Robert Marshall
Finance	Kress Bohrer
Dance	James Stoddart
Communications	Jay Mangan
Radio	Sanford Hanscom
Illumination	Wilbur Schorr
Programs	Howard Nichols
Decorations	Lloyd Graves
Signal Corps	John Storkerson
Senior Representative	Louis LaBonte
Junior Representative	Sven Pearson
Sophomore Representative	Daniel Kerns
Freshman Representative	Carl Henrici

A LOUD, intermittent crackling noise, not unlike lightning may cause you to reach for your raincoat or your umbrella, but that will be quite unnecessary, for the noise is being produced by the high tension apparatus, and the operator has the elements completely under his control. A discharge of almost a million volts will be made to jump a distance of 42 inches.

If you wish to see "what makes you tick" you can take a look at yourself through the Victor X-ray machine. This apparatus will be operated by Al Greene, X-ray technician of the Glen Lake Sanitorium. Another exhibit will show exactly the appearance of an alternating current. You will be able to see an electric toaster operated by an alternating current which plays a tune while it toasts the bread. However, it is not "fiddling while the toast burns," for everything is automatically regulated.



Parker Lowell, ***Manager***

In contrast to the many new and practically automatic devices which will be presented at the show, there will be a group of electric antiques on the main floor and in the museum which are far from automatic. Many of these are prized possessions of the department.

Two Minnesota Graduates will present a television exhibit. They are Max Risley and Robert Campbell. Their equipment is of the latest type, and the projector used to throw the image on the screen employs the latest type of neon tubes. One of the features of the show is the narrow-casting project. The manner in which the light beam talks is different from anything which has been seen in other shows here. Vibrations of the human voice are sent over the light beam to a photo-electric cell, thence to an amplifier and the loud speaker.

A small automobile which threatens to revolutionize the automobile industry has passed the necessary tests. The tin can motor which uses no gas, oil, or water, and operates without electrical connections is one of the exhibits which continues to mystify onlookers.

Many other interesting educational exhibits are arrayed. Luminous paints which fluoresce when irradiated with ultra violet light, lighting arrangements, telephone circuits, protective devices, battery manufacture, and many other unique displays will complete the show.

The MINNESOTA TECHNO-LOG

UNIVERSITY OF MINNESOTA

ENGINEERS' DAY—MAY 19

ONCE again all loyal engineers are beginning to look forward to the day when they will pay homage to that patron of engineers, Saint Patrick. It is not far off, and the committees have already begun the process of organization. Engineers' day involves a great deal of preparation and hard labor on the part of the few men who are placed in charge, so everybody get behind the project and lend a hand.

There are many ways in which every engineer can be of great help. First every organized group should begin to make their plans for a float in the parade. An early start on this will eliminate the last minute rushes, and will enable each group to make their plans carefully and get their ideas in on time. There is one thing to bear in mind, engineers are gentlemen through and through, and as such it is hoped that the loyal engineers will design their floats accordingly. As students of a great university we are judged by the general public from what we do outside the classroom, and it is quite evident that we cannot impress the outsiders by cluttering up our parade with a mess of vulgarity. Let us make our parade one that will go down in the history of our Alma Mater as the best and biggest of all times.

Every engineer can also aid by buying his Engineers' Day button and his brawl ticket early. The prices are going to be greatly reduced this year, so let's make every effort to make our sales one hundred per cent.

Do your bit, all "ye loyal engineers" and we will make the coming Engineers' Day one that will be talked about for years to come. The success of our celebration depends on every engineer. Don't forget the date, May 19th. —W. R.

▼

There is good in everyone. If we look for good instead of for faults we are happier and so is everyone.

JOBS

Looking over the long lists of graduates of last June, we often wonder how they are getting along. They obtained their degrees at a time when jobs were next to impossible to get and even harder to hold. But they have not given up—they have not lost faith in the world because of the times—they have gone out into the world looking for anything which will give them enough income to carry them over these difficult times. We see our graduates everywhere but in the engineering profession—we see them as clerks in stores, as insurance salesmen, as graduate students who correct papers or do other part time work, and we see a few who are holding down real engineering jobs, but at very reduced wages.

Is this year just a blank space in their lives—a period to be gotten over with as little loss as possible—a period during which nothing is gained, and life is hardly worth living? It is not, if we just sit and think things out. These men who are now struggling for their very existence are learning more than they ever could during more prosperous times. They are learning, first of all, the value of the American dollar—they are learning that it is not always the best policy to spend every cent of the income—they are impressed with the idea that a little money in the bank comes in very handy at times.

And they are learning to do the little things in life—the drudgery and manual labor that a few years ago was deigned far beneath the status of an engineer. They have obtained an experience which will serve them in good stead as prosperity returns—and they will never be caught in the position the leaders of industry find themselves in now, if another period of depression ever occurs. —L. J. M.

THE ELECTRICAL SHOW

AFTER weeks of preparation and toil the Tenth Biennial Electrical Show is approaching completion. It is the duty of everyone in the University to attend the show, not only for its educational benefit but for the enjoyment to be derived from it.

To undergraduate electrical engineers it furnishes an insight into the profession which they have chosen as their life work. For other engineers it is a means of becoming acquainted with one of the other professions with the view of making use of some of the developments in their own respective fields. For the general public there is interest from an educational viewpoint provided by applications of Electrical Engineering developments to the home and to our everyday life. The miniature house of magic, while not as large as that of General Electric fame, will provide much interest to everyone.

There are many reasons for putting on a show of this type. The experience in cooperation gained by all those taking part is very necessary, for as our world becomes smaller and smaller through engineering development each of us must learn to get along cooperatively. The public attending the show is given a chance to see that something worth while is being learned in our colleges.

SPRING AND THE ENGINEER

EVEN the engineer—stoic though he is—feels a quickening of the pulse when that *"Aprille with his shoures soote"* comes around. The spring brings with it a rejuvenating atmosphere that unmistakably sets one's internal mechanism operating at an abnormally high rate of speed. One notices that the campus really is quite a beautiful spot with its innumerable freshly budding trees and bushes. One yearns to stroll through the colorful Greenhouse and spend a dreamy hour in the lovely wild flower garden. Perchance one may even get a touch of spring fever and neglect a few classes merely to waste an afternoon walking aimlessly along the river bank. There are many spots on the campus where one can find pleasure in just doing nothing but absorbing the beauty of nature. This is a valuable pastime if not indulged in too freely, for everyone should cultivate in himself an appreciation of nature.

—M. C.

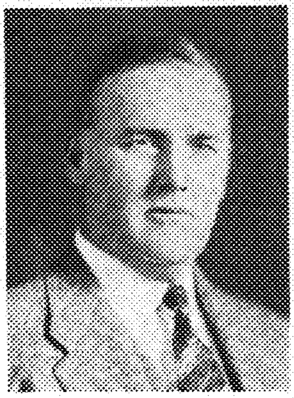
ROOSEVELT ACTS

AN almost miraculous change has occurred in the United States since the inauguration of President Roosevelt. No American president since Washington has entered the White House possessing such popular confidence and support. There is no greater evidence of the universal confidence in the new administration than the public reaction to the now past banking emergency. The crisis came not only as an unexpected responsibility, but also as an opportunity for the new president to demonstrate his ability, and he admirably came through.

The president carried on his rapid fire action by appearing before the special session of Congress and in a few hundred words telling them just what he planned to have done. His plans included a new tariff policy; help to the farmers by definite efforts to raise the values of agricultural products and by use of farm mortgage relief; fifteen per cent slash of the wages of all federal workers; and plans for easing the unemployment situation through the beer bill and the reforestation program.

—S. L.

DEAN LELAND SAYS - - -



Leisure Time Study

IN this period of depression, many engineers, as well as other professional men, are partially or wholly unemployed so that they have considerable leisure time. It is important that they take advantage of this condition to engage in systematic reading and study, both in preparation for a return of industrial activity, and to broaden their cultural horizons.

This postgraduate study may or may not be directed towards an advanced degree such as the Master's degree or the professional engineer degree. If the necessary funds are available to provide for graduate work in residence at an engineering school, this is a favorable opportunity for working towards a Master's degree. If, on the other hand, it is not convenient to attend the University owing to residence at a distance, it is still possible for our own alumni to pursue graduate study *in absentia* towards the professional engineer degree from the University of Minnesota, the only expense being the tuition and other fees amounting to about $75 which covers the equivalent of a year's study estimated at 1500 actual hours, although it may extend over more than one year. Details of these plans may be found in the Bulletin of the Graduate School.

ON the other hand, the unemployed engineer may find that he cannot afford to pay tuition, and this is the man who should give special consideration to the question of study in his leisure time. He should make a program of systematic reading and study and then exercise his will power to carry out the plan. Any university professor will advise such a man regarding desirable books to be read. The books may be obtained from libraries, borrowed, or purchased. There should be no difficulty in obtaining access to suitable books. A course of reading diligently carried out may be nearly as effectual as a similar course pursued in college inasmuch as the alumnus has learned to study during his undergraduate years.

The subjects studied are of less importance than the study itself. The main objective should be to maintain one's mental agility and keenness and so avoid becoming dull and rusty from lack of exercise both mental and physical. For an engineer, a review of some of his college textbooks is frequently interesting and helpful. Problems of all kinds afford valuable exercise. Many men are reading books on economics, government, industrial management, cost analysis, and similar subjects relating to engineering administration. Modern world history affords a useful diversion.

The unemployed engineer will be fortunate if he can associate himself with a group of other men who are interested in professional matters to form a discussion class. His college training and professional experience may provide a background for service as a leader or teacher of classes in mathematics, mechanics, and other fundamental subjects for young men who also are temporarily without employment. Certainly no one should waste his time in bewailing his misfortune.

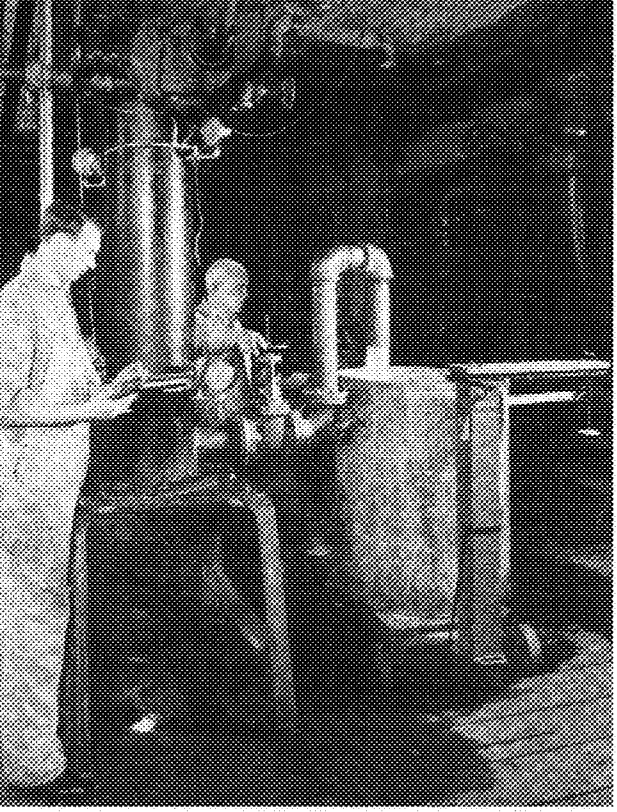
O. M. LELAND.

RESEARCHES AT MINNESOTA

The University of Minnesota has in the past sponsored outstanding researches in the fields of Engineering, Physics, and Chemistry.

We believe that our readers will be interested in the researches being carried on at the present time, and so we present here descriptions of the different projects as they have been written up by the researchers themselves and collected by Ralph Fredrickson, C '34.

Space does not permit the publication of all of these reports in this issue and so further research projects will be described in the May and June issues of the Techno-Log.



A view of a recently constructed permeammeter used for studying the laws governing the flow of water through sand under high pressures. The sand to be studied is placed in the cylindrical tank; water is allowed to enter the upper end of the tank under pressures up to 250 lbs. per sq. inch and is discharged through the material into a weighing tank. Determinations are made of the drop in pressure in the water incurred as a result of flowing through the sand at various velocities and pressures. The experiments are applicable to the flow of water through sand filters in municipal water purification plants, studies of the drawdown of wells, percolation through sand dams, etc.

Experimental Engineering

Air Conditioners

With air cleaning devices assuming an increasingly important role in modern life, a set of efficiency standards for the comparison of various types of cleaners has become a necessity. Under the direction of Professor Rowley experiments are progressing with the purpose of arriving at such standards. R. C. Jordan and C. H. Pesterfield, research fellows in Heating and Ventilating, are working on this problem.

The method in use is to draw a predetermined amount of air through the filter or washer. A given amount of dust is thoroughly mixed with the entering air, and the weight per unit volume of the air is measured before and after passing the filter by means of a special filtering crucible. By this method, it is possible to account for practically 100 per cent of the dust fed into the air stream. The dust is composed of a mixture of equal parts of lamp black and bituminous coal ash passing a 200-mesh screen.

Airplane Engine Research

A 3-cylinder radial aircraft engine is being cooled by a blast of air which is drawn through a large metal tunnel. The power output is absorbed by a Sprague electric dynamometer. Any desired condition of load and speed may be imposed upon the motor. The velocity of the cooling air may also be changed as desired.

Thermocouples on each cylinder are used and the cylinder temperatures are observed during the experimental work. A Jacklen high speed engine indicator records instantaneous pressures at different positions in the intake manifold and in each engine cylinder.

The purpose of the investigation is to determine the losses in the intake system and their effect upon the engine output and performance.

Lester Gustafson, graduate in Aeronautical Engineering, is working on this problem.

Air Filters

Mr. O. J. Wiggins, a graduate student in Mechanical Engineering, is studying the cleaning characteristics of the dry viscous air filter as a thesis problem.

Filters are built up of different materials and their cleaning characteristics determined for different thicknesses, densities, and air velocities through the filters. The test filters are placed at about the center section of the air duct, a given amount of dust is mixed with their air entering the duct, and a predetermined volume of air is drawn through by a centrifugal fan. After passing through the filter, the air is drawn through a standard orifice and the volume is measured by the drop in pressure through the orifice.

The filters are weighed before and after the test, and the efficiency is taken as the ratio between the gain in weight of the filter and the amount of dust fed in throughout the test.

Piston Ring Leakage

A horizontal gasoline engine is being used to investigate leakage past piston rings. Special apparatus has been developed at the University of Minnesota for making measurements of the pressure leaking back of the ring while the piston is in motion.

Neil J. McDonald, graduate Mechanical Engineering student, is operating this tricky apparatus.

Physical Chemistry

Water Gas from Lignite

The investigation is at present concerning itself with the yields of water gas obtained under varying conditions of temperature. It is found that very good yields of hydrogen can be obtained from some of the lignite cokes. It is, furthermore, found that the ash contents of the coal or coke has an important influence on the yield of hydrogen in the water gas reaction.

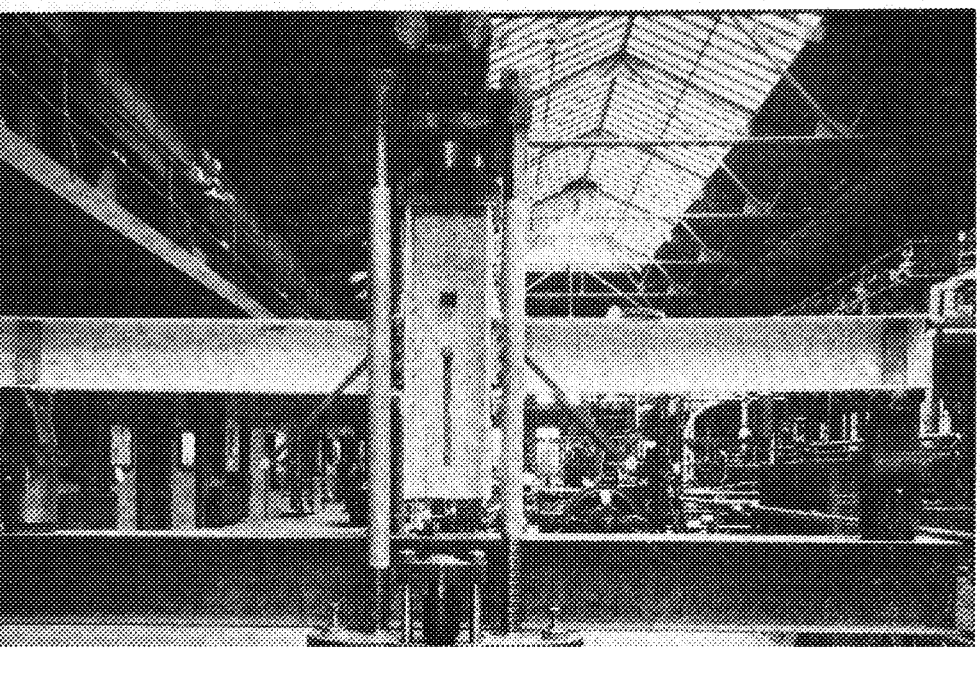
Hydrogen-Bromine Reaction

Hydrogen and bromine gas combine to form hydrogen bromide when the gaseous mixture is exposed to the alpha radiation from radium emanation. The relation between the speed of this radiochemical reaction and the temperature, the amount of radon used, and the partial pressure of bromine, hydrogen, and hydrogen bromide, is being investigated. Since this reaction does not involve a change in pressure, its course is being followed by measuring the (changing) absorption of green light by the bromine present. The theoretical interpretation of these results should bear some relation to the corresponding photochemical and thermal reactions, which have been extensively studied.

Physics

Mapping Pre-Glacial Topography

Pulsating current of known value is introduced into the earth at grounded electrodes. The fall of potential between two points located between the current electrodes is measured, and from this data the apparent resistance of the earth section through which the current flows can be calculated. The distribution of the flow of current is dependent on the resistances encountered. In general, the thicker the drift, the deeper will the current penetrate; and where the drift is thin the current will confine itself nearer to the surface to avoid the more resistant rocks below. The values of the apparent resistances are also dependent on the flow of current along the surface, and thus from them one can estimate the thickness of the drift. In this way buried pre-glacial valleys, hills and like features can be located and mapped.—STANLEY M. WILCOX.



Riveted Bracket Connections: Research project No. 56—The object of this investigation was to determine a satisfactory measure of the moment of resistance of a bracket connection. Methods of calculation now in use give widely varying results. This figure shows one of the specimens being loaded in the huge Experimental Engineering testing machine.

Ionization by Electron Impact

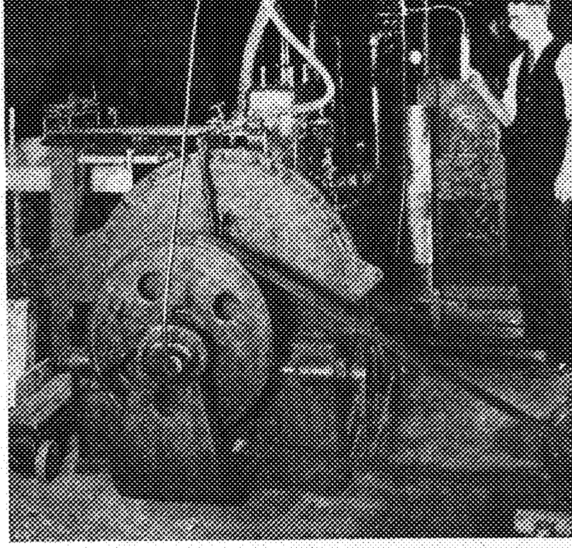
An electron having sufficient energy may, at impact with an atom or molecule, cause one or more electrons to be ejected. This ionization process is of prime importance in the study of electrical discharges in gases. Dr. Tate and Philip T. Smith have been making a systematic study of the probabilities of ionization by electron impact, of various atoms and molecules.

There are two problems with which they are at present concerned. The first is a determination of the total number of ejected electrons per impacting electron per centimeter path in a gas at a definite pressure. This quantity is being measured directly.

The second problem consists of a determination of the number of electrons which may be ejected from a single atom or molecule as well as the relative numbers of the different kinds of ions formed. This is being done by passing the ions through a magnetic analyzer which gives a measure of the ratio of the charge on an ion to its mass.

Measurement of Small Direct Currents

The problem is that of developing a stable and convenient method of measuring direct currents of the order of magnitude of 10^{-17} amperes. A number of vacuum tube circuits permitting of such measurements are now in use; but they are all of the "d.c. amplifier" type, that is, they have direct coupling between stages. As is well known, the "d.c. amplifier" becomes unstable if more than one stage is used, unless extreme precautions are taken in shielding and filtering the supply voltages; and it is subject to current drift. Both of these factors make such an amplifier undesirable for precision measurements.

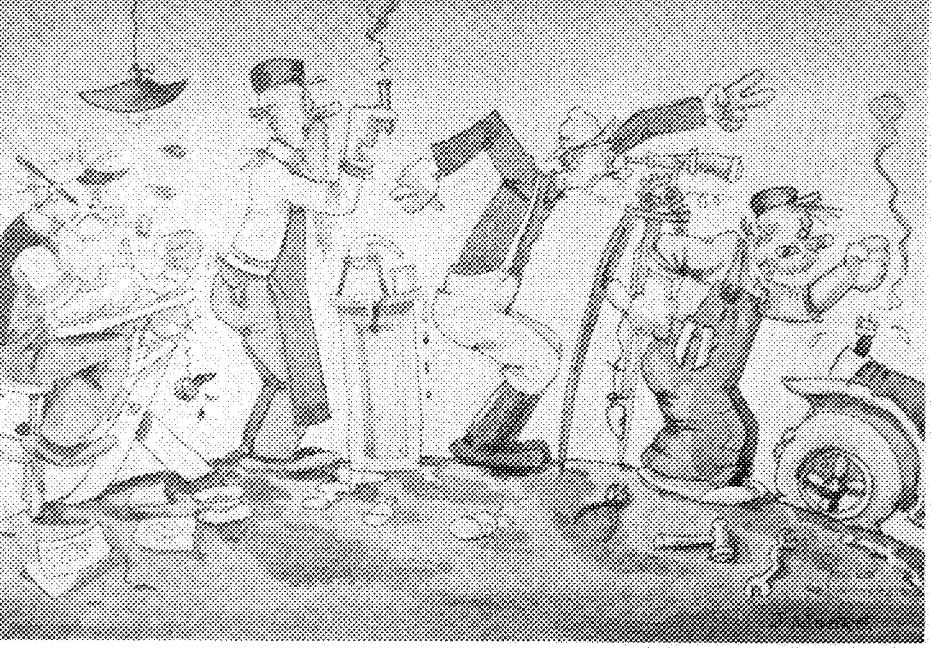


K. G. Jones, graduate Aeronautical Engineering student, is determining the best wearing material for engine cylinder walls. The engine and water brake shown in the photograph were loaned to the University for this purpose by the Minneapolis-Moline Company. Accelerated wear is obtained by introducing a finely divided floating dust which was shipped in from Kansas for this purpose. This engine is equipped with removable cylinder liners which are removed after wear and replaced with others made of different metal alloys.

The method now under development proposes to change the direct current to be measured to an alternating current, which will be amplified by a conventional high frequency amplifier, tuned coupling and the amplified current measured with a vacuum tube voltmeter. This type of amplifier is readily kept stable; and since direct coupling between stages is not used, drifts in currents are not amplified as in the case of the "d.c. amplifier." This method gives promise of a more stable, more easily controlled circuit than is now in use.—LEON S. NERGAARD.

Electrons in Sulphur

An X-ray tube was constructed with a special form of target which protected the compound from the electron stream and eliminated the effects of chemical reactions with the target. The wave-lengths and structures of the X-ray spectrum lines from S, FeS, CoS, NiS, Cu_2S, and ZnS were measured by means of a vacuum spectrograph. The results enable one to calculate the influence of the force fields of adjacent atoms on the electron energy levels in the sulphur atom and contribute to a better understanding of the nature of chemical union. The results obtained to date will appear in an article in the April fifteenth issue of the *Physical Review*.—JOSEPH VALASEK.



ALUMNI SKETCHES

Architectural Engineering

'20—FLORIAN A. KLEINSCHMIDT is now head of the School of Architecture and the Allied Arts of the Texas Technical College in Hubbock, Texas. Mr. Kleinschmidt may be addressed in care of the school.

'24—HERBERT MAGOON is architect for the Long Island State Park Commission, Babylon, Long Island, and writes, "I am registered as an Architect in New York and New Jersey and have done all the architectural work in the famous Jones Black State Park." Mr. Magoon may be reached at Box 978 Lindenhurst, Long Island.

'30—GERHARD C. PETERSON has kept himself busy the past two years lettering a large portion of the diplomas used here at the University. He writes that he was also doing some architectural work about a year ago. Gerhard may be reached at 18 Wilkin Street, St. Paul, Minn.

'32—BERNARD H. KNOBLA is a member of J. F. Dreger Co., who are architects at 20 Algoma Blvd., Oshkosh, Wisconsin. Bernard lives at 187 Otter Street in that city.

Chemical Engineering

'29—MAX KANTOR has recently been given a research fellowship at Lehigh university by the Archer Daniels-Midland company of Minneapolis. He has been working there for the last few years and has learned quite a bit about linseed oil and similar substances. Max's home address is still at 1127 Humboldt Ave. North when he is in town.

'29—DAVID W. GLASER is doing graduate work at the University of Minnesota.

'29—GUSTAVE HEINEMANN, who received his M.S. in 1930 at the University of Minnesota, is a chemical engineer with the Columbia Alkali Co. at Barberton, Ohio.

'29—CARL M. LANGKAMMERER is continuing his duties as assistant in the School of Chemistry, University of Minnesota.

'29—THEODORE PETRY received his M.S. in Chemical Engineering at the University of Minnesota in 1930. Ted is at present Research Engineer, Oil Treating Div., with the Vacuum Oil Company at Paulsboro, N. J.

'29—H. ARTHUR SHABAKER (M.S. in Ch.E.—1930) is a chemical engineer in the Research and Development Department of the Vacuum Oil Company at Paulsboro, N. J. Mr. Shabaker, as men will do, married Miss May Humphrey on August 30th last.

'30—MAURICE W. LEVY is Examiner in Division 63, U. S. Patent Office, Washington, D. C. He specializes in Foods, Food Chemistry and Preserving. He wants to be a lawyer and is studying law at Georgetown University. His present address is 4409 15th St. N. W., Washington, D. C.

'30—CLINTON W. MACMULLEN is continuing his duties as an assistant in the School of Chemistry.

'31—CLIFFORD T. HULTIN is now back doing graduate work at the School of Chemistry, University of Minnesota.

'32—LEONARD REITER has started a new system of bidding for building contracts by publishing of "Reiter's System of Bidding" in December of last year. Leonard has been working hard in perfecting this system for the past year. Mr. Reiter's home address is still at 413 Oak St. S. E.

Civil Engineering

'20—FRANCIS A. DEVER is at present Supervisor of track for the Pennsylvania R. R. in Cleveland, Ohio. He writes that though he is married, there are as yet no future engineers in the family. Mr. Dever's home address is 1568 Compton Rd. in Cleveland.

'30—G. H. MEFFERT was in to see Prof. Zelner of the department recently just before he went to Dallas, Texas, on a temporary job with the Carrier Engineering corporation. He wrote recently saying that Dallas was a very nice town. "Outside of two days rain, the weather has been quite 'springy.'" George is staying at 2022 Bryan Street, Dallas, while his job lasts.

'31—JOHN H. KREMA, 817 Hague Ave., St. Paul is still connected with the Minnesota State Highway Department. This spring he is working on a location survey for a highway to run along the North Shore of Lake Superior between the Arrowhead River and Pigeon River. While working he will be in Grand Marais, Minn.

'31—FRANK W. KUHFELD has also been working in the St. Paul office of the State Highway Department during the winter. He is now stationed at Faribault, but letters addressed to him should still be sent to 891 Tuscarora St., St. Paul.

'32—WYLLYS F. MCELROY has been working in the central office of the Minnesota State Highway Department all winter. During the spring he will be in the field at Detroit Lakes. Wyllys present address is 5000 Beard Ave. S., Minneapolis.

Electrical Engineering

'96—CARL EDWARD MAGNUSSON, Professor of Electrical Engineering at the University of Washington, published in 1932 an Eng. Exp. Station Bulletin on Electric Discharges. This bulletin, besides other things, includes the effect of the Magnetic Field on the Lichtenberg figures of a discharge. Mr. Magnusson may of course be reached in care of the University.

'24—ALFRED GREEN is at present a technician and instructor in X-ray technology at Glen Lake Sanitarium and is working on technical problems related to the use of electricity in medicine. Al was president last year of the Society of Radiographers and is now executive Secretary and Treasurer of the American Society of Radiographers, a national organization. He is now a registered technician and editor of "The X-ray Technician," a national X-ray magazine. Al says he is still single, drives a Ford, and still has most of his own teeth. Proudly he announces that he has as yet no jail record.

'26—PAUL B. NELSON sailed on a Caribbean cruise this past winter, visiting Cuba, Panama, and Nicaragua. Nelson spent several days in New Orleans before the cruise and in his rambles through this quaint city ran into Win Hilgedick, E.E. '26, who is connected with the Western Union Telegraph Co., and one night at Arnaud's Restaurant unexpectedly met Stuart Bailey, E.E. '27, and Millard Garrison, E.E. '30, both in New Orleans conducting a radio survey. Nelson was managing editor of the MINNESOTA TECHNO-LOG in 1925-'26 and wrote the Arabs musical show in 1927.

Bookstore Notes

1925—Harold Smith, our Bookstore Manager, gets sentimental in telling about his recent protege. On January 5th, 1933, a son, Robert Dunham, was born to his wife (nee Cornelia Clousing, a sister of Larry Clousing, TECHNO-LOG editor, 1927-28). Harold devotes considerable time these days to studying the development of the early stages of the human being and reading numerous books on child care and training. The prediction is that Bobbie will occupy the position of tackle on the football team some day.

The beer question hasn't bothered Harold yet. He didn't like near beer, and as yet doesn't know what 3.2 may do to it. To him golf is a nice game but takes too much time. He would rather play tennis. His hobbie we mentioned in the first paragraph—no more need be said on that score.

The Bridge Club of the University Business Staff occupies two evenings of his time a month. Harold once won a prize at the game, and is still working for his second success. Jig-saw puzzles were just a passing fancy with him.

His full time services with the Bookstore started in 1925, immediately after graduation, and his enthusiasm for the work is just as strong now as it was then. It is his desire to have everybody in the college a member of the store so they could use the advantages of its service and savings.

Alumni Employment Service

'30—ROY H. COMSTOCK recently wrote a long letter to the TECHNO-LOG in which he suggested a plan with regard to the present unemployment situation, and we would like to know how some of the other alumni feel about it.

In part Roy said, "There is one way in which I believe the TECHNO-LOG can be of much service to the alumni. That is through an alumni employment service and survey such as was suggested and, I believe, started in 1930. At the present time a large percentage of the engineering graduates of recent years are unemployed. Others are employed in positions which do not offer the greatest opportunity for the use of their particular talents and education. These alumni are interested not only in getting employment but also in learning the general and specific trends in the engineering employment market. Many of them are isolated from contact with other Engineers and have very little idea of what is actually happening. They would welcome information."

If you alumni are really interested in a plan to that effect, we wish you would write and let us know, and something will be done about it. Roy's present address is Spring Valley, Minnesota.

Mechanical Engineering

'15—DAVID MURRAY GILTMAN is now President and General Manager of the Eskew, Smith, & Cannon Co., Charleston, W. Va. Mr. Giltman has gone in for some flying lately as he now has a Private Pilot's license from the Department of Commerce. His present address is 1223 Virginia St. in Charleston.

'22—ERNEST F. CARLSON, 3224 Forty-eighth Ave. So., Minneapolis, Minn., is still Plant Results Engineer at the High Bridge Steam Plant of the Northern States Power Co. in St. Paul. Ernie has been doing abour the same things as usual lately and writes that things are pretty humdrum.

'24—R. D. HOLMSTEN is at present with the Aurora Metal Co. in Aurora, Illinois. His present home address is 538 Hardin Ave. in that city.

'28—ARTHUR NELSON is at present another of our great family of unemployed. He is preparing himself for better times, by taking graduate work at the University this quarter. Art's home address is 3340 43rd Ave. So., here in Minneapolis.

'29—Rolf M. Smith is Junior Engineer with the Frigidaire Corporation at Taylor St. in Dayton, Ohio. He writes that he just brought about the need for a $1,100,000 tooling program for an air compressor in a certain development. Rolf's present address is 618 Superior Ave., Dayton, Ohio.

'30—GLENN H. NORTHFIELD is with the L. W. Northfield Co. of Minneapolis as engineer. His home address is 2542 Central Ave., Minneapolis.

'30—ROBERT W. ORTH writes that if it were not for his work with our University Radio Station, WLB during his university days, he would also be one of the unemployed. As it is, he is very busily engaged as Publicity Editor of the Editorial Section of the Publicity Department in the General Electric Co. at Schenectady, N. Y. Bob's address while at home is 518 Union St., Schenectady, N. Y.

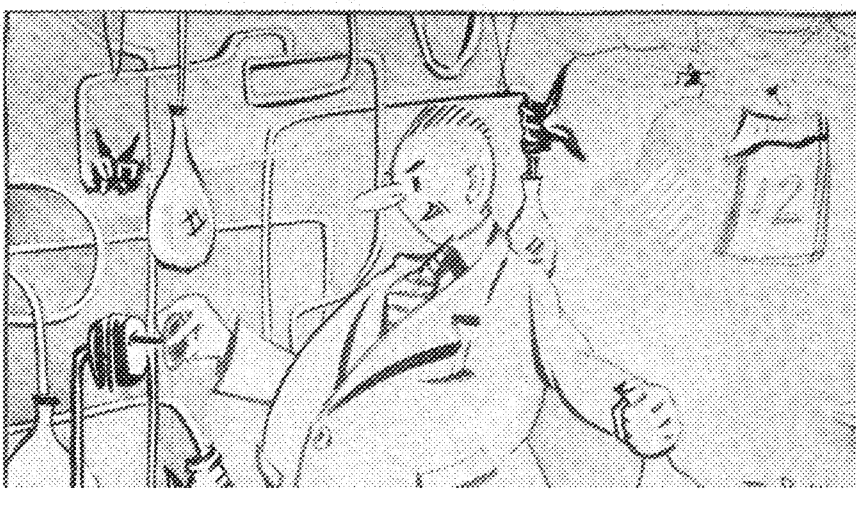
An Electrical Doctor

'30 E.E.—ISODORE CHALEK is now very busily engaged in the University Hospital. He is working in the Bio-Physics department of the hospital and is engaged in all sorts of work. While visiting him, he was measuring the temperature of a patient at various points in his body by the use of a thermo-couple and a bridge circuit. By finding how the temperature varied over the patient's body it was possible to determine whether the patient had one type of disease or another.

Another portion of Mr. Chalek's work is to collect the radon from a radium chloride solution. To do this a rather complicated system of mercury valves, pumps, and glass tubing was required. The radium emanation was first taken from the safe, in which the radium proper is kept, by means of a glass pipe. From here the radon passed through the valves and purifiers and then by means of cleverly devised tubing it was possible to concentrate this small amount of emanation into a space the size of a small bubble of glass. Two such sets of apparatus are available, both operating from the same safe, so that in no case will the radon be wasted. Also a large number of spare parts are kept on hand so that long delays are completely avoided.

In his office, Mr. Chalek has some more equipment, the purpose of which is to measure pressures very accurately. This apparatus works on the principal that the amount of current that will flow in a vacuum tube is dependent on the pressure. By measuring the current between the filament and plate it is possible to obtain accurate reading of pressure down to the thousandth of a micron. The pump used to obtain these low pressures is similar to an ordinary mercury vapor pump except that it works with a special oil and has carbon dioxide snow for cooling.

Another of Mr. Chalek's jobs is to give patients diathermy treatments, and to work at odd times on the various X-ray set-ups in the hospital. Besides all his work in the hospital, Chalek is taking courses in German and Chemistry and is planning to enter the medical school next fall.



AROUND THE CAMPUS

Alpha Tau Sigma

The Spring initiation banquet of Alpha Tau Sigma, honorary engineering journalistic fraternity, was held at King's X Cafe at 6:45 P.M. Tuesday, April 11, with Dean Leland, honorary members, as toastmaster. The initiation ceremony was held immediately preceding the banquet in the MINNESOTA TECHNO-LOG office.

The following men, all of whom are members of the MINNESOTA TECHNO-LOG staff, were initiated at this time: Clayton Ebert, Frank Leistiko, Robert Marshall, Charles McDonough, Ralph Monson, James Moore, Gordon Rosholt, and James Weldy.

Tau Beta Pi

Tau Beta Pi has been thinking of an inter-honorary fraternity dance for the past month or so. Because of lack of interest on the part of the other honoraries, however, it is planned that Tau Beta Pi shall hold its own dance. Tau Beta Pi is also to hold its spring initiations very soon, and an interesting time is being planned for the new men.

A. I. E. E.

Prof. W. T. Ryan gave a travelogue on his travels in Europe and spoke on the subject "The Electric Power Development in England, France, and Germany," at a meeting of the American Institute of Electrical Engineers on Tuesday, April 11. Following the travelogue a discussion was given by the members concerning new ideas for the Electrical Show and several new ideas for student exhibits were brought up. A film was then shown depicting the many buildings already constructed at the Century of Progress.

The entertainment included a boxing and wrestling match, the results of which can not be divulged since another fight would result over the improper decisions. The wrestlers were "Masticator Joe Getsug" and "Battling Howard Morgan" with Joe Schoenig acting as referee. The boxers were "Big Shot Johnny Lerner" and "Scrappy Edward Tangon" with Cledo Brunetti acting as referee. Refreshments were served.

A. S. M. E.

Last Thursday morning, April 6, the student branch of the American Society of Mechanical Engineers held a meeting for the purpose of selecting delegates to the National Convention in Chicago on April 28 and 29.

Two official delegates are to be selected by the vote of the club, as well as two members-at-large, chosen on the basis of their activity in the society. The group plans to make the trip by motor.

President Norman E. Carlson appointed a committee consisting of Professor J. V. Martenis and B. J. Robertson and three seniors, Al Hutchings, Norbert Mengelkoch, and Harvey Tangen, to select the six best of the seminar papers submitted by the group for the winter quarter. The students whose papers have been chosen will present a five minute review of their paper at the next meeting of the society, which will be held as soon as the committee makes its report.

Professor Robertson, besides giving particulars regarding the convention, also announced that Dean A. A. Potter, the national president of the A.S.M.E., will address the local group on "What is ahead of the engineering student," on Tuesday afternoon, April 25, in the Electrical Auditorium. Other features of the program will be a report on the National Convention held last December, musical numbers, and selections by the Pioneer Hall quartet. R. W. Knudson, John and Bill Hatch, and Erling Hauge are the singers in the Pioneer Hall group.

Eta Kappa Nu

At a recent luncheon of Eta Kappa Nu, Mr. Boring, representative of the General Electric Company, spoke briefly on the difficulties confronting the graduating engineer. He stressed the fact that if study was not continued after graduation, the engineer may as well go back to the farm, and as an afterthought added that there might be a good field for engineers in agriculture.

During the past few weeks, candidates for membership have had a few samples of the trials and "tortures" that lie before them. May their guardian devil watch over them.

Junior College News

WITH this issue the TECHNO-LOG presents a new feature—a column devoted to the activities of the Engineers' Clubs in the Junior Colleges of Minnesota. Realizing that the majority of the graduates of these institutions transfer to the University after completing their Junior College work and that there are many ex-Jaysee men now enrolled in the College of Engineering, we hope that this column will be of interest to them, as well as to others.

This month we hear from the Duluth Junior College Engineers' Club, one of the most active organizations of its kind in Northern Minnesota.

And now presenting the D. J. C. Engineers——

Contrary to their traditions for Engineers' Day, which will be May 5th this year, Duluth Junior College Engineers will stage a cabaret at the Spalding Hotel to replace their usual cabin party and parade. As usual the club will present a convocation for the entire college on that day, and tags will be sold for the purpose of replenishing the treasury.

Sylvester Laskin is general chairman in charge of all the plans for that day. Other committee heads are as follows: cabaret, Arthur Wright and Frank Hickory; convocation, Marvin Bennett and Robert Rhodes; publicity, George Pearson; and tag sales, Robert Gilruth.

Mustache-twirling is the latest wrinkle among Duluth junior college men, for the Engineers are sponsoring a hair-raising contest with two cabaret tickets as first prize. They believe that raising a mustache is one thing in which the women of the college can't compete.

The "Blueprint," the Engineers' annual publication, will be issued on Engineers' Day, and will contain all the highlights of the club's activities during the year, as well as special features, and pictures of all the members. Those who wish to obtain copies may communicate with Hasty Newton, care of Duluth Junior College. P.S. Thirty cents, please!

The fourth of a series of sunlite dances planned by the Engineers' Club, in which the leading dance orchestras of the Northwest have been featured, will be held April 28th at the college. Millard LaJoy's Royal Collegians will furnish the music.

ART AND ARCHITECTURE

By Marion Andrews, Arch. '33

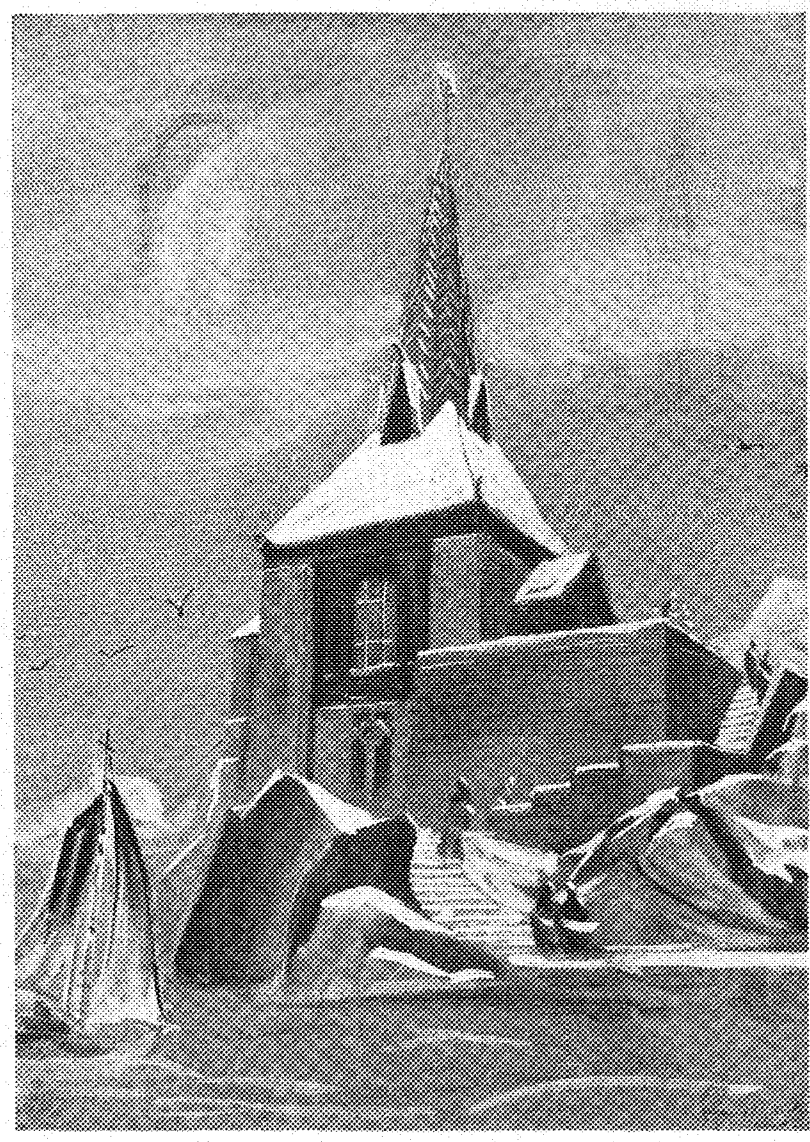
English Lithographs

SOME time ago, on the third floor of Main Engineering Building, there was shown an exhibition of Persian art, one of a group of exhibitions circulated by the American Federation of Arts, "a national organization for the cultivation of taste and the development of the arts." A second of the series of displays has since been received. It is a group of thirty mid-nineteenth century English lithographs. The artists whose work is represented are Thomas Shotter Boys, David Roberts, Joseph Nash, and Samuel Prout.

Prout is the least known of these men. His drawings are in black and white and include as subjects l'Hotel de Ville, Brussels; Belfry, Ghent; Kraen Strate, Malines; town hall, Louvain; and a scene in Cologne showing the cathedral before it was completed and portions of the old fortification walls.

The lithographs of Nash and Roberts are colored with water color. There are two ways of doing this: the color may be applied to the lithograph after printing or to the stone before the print is made. Roberts turns to Spain for his subjects while Nash portrays English interiors and exteriors with figures costumed according to the period and, occasionally, historical personages associated with the places depicted.

In contrast to Nash and Roberts, who colored their lithographs by hand, Boys printed each color by stone in the true lithographic process. In a notice accompanying one of his books he writes, "Whole of drawings comprising this volume are produced entirely by means of lithography; they are published in oil-colours, and come from the press precisely as they now appear. . . . They are pictures drawn on stone and reproduced by printing in colours; every touch is the work of the artist, and every impression the product of the press." This method is extremely difficult, and Chancellor considers Boys' works "the finest examples in this method ever produced."



A Norwegian Chapel

THE problem reproduced above is a Norwegian chapel, one of the winning designs in the last junior problem for winter quarter. It was a short time project—only two weeks—and the esquisse was given "en loge" or under supervision.

The program in part reads, "A wealthy summer resident on the North Shore of Lake Superior plans to build a chapel for a congregation of Norwegian fishermen who live in scattered settlements along the shore near his house. He wants the chapel to be interesting architecturally, to memorialize the picturesque, rugged qualities of these people as a highly individual group." The chapel, seating about eighty people, was to be on a bold rocky point adjoining a small bay and should contain nothing which was not directly connected with the church services.

The solution reproduced here was submitted by Ray Weidlich. Its good qualities lie in the sturdiness and character of the building, the feeling for surroundings, and the general atmosphere. Some criticism was made, however, of the stone construction for a Norwegian chapel and of the use of the cross.

The Cover Design

THE cover design each month has a different color scheme and corner motive, but this month they are of especial significance. The color scheme of purple, yellow, and silver is, of course, for Easter. The decorative panel, with its interest centered in the airplane, is prefatory to an article by Ross Mahachek upon his proposed trip. He plans to circle the globe by airplane, and will use a ship similar to the one in which Lindbergh crossed the Atlantic.

This panel was first drawn as a pen and ink sketch in black, with the lines which are now white showing in black.

THE PICKLED CATALYST

blurbs consolations to buddy april seventh-sters

by OSCAR QUACKENBUSH FEGAS, I. (still) O. U. '36.40

the takeoff

Well, take me for a cross-eyed hop toad if another month hasn't rolled around, and the time has come for us to cast our observations of the rather recent portion of this epoch before the eyes of our dear readers. If there are any. Boo, hoo, hoo.

With spring rolling around we notice young men's fancies are lightly turning to things—that coeds have been thinking of all winter. And who can resist an occasional day dream of perhaps a stroll along the edge of a cheery creek in a budding forest, or being perched on a grassy knoll beneath a sturdy oak (and studying tomorrow's calculus), of gondoliering down a moonlit river in a glistening canoe and strumming favorite chords on the old "uke." Oh, goo, gooooo.

Now that we've had our mush—

The congregation will now do as it pleases.

no sense

In greeting his double E class of Chemical Engineers, prof Kuhlmann remarked, "I suppose you boys had a good time on your spring inspection trip. Too bad you couldn't go after April seventh, though."

"Ho, ho," snickered Deacon Malcom Hope, "that didn't make any difference."

* * *

E. E. "The way you eat apples reminds me of a cheap transformer."

C. E. "Why so?"

E. E. "Too much core losses."

* * *

I've lived on vegetables for two weeks.

That's nothing. I've lived on earth for twenty years.

conscientious efficiency

A business student was sent to take an inventory of the property in a house. When he did not return for three hours the instructor went after him, and found him asleep in the living room. He had made a brave effort with its inventory however, for he had written down, "Living room, 1 table, 1 sideboard, 1 bottle full of whiskey."

Then the "full" had been crossed out and "half full" substituted. Finally this was overlined and "empty" put in its place. At the bottom of the page in wobbly writing was scrawled, "I revolving carpet."

* * *

Then there is the tale of the engineer's girl who thought he really loved her but found he had only a slide rule in his pocket!

the poets corner

Kipling, speaking of the HEIGHTS, of this and that, once said:

Heights by great men reached and kept
Were not attained in sudden flight.
But they while their companions slept
Kept toiling onward through the night.

Did he ever think of the modern kind of HEIGHTS? Look at—the height of:

Accuracy—dimensioned to the width of an undernourished light wave.

Boredom—the Baron and Kate Smith cast on a desert isle.

Carefulness—Moffet with a dipper full of molten iron.

Diversion—Prof McClintock playing tiddeldy winks with manhole covers.

Exasperation—Physics Quiz corrector without any red crayon.

Folly—Astronomy prof jumping off Foshay tower with lit cigar in mouth thinking he's Haley's comet.

* * *

Our informant tells us that there is an author named Love who has written texts in Math, Physics and Dynamics. Which forms the basis for this little story.

While discussing various mathematic authors, prof Tate remarked, "And then there's Love. Love has a good many problems."

Vassss you effer married, Sharley?

engineering tact

"Darling," cried Thomas passionately, "I will lay my fortune at your feet."

"Oh, but your fortune isn't so large," she whispered.

"No, but it will look larger beside those tiny feet." The wedding bells soon rang.

another question

Dear Oscar—I wish to conduct some research on candles. Before I start however, I would like to know which candles burn longer, wax or tallow candles?

Ans.—How ridiculous—they both burn shorter.

* * *

"Willie," said his mother, "I must insist that you stop shooting craps—those poor little things have just as much right to live as you have."

* * *

Didn't I see you at the artists' ball last night in a bathing suit?

Say, you must have left early!

just rambling

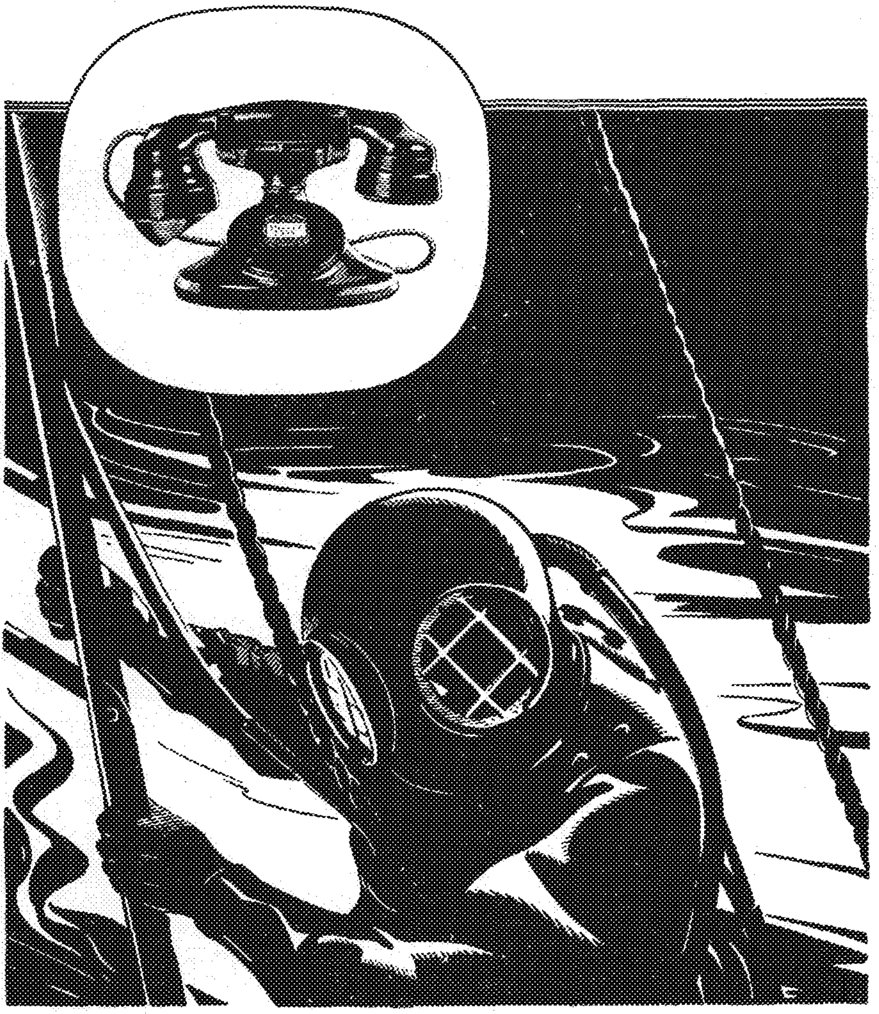
WE really don't know what Technocracy means but it sounds Engineerish and we do want to seem Engineerish. . . . Of course there is Eddie Cantor's famous unabridged definition of it. . . . You can think of us as that, unless you know what it really means. . . . And that might be worse. . . . There are persisting rumors that the Minnesota will open within the month. . . . It may have been just a proofreader's mistake, but did you notice the ad for "No Man of Her Own"? It read, "Hurray! Only four more days to see this Hit-and-Run Lover." . . . Well, it's certainly O.K. by us.

We just noticed that in the Ohio State Engineer they separate their scribblings on the Architects' page with x's: thus: x x x x

Hot-cha! We're crazy about it!

x x x x

It does take less material to fill up more space.



It takes *resourcefulness...*

Time and again, Bell System engineers have demonstrated their pioneering bent in working out unusual telephone construction problems.

For example, they laid a huge conduit under the Harlem River. They dredged a trench in the river bottom, lowered enormous sections of iron pipe, sent down divers to join the sections, encased the finished tube in concrete. Through this they ran telephone cables forming one of New York's main lines of communication. Across the Gila River in Arizona they constructed a catenary span 2373 feet long. To bridge oceans, they developed radio telephony. They have built telephone lines over mountains, across deserts, through swamps.

Their resourcefulness in getting through, over or under natural barriers makes possible telephone service that is practically world wide in reach.

BELL SYSTEM

SAY "HELLO" TO MOTHER AND DAD
...RATES ARE LOWEST AFTER 8:30 P. M.

WHICH GAS—AND WHY?

[*Continued from page 191*]

The increasing use of high-compression engines has increased the necessity for fuels of high anti-knock qualities. The motorist can determine by road tests whether a special anti-knock fuel is required to give satisfactory results in the operation of his own engine. But a knowledge of the octane number of the gasoline will often save expensive trials by experience.

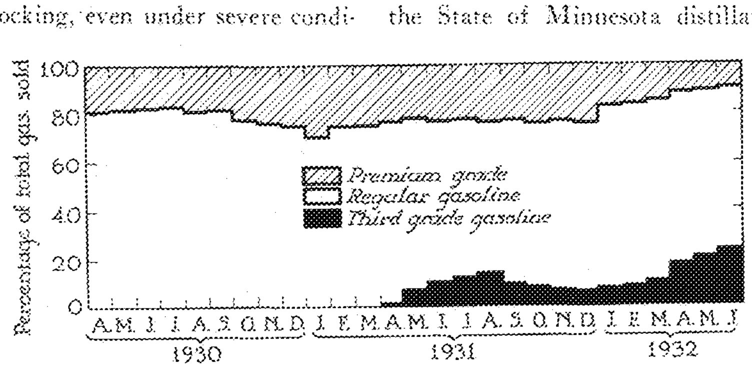
The accepted method of expressing the knock rating of a gasoline is by use of the octane number. The octane numbers of standard mixtures of normal heptane and iso-octane (2,2,4 trimethyl pentane) are numerically the percentages by volume of iso-octane they contain. The octane number of a particular fuel is equal to that of the standard mixture which it matches, when tested by an approved method.

In states in which no legislation is in force to prohibit artificial coloring of gasolines some unscrupulous companies color their gasolines both for the purpose of improving the appearance and to "cash in" on the idea that some people erroneously believe "a colored gasoline is necessarily superior fuel." The dye used as a color cannot improve the quality of the gasoline. The Ethyl gasolines, which contain "Ethyl Fluid" to improve the anti-knock quality, are colored red to indicate that they contain "Ethyl Fluid." The quality standards set by the Ethyl Gasoline Corporation are high. Prior to March 1, 1932, all gasolines sold as Ethyl gasolines were required to have an octane number of 74. Since that date the requirements have been 78 or higher.

A gasoline with an octane number of 65 to 80 should show unusual freedom from knocking, even under severe conditions of fast acceleration, hill climbing or other heavy service conditions. A gasoline with an octane number between 57 and 65 will usually give satisfaction in ordinary driving in which quick pick-up is not particularly important. Gasolines with octane numbers between 50 and 57 are usually satisfactory for low-compression motors, operating under ordinary driving conditions. For high-compression engines the use of such gasolines results in a sluggish motor and pronounced knocking under conditions of fast acceleration or heavy load. Anti-knock quality seems to be the only consistent difference noticed between many premium-price and regular-price gasolines. Consequently, the motorist may know that he pays the premium for that one characteristic for the two respective grades sold by some companies.

The State of Minnesota and the Federal Government specifications include no knock rating specifications for motor fuels. The octane number is an important specification on the gasolines sold in many localities, however, and the practice of including such a specification is steadily increasing. We have used the range of octane numbers for three grades of gasoline quoted upon the Chicago Tank Car Market for classifying the gasolines tested in this survey. Third-grade gasolines are, accordingly, classified as those having an octane number of 57 or lower; regular-price gasolines, an octane between 57 and 65; and premium-price gasolines, an octane number above 65.

For ready comparison of the gasolines tested, the data have been translated for the specifications noted above into "requirements passed" designated by the letter P and "failure to pass requirements" indicated by the letter F. The summary of the results in these terms is shown in Table I. All gasolines passed the State of Minnesota distillation requirements, and to save space the tabulation of these comparisons is omitted from the table.



This chart shows the proportion of sales of the three grades of gasoline over a period of two years. In the early spring and summer of 1932, the sale of third grade gas increased rapidly until mid-summer it had reached about 25 per cent of total gasoline sales. Consumers in increasing numbers, evidently, are finding third grade gasoline satisfactory at least in times of depression.

The advisability of applying the rigid Federal Motor Fuel V distillation requirements as given in Table II to the third-grade, or even to regular-price gasolines, is open to some question. It is known, however, from this and other studies that a large number of the better regular-price and quite a few of the better third-grade gasolines meet even this rigid specification. Other things being equal, such gasolines should be a better buy for the motorist.

Comparison of Gasolines by Type of Distributor

From original data and the "pass" and "fail" classifications as given in Table I, the averages show that the summer gasolines sold through the national and sectional chains are somewhat less volatile at low temperatures than that sold by other groups. This condition is adequately corrected, however, in the winter gasolines. In the case of the winter gasolines, the premium grade of the bulk filling stations and the third grade of the local multi-units are probably too volatile for best results. The premium-price gasolines sold through the bulk filling stations have octane numbers that are too low for that grade.

Individual variations from the group averages, on the other hand, show that the products of the national and sectional chains are more uniform than that of the other groups, particularly with respect to octane ratings, and to the starting qualities of the winter gasolines. The products of the bulk filling stations are the least uniform. It should not be overlooked, however, that a few individual samples of each grade obtained from local multi-units and from bulk filling stations were of as good a quality or higher than the samples of the same grade obtained from the national chains. Moreover, two of the three bulk filling stations sell their regular and premium grades ranging from one to two cents less per gallon than the regular filling stations. Whether the quality of their gasolines is sufficiently lower to offset their price advantage is rather doubtful. The ratings of the gasolines of the bulk filling stations were materially reduced by the relatively inferior products of one company. If bulk filling stations continue their price advantage and are conscientious about the quality of their products, definite savings can be made by the consumer in his gasoline expenditures.

Tests upon the three grades of *winter* gasolines, sold by the mail order house at prices from one to three cents lower than the correspondingly classified equivalent grades sold by other stations, showed these gasolines to have distillation ranges similar to *summer* gasolines. The octane ratings were definitely lower, also, than in the corresponding grades of other distributors.

Differences Between the Grades of Gasolines

In view of the price differences between the three grades of gasoline, the consumer is interested in knowing which of the three grades represents the best buy. Judged alone from the standpoint of their starting qualities as indicated by averages of the distillation volumes, there is little choice among the summer grades. The regular-price winter gasolines have been adjusted to give satisfactory starting performance, but some of the third-grade and premium-price fuels are likely to give trouble because they are too volatile or not volatile enough. The results of the distillation tests at higher temperatures, however, point to the superiority of the premium-price fuels in both the summer and winter gasolines, although the regular-price gasolines are only slightly their inferior.

The generally lower vapor pressures of all the premium-price fuels, except six samples, are an important and favorable quality in that grade. Vapor pressures, above ten pounds per square inch absolute at 100°F., combined with high distillation percentages at low temperatures are undesirable features of several third-grade and regular-price samples obtained from local multi-units and bulk filling stations.

Significant variations are indicated in the anti-knock qualities of the three grades. With the exceptions of two regular-price and three premium-price samples, all gasolines pass the specifications for each grade as classified (See Table I), although a minimum octane number limit should, perhaps, have been placed on the third-grade gasolines. In general, the octane numbers of most of the winter gasolines were markedly higher than the same brand of summer gasolines in the third-grade and regular-price fuels. Considerable variation between samples in the values of octane numbers was noted, however, in both the regular-price and premium-price gasolines sold by the bulk filling stations and the mail order house. The octane numbers of the premium-price gasolines sold by these two groups were, also, very noticeably less than for the premium-price gasolines sold by the national chain and local multi-unit companies.

Only one gasoline, a benzol blend, showed positive corrosion. The other sixty-eight samples are equally good in this respect.

The choice of grade of gasoline to be used by the consumer is, in the last analysis, a matter of individual preference. The same gasoline will not give identical results in all motors, and it is, therefore, impossible to make positive recommendations for any particular grade, much less a certain brand. On October 1, 1932, the Twin City retail price of third-grade gasoline was 10.9 cents per gallon, of regular-price gasoline, 15.4 cents, and of premium-price gasoline, 18.4 cents. Whenever the price of third-grade is as much as 4 or 5 cents a gallon less than that of regular-price gasoline, a mixture of third-grade and premium-price fuels with a net cost lower than that of the regular-price gasolines might be used to advantage by many consumers.

[*Please turn to page 212*]

WHICH GAS—AND WHY?

[Continued from page 211]

Experience of Users

In order to determine the experience of consumers with respect to the several commercial grades and brands of gasoline, representatives of various classes of users were interviewed. In the first place, representatives of sixteen companies operating over four hundred trucks, cabs, and buses were interviewed. The testimony of these men is somewhat conflicting. Eleven of the companies were using regular-price gasolines, five were using third-grade gasolines, and none were using premium motor fuels. This latter fact is of considerable significance to consumers in general, for it indicates that where costs and profits are determining factors the decision is against paying the higher price. Moreover, such factors as smoothness and flexibility of control must have entered into the decision at least of the cab and bus companies.

Seven of the eleven users of regular-price gasoline had tried the third grade but had gone back to the regular-price grade. The commonly expressed reasons were that the third grade gave difficulty in starting, left more carbon in the cylinders, and tended to knock. Each of these three claims of inferiority is borne out by the laboratory tests: the first test proved, as we have seen, that the third-grade gasolines have a higher average initial boiling point and smaller proportions evaporated at the low temperatures, indicating more difficult original ignition; the second proved that they have a higher average end point, indicating more carbon residue in the cylinders; and the third that they have a much lower average octane number, indicating a greater tendency to knock. The differences shown by the first two tests are so slight, however, that no change in performances is likely to be detected by consumers under the majority of driving conditions. The difference shown by the third test—greater tendency to knock—is much more apparent. The five companies that were continuing to use third-grade gasolines were satisfied with the results and were convinced that the savings in cost over the use of the next higher grade would not be offset by additional repair bills. Four of the sixteen companies had never tried the third-grade gasolines, and therefore, had no experience to report.

In the second place, the managers of several large garage companies were interviewed. In each case these companies were distributors for some make of automobile. Each one recommends to purchasers of new cars either regular-price or premium-grade gasoline. This recommendation is said to be based on the fact that many of the present high-compression engines have a strong tendency to knock with third-grade gasoline. It is believed to be good sales strategy to urge the use of high-grade gasoline in new cars so their performance will be more perfect. The officers and employees of one of these garages were interviewed, and it was found that they used the following grades of gasoline:

Grade	Number of Users
Premium grade	0
One-half premium and one-half regular	1
One-half premium and one-half third	1
Regular	9
Third grade	3

This company's demonstration cars were filled with premium-grade gasoline.

In the third place, approximately one hundred drivers were interviewed as they called at filling stations. The proportion using each grade of gasoline is given in Table II.

TABLE II

GRADES OF GASOLINE USED BY CONSUMERS INTERVIEWED

Grade	Percentage of Consumers
Premium price	7.5
Regular price	45.0
Third grade	35.0
One-half premium and one-half third	10.0
One-half premium and one-half regular	2.5

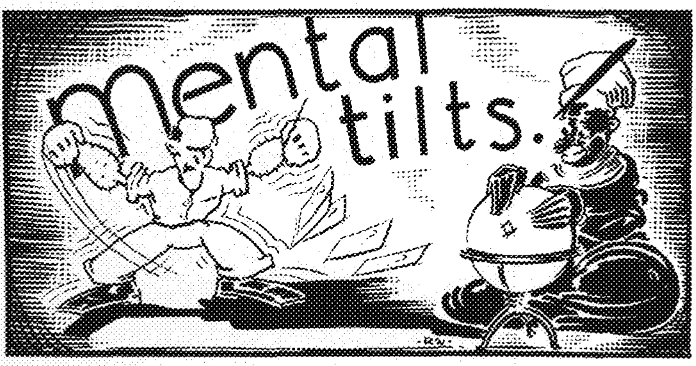
Of those consumers using either of the two higher grade gasolines, 40 per cent have never used third-grade gasolines. The objections of the remaining 60 per cent to the third grade are shown in Table III.

TABLE III

OBJECTIONS OF CONSUMERS OF HIGH-GRADE GASOLINES TO THIRD-GRADE GASOLINES

Objection	Per Cent
Too much knock	20
Too much carbon	16
Sluggish pick-up	16
Slow starting	4
Low mileage	4

Of the present users of third-grade gasolines, sixty-five per cent reported it entirely satisfactory for their purposes. Twenty per cent objected to the sluggish pick-up and 15 per cent to the tendency to knock, but they all felt that the economy offset the disadvantages.



HERE you are, fellows! A bright, new, one year's subscription to the TECHNO-LOG for a friend or for yourself after graduation (cash value $1.50) to the first one to send in correct solutions to this month's Mental Tilts. They're neither hard nor long, but each is tricky in its own way. Remember that the early bird does not always get the worm if his methods are faulty; so don't hesitate to send in solutions a day or two late. They may be the first correct ones received.

●

"OSCAR'S" DOG HOUSE

"OSCAR," our feminine engineer, has acquired a dog (combination Dachshund and Great Dane), and has borrowed a packing box from Mr. Richards to use as a dog house. The box measures 16"x32"x48". She intends to use the least dimension as the height of the walls and to build a ridge roof over it; the ridge running the length of the box. Because of the high cost of roofing, her problem has become one of finding the height of the ridge from the floor of the box that will give the greatest volume per square inch of roof. Can you solve it for her?

EXPONENTS

By what integral exponent must 989 be raised to give a number with 989 figures?

CIRCLES OF CONFUSION

If 5 inches added to the circumference of a circle increases the radius by .795 inches, by how much will the diameter of a circle whose original radius is 7 times the circumference of the first circle be increased if the same amount is added to its circumference?

it wasn't told to me - - - -

I JUST HEARD

By E. H. R.

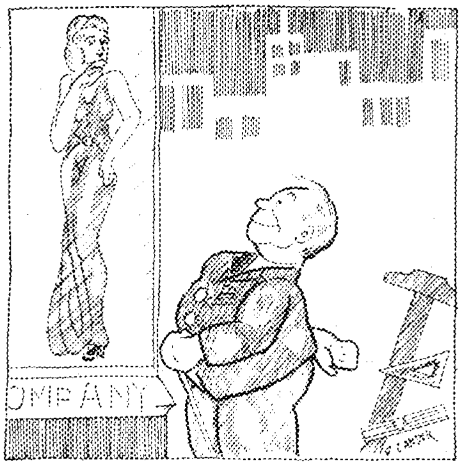
The Black Hand. What is it? Is it owned by the person whose shadow was seen in the office one morning tearing telephone books in half? If the TECHNO-LOG were a radio program, would The Black Hand become another "Beetle" of the air???

When he is losing a game of cards, what member of the business staff is prone to mutter, "Foiled by the fickle hand of fate"?

Each month a list of students who did not receive their TECHNO-LOG is made out from the list posted on the bulletin board. When the name A. Hitler, 1933, appeared on the list, what local circulation manager was sorely perplexed, knew not what to do, and generally had his hair in a braid when no such name could be found in the address book?

We'd like to have the gentleman who was watering flowers on all the tables—using a pitcher as an impromptu watering can—in the Coffee Shop of the Curtis during the Tech Frolic come forward and give us the low down. Did he really mistake a gal's open back for a lily?

Who are the engineers who collected—on a certain week-end—all the hamburger-free beer coupons they could, and almost monopolized the delivery service? Seems if a crop of "Wimpys" has been generated.



A picture without a story—that's what we have here. Or maybe this picture doesn't need a story.

For a box of good cigars, the identity will be closely guarded of a certain chemical engineer who lost a list of names labelled: "Profs I'd like to Hang." And make it snappy with those cigars, or Mr. French will be informed that his name headed the list.

Pardon the intrusion of The Black Hand again, but it is quite likely that he may be the one who hides text books of unsuspecting culprits around the office. When he finally discovered his printed instruments of wisdom, our friend Charley McDonough found the following note inside the cover of one of them: "Mac, what the h——l is your books doing in all the places, you Sap, Sir?" And has Mac been galloping around ever since in a fury fit to completely cleanse The Black Hand.

With the advent of spring, the heart-aimed darts of cupid have already found their mark, and where they have not already done so, they are well on their way.

The mysterious disappearance of Jim Stoddart's KHK pin has caused no little amount of speculative conjecture on the part of his confreres. Jim was last seen wearing the metal emblem when driving with a lovely little brunette—and that's that.

Spring. Wedding Bells. June brides. And poppa loves momma.

From whose throat comes that divine feminine voice that always asks for Louis Clemens, and then engages in a scrappy conversation? They've been engaged for some time, too, says Cupid.

If Kress Bohrer and the cute little nurse seen with him gazing into a ring filled jewelry window will set the date, we'll tell the world!

We don't claim to know anything about this, but it seems there are two electricals with the same name—Hammond. Some wise cracker has explained the difference between them as: One gets everything like nothing and the other gets nothing like everything.

Where is it that Ray Penny spends so much time collecting money for the telephone? And we learn he is not doing it to be helpful, but that he is making his spending money by betting on whether the call is for him or not.

What architectural "jury" criticized Ray Weidlick's drawing of a Norwegian Chapel for having a cross on it, and then found out the cross was put on by Prof. R. C. Jones!!

From some kind contributor we are informed of many of the low downs on the chemical engineers' recent inspection trip.

What a grand time Mr. Hoyle would have on a trip such as this. It is said that even before the bus started, the boys were dealing them out.

In the penny matching contest, why did Doc Mann finally have to drop out?

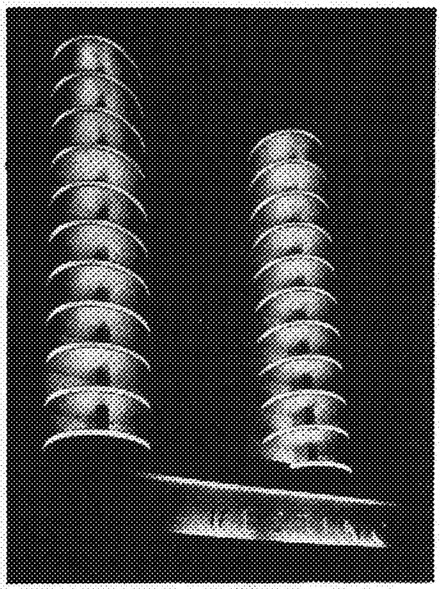
Is it really true that Al Miller and Bill Hollen threw a blanket out a fourth story hotel window?

Where is this room 603? How much did you say Doc Mann lost? And after this episode, why was it unnecessary for Linneroth to spend his own money?

And speaking of windows, who threw all the glassware in the form of bottles out the window, and then watched a man sweep up the pieces the next morning in the street?

Why did Hope object to sleeping in his own room? Or did he sleep in the hotel lobby for anther reason?

Why did Lindner and Hollen indulge in a midnight ride in a "paddy wagon?" And was it because he had sore feet that Lindner took off his shoes in the lobby before ascending the stairs??



Flood lighting on the underneath surfaces of these desks, in combination with lights at the rims, lends an impression of solidness to the illumination of these columns which will appear as a part of the Westinghouse exhibit at the Century of Progress.

In Prof. Haga's class in freshman English the red mustachioed gentleman remarked, "Now children, you must realize that there are some 250 odd Freshmen in your class. . . ."

To which the usual gallery voice answered, "Sure, and some are *very* odd."

There weren't many M. E.'s who sympathized with a certain instructor in Steam and Power Lab who was attempting to change the lab sections from Friday to Tuesday afternoon.

As if the mechanicals can help it if Good Friday and Engineers' Day are holidays!

On the second floor of the Electrical building is a large clock fitted with innumerable gadgets to guarantee correct time. Conspicuously attached to the front of the clock one will find a note culled from a popular advertisement stating in large bold type—"It's fun to be fooled, but it's more fun to know."

The "Acadia Athenaeum," the monthly publication (and a very fine one, too) of Acadia University, Wolfville, Nova Scotia, is on the complimentary mailing list of our deah ol' TECHNO-LOG. In their Exchange section of the magazine they had last month nearly a page devoted to a description of our periodical.

Said the *Acadia Athenaeum*: "As ever, THE MINNESOTA TECHNO-LOG is a scientific magazine unsurpassed on our Exchange Shelf. Tasteful illustrations and amusing cartoons add considerably to its excellence."

And to the Editors of the Wolfville publication we say, "Congratulations on your excellent taste in magazines!!"

The *Zenith City Collegian*, published by the Duluth Junior College twice monthly is another paper worthy of your attention, gentlemen. Not only do they have many interesting notes through their pages, but they are doing a bit of very constructive work in being on the TECHNO-LOG's mailing list to the tune of 35 copies per month.

The object of this large subscription in a distant college is due to the fact that many of their graduates come to the University when they graduate from the Duluth institute. And by having access to the TECHNO-LOG during the years previous to their matriculation here, they will become partly acquainted with Minnesota's University before they arrive.

And we might add, the thirty-five copies taken by the ladies and gentlemen in Duluth do not do the "credit" column of our manager's books any harm either!

And now that spring is here and a new quarter is well on its way, why not brighten up a little and forget all the woes of the last winter? Didn't we learn in analytical geometry that, after all, everything depends on the position of our coordinate system? Why not shift the coordinate axis over a trifle and get a new angle on life?

It was at the last meeting of the A. S. M. E. when Norman Carlson tried to find out if any members would volunteer cars for driving to the National Convention. The offers ranged from a "Super-sportster" to a seven passenger limousine(?) besides one M. E. who said he could furnish either a Studebaker, or a Chevy, or a Ford, or another Ford.

Soooooo, Graham, the depression must be over.

Over at the Theta Tau house one gentleman can't sleep at night on account of the shades being up. But on account of the fact that he can't reach across to the house next door and pull them down, he sits up every night to watch a fair maiden prepare for her nightly slumber.

When some of the "brothers" dropped in the other night and asked Mr. Window-sitter-upper if he had met the young lady yet, he replied quite fittingly, "No, I am just on peeking terms with her."

Surveying in Norway

[*Continued from page 197*]

to be done on foot, and any extra weight was a serious burden.

"In the second place, the country in which the work was being done was extremely rough. At times the cross sections extended as far as 60 feet to one side of the centerline and there were as many as fifteen breaks to one cross section. In several cases the drop was so great that in two meters (the length of the leveling rod) the drop would be so great that it could only be measured by dropping a string and plumb bob from the end of the rod and later measuring the string. The accompanying pictures give some idea of how steep these slopes were when it was necessary to suspend ourselves by ropes over the edges of steep cliffs.

"In this kind of country, the use of modern road building equipment was hardly practicable. When the rock could not be blasted and made to fall in the required place, it would be hauled in wheelbarrows. After a rock fill was made, it would be covered with half a meter of crushed rock, three centimeters of clay for binder, and then a layer of gravel on top. These surfacing materials were hauled in by wagons or trucks, over the part of the road already constructed."

In conclusion, Mr. Flaata adds, "My entire trip to Norway and all my experiences there have given me a world of valuable and interesting information which I could not have gained by a similar time of study. My one regret was that I did not get beyond the arctic circle, for although I was within 100 miles of it at one time, I never was able to get beyond that parallel."

Minnesota's Exhibit

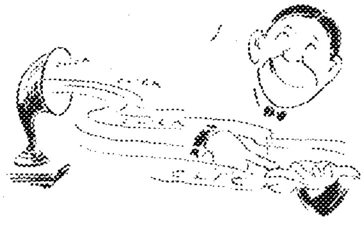
[*Continued from page 195*]

One of the immense moving canvasses develops Minnesota historically beginning with it as the voyageur found it. There are Indians and tepees by a lake. Father Hennepin is blessing St. Anthony Falls. The crude early homesteads blend into modern farming country. At the last, in the sharp foreground is a modern city, in which are recognized buildings of the Twin Cities and Duluth.

As the visitor leaves the main exhibit room he steps out-of-doors into a miniature portrayal of the headwaters of the Mississippi River in Itasca Park, prepared under the direction of Grover Conzet, state forester. Fifteen lakes are reproduced in miniature form shaped exactly as they are at the headwaters of the Mississippi. Water will bubble into them as if from springs, and it will flow out as a miniature Mississippi. Several beaver dams will be seen in the river. Sheet metal will be shaped into the bed of the lakes and concrete used around the edges to get exact contours. The sheet metal will be painted black to add depth to the appearance. The shoreline will be painted in lighter colors.

A doorway leads into a motion picture theater in which are sixty comfortable seats. The aisles are wide so that one may come in or leave without inconveniencing another spectator. The walls are painted to give the impression to the onlooker that he is in the Minnesota woods. On the screen will be shown 8,000 feet of film selected from 20,000 feet which an operator for the commission has been taking during the past year. The reels get in everything that could not be shown otherwise. In short, from the world champion cow resident at Breckenridge to the wild deer leaping away from a red hat at International Falls, the story of Minnesota is there.

G-E *Campus* News



COUNTING COSMIC RAYS

We hear a lot about cosmic rays, but know little about them. Some believe the rays are the birth cries of new matter, photons, which are like light rays. Others believe they're electrons, the death rattle of matter as it radiates itself away. But whatever the rays are, they come to us from every direction, night and day.

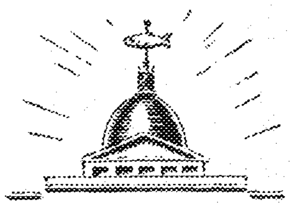
One of our engineers, Chester Rice, a '10 grad of Harvard, didn't think cosmic rays were so mysterious. He even perfected a device to count them. Imagine — counting cosmic rays! He counts them with a nickel cylinder detector that is suspended in a low-pressure tube. It's shielded by a housing of lead, 4 in. thick, to keep out the effects of radioactive material. The rays, passing into the cylinder, initiate corona discharges, which are fed into an amplifier, then through a radio loudspeaker. The rays can be heard as distinct clicks. The small cylinder has a count of eight rays per minute.

DNEPROSTROY

On October 10th last, the largest masonry dam ever built was dedicated in Russia. It's part of the tremendous Dneprostroy hydroelectric development.

There, Charles Thomson, who completed his engineering course in '13 at the South African School of Mines, Johannesburg, Transvaal, was honored by the U.S.S.R. He received the Order of the Red Banner of Labor for his skill. His had been the job of erecting all the electric apparatus. And some job it was!

As a construction engineer for General Electric, he spent 18 months in Russia. He put into operation the nine enormous 77,500-kv-a. generators, five of which were built by G.E. They're the largest water-wheel generators ever built. Incidentally, it was some achievement, considering the enormous weights, to ship the G-E generators and transformers nearly 6000 miles—and then to put them into operation successfully. Even engineering veterans were astonished.



MEET THE PHANOTRONS

Boston, proud guardian of the Beans and the Cods, has been harboring another celebrated family, lately. The name is Phanotron; present condition—that of lusty infancy; job—rectifying alternating current.

Housed in the Salem Street substation of the Edison Electric Illuminating Company in downtown Boston, this equipment is changing alternating current at 13,800 volts, 3-phase, 60 cycles, into direct current at 238 volts. Listed advantages: no moving parts, silent operation, high efficiency, economy in floor space. Six tubes, with a combined rating of 600 amperes, are employed. They are an outgrowth of the vacuum tube used in radio sets but have a current capacity 100,000 times greater.

The Phanotron rectifier, a highly desirable neighbor, comes from good old G-E stock, incubated in the Research Laboratory in Schenectady. Incidentally, Harry Steiner, a University of Kansas grad of '26, is largely responsible for its engineering and design development.

HELLO, WATERWORKS

Two pumping stations which supply the Baltimore water system have no personal attendants, but they are able to give a complete report of conditions existing at the plant when called on the telephone. If you know the telephone number (and the code in which the station elects to talk back), you have only to dial the station. The G-E audible indicating equipment in the station signals how well the pumping equipment is operating, what the water level is, the pressure, etc. It gives prompt, complete, and—if you please—courteous service. The public telephone system is used, but conventional house-to-house conversations in and around Baltimore are in no way affected. Operating officials delight in demonstrating the equipment to the uninitiated, letting them listen as the pumping station makes its report. "Amazing!" is the now familiar remark.

Arthur Johnston, a '25 grad of Oregon State College, is largely responsible for this development. He also did much to develop telemetering and the electric scoreboard.

GENERAL ELECTRIC

Minnesota

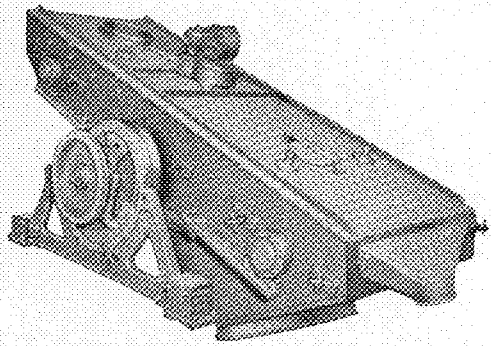
Member Engineering College Magazines Associated.

MAY, 1933
Vol. XIII No. 8

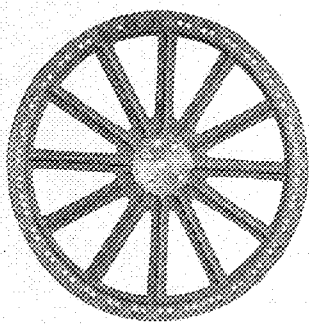
NGINEERS' DAY NUMBER

DOWMETAL-

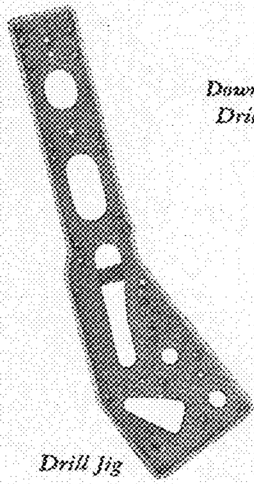
now serving many INDUSTRIES



Vibrating Sifter

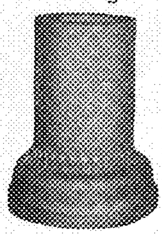


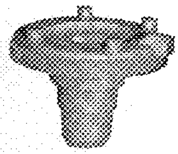
Dowmetal Drill Jig



Drill Jig

Tail Wheel Casting





Dowmetal Tail Wheel Part

MANY mechanisms, formerly awkward and inefficient, have been made flexible and easy to handle by replacing heavy metal parts with the world's lightest structural metal, Dowmetal. High speed rotors and reciprocating parts now move faster and with less vibration, thus increasing life of machinery.

Diversified equipment in many industries has been relieved of burdensome weight by redesigning in Dowmetal. Portability, flexibility and speed have reached new heights in products made of Dowmetal. Dead weight is cut down in favor of pay load when Dowmetal becomes part of a transportation unit.

Light weight combines with strength to make Dowmetal valuable in redesigning to meet modern conditions. Dowmetal, easiest of all metals to machine, can be sand or die cast, rolled, extruded, forged, welded and fabricated by processes common in industry. It is strong, durable, light, and above all, adaptable to a myriad of uses.

Discuss your production problems with us. Write for the Dowmetal Data Book.

DOWMETAL

MAGNESIUM Lbs ALLOYS

· DOWMETAL DIVISION · THE DOW CHEMICAL COMPANY · MIDLAND · MICHIGAN ·

MAY, 1933
VOLUME XIII, NUMBER 8

Minnesota Techno-Log

37 ELECTRICAL BUILDING · · · U of M

Published monthly from October to June inclusive, by the students of the College of Engineering and Architecture, the School of Chemistry of the University of Minnesota

Laddy Markus, Managing Editor
Thomas Rogers, Business Manager

THIS MONTH

THE EDITOR SAYS

Did you find the error in the April issue? No? Nobody else did either, so here it is—in the SURVEYING NORWAY story, a young man is holding up a stadia rod. Of course the numerals on this type of stadia rod are upside down, but look closely, and you'll see that they are reversed, too. And that's what happens when the editor reverses negatives without thinking of consequences.

This month we must express our appreciation of the fine work done by our secretaries during the year. To Margaret Hartley (Peggy), many thanks for your cheerful willingness to spend your afternoons typing away in the office, to take our halting, labored dictation, to keep our files straight. And to Astred Anderson, B '33, many thanks for the hours you spent in installing our fine new filing system, and taking dictation. You know, it is rather a grand feeling to be able to sit importantly at your desk, with your faithful secretary close at hand, and proudly dictate l e t t e r s while the staff members come in and out of the office.

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Entered as second-class matter April 9, 1925, at the post office at Minneapolis, Minnesota, under the Act of March 3, 1879. Office, 37 Electrical Building, University of Minnesota. Telephone, Dinsmore 2760. Contents copyrighted and permission must be secured for re-publication. Subscription rate, $1.50 a year. Single copies, 25 cents. Advertising rates upon application. Alumni Directory, 50 cents.

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His Majesty
SAINT PATRICK

■ HELEN McBROOM
Her Majesty
THE QUEEN

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THE PROGRAM

9:30 OPEN HOUSE
All shops and laboratories in the engineering building are open to the public. Prizes and souvenirs will be given only to those who register at the desk in Main Engineering.

11:00 THE PARADE
The parade forms at the experimental building, going past the experimental buildings, down to University, west along University to 10th, north on 10th street to 5th, then east on 5th to 15th, and back to the Knoll.

12:30 KNIGHTING CEREMONY
All good engineers will be at the knoll to see St. Pat bestow his blessings upon the seniors.

2:30 GREEN TEA AND DANSANT
Brawl tickets will admit students to the dansant in the engineering auditorium—a small admission fee will be charged to others. Tea will be served in the architectural library on the third floor of Main Engineering. Art Swaline's nine-piece band will supply the music for the afternoon.

9:30 THE BRAWL
Art Swaline's band will provide music for the big event of the day in the Minnesota Union ballroom. Admission will be $1.00 per couple.

Tea and Dansant
Eng. Auditorium
3 to 5 P. M.

A Bit of Blarney

Engineers' Brawl
Minnesota Union
9:30 on—

Minneapolis, Minn., Friday, May 19

Irish Forbid Kissing of Blarney Stone

St. Pat Reinstated at Wisconsin

Madison, Wis., May 19.—After four years of inactivity, the University of Wisconsin Engineers restored St. Pat and Engineers' Day to their repertoire of activities. The revival of the old tradition was as interesting as it was unique; it may be traced directly to the "Wisconsin Engineer," the guardian of engineering traditions, as pointed out in an article by R. H. Paddock in the April issue of this publication.

Shortly after the appearance of the March issue with a full page cartoon of St. Pat driving snakes out of the law school, the magazine was posted on the law school bulletin board. According to the Wisconsin Engineer "the reaction and handiwork of the law school was no less pointed or delayed." Engineers on the way to classes on St. Patrick's day were greeted by a life size sketch on the sidewalk in front of the engineering building of one of Chic Sales' Specialties labelled "An Engineering Product" and for the final touch of realism sheets and rolls of green toilet paper were draped over nearby trees. The engineers retaliated the next morning with a closet bowl suspended from a tree in front of the law building with these signs "This Ought to Hold the Lawyers" and "These Un-Canny Lawyers."

And not satisfied with this the engineers padlocked the law school the next Monday morning. A huge steel chain held the front doors shut and on the doors was affixed this sign, done up in a legal manner, informing all of the official padlocking.

"KNOW ALL MIN BY THESE PRISINTS THAT—

Whereas: The shyster inmates of this here asylum have conducted themselves in a verra stinking manner,

Whereas: The aforesaid inmates have dared to molest and attempted to degrade my faithful followers, the Engineers, the time for decisive action on my part has therefore become imperative. Now, therefore, I, Saint Patrick, do hereby padlock this asylum for an indefinite period."

The lawyers had to use the basement door until nine o'clock that morning before the chain could be filed in two.

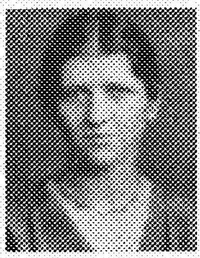
After this victory the engineers immediately started plans for the resumption of St. Pat's Parade at a mass meeting Wednesday evening. As a notice to the lawyers that the engineers meant business, they managed to turn off the heat to the law building and posted challenges on the law school bulletin boards for a snowball fight at 10 o'clock the next morning. The engineers advanced on the law building at the stated time but were promptly met by a stream of water and then were suddenly beset from the rear of the building with a case of eggs. When the melee was over it found the engineers still holding their ground, with evidence of the battle in the form of over-ripe eggs unmistakably present.

It is a matter of record that the parade itself was one of the largest and most successful in history. The all-engineering float with its jibes at the law school, depicting a shyster machine and an old man "Fishing for Lawyers" in a privey won the grand prize—a 32 gallon barrel of 3.2 beer to be delivered after April 7.

Present Activities of Past Queens

Recent Wedding of Cheffe Marx and Gordon Bodien Announced

It was news indeed when word leaked out that Cheffe Marx, Int. Arch. '32, and Gordon Bodien, C.E. '32, were married. Cheffe, as you remember, was our beloved queen last year. She was an Alpha Alpha Gamma and member of the Architectural Society, Interprofessional Board, and Students' Faculty Contact committee. When we heard from her sometime ago she was teaching kindergarten in her home town, Kenosha, Wisconsin.



The wedding was an event of Saturday, May 6, in Minneapolis, and must have been a very quiet affair, for none of the Alpha Alpha Gammas or Zeta Psi brothers seem to know much about it. Gordon is now working for the State Highway Department. It is rumored the couple will live in Preston, Minnesota, this summer.

And now you ask, "What are the other St. Pat Queens doing?" Well, here's the answer. Beatrice Johnson, who was queen two years ago, worked as hostess in the New England's model home for some time, and now she is in the drapery department there. Helen Thian, her predecessor, is with the Northern States Power Company in St. Paul and designed most of the lighting for the model homes just built in the Golden Rule, St. Paul. Margaret Bradbury, St. Pat's choice in 1929, did illustrating for a time for Wm. A. French. Since then she has been doing sketching work at Harrison and Smith Company in Minneapolis.

Well, Queenie, what will you be doing a year from now?

Special Dispensation Offered to Minnesota Engineers

County Cork, Ireland, May 19.—Today loyal engineers will be given the rare privilege of kissing the Blarney Stone, and rare indeed is this privilege, for early this year the Irish authorities issued an edict decreeing that no one from now on shall be permitted to kiss the Blarney Stone because of a recent tragic attempt to do so.

For centuries those who wished to become gifted oratorically made use of an aperture in the wall at the top of Blarney Castle tower and, with a couple of trusted friends hanging on to their legs, just in case — —, bent down to kiss the Stone.

It happened that James Burke of County Cork desired to kiss the famous stone, but dispensed with the customary leg holding measures. Exit James Burke, and it wasn't very long after that the government edict was published forbidding the kissing of the Blarney Stone.

Engineers Celebrate with Brawl at Union

Price Winners of the Day to Be Announced

Tonight engineers will dance and away to the dreamy melodies of Art Swaline and his nine merrymakers at the Engineers' Brawl, an annual event which climaxes fittingly the reign of St. Pat. Reynold Caleen, chairman of the Brawl and Dansant committee, announces that special surprise entertainment will feature the evening's program.

Prize winners in the ticket and button sales competitions, as well as the winning floats in the St. Pat's day parade, will be announced during intermission at the Brawl, according to Bill Rindsland, chairman of Engineers' Day.

Holders of Brawl tickets will be admitted to the Dansant which will be held from 3 to 5 in the afternoon in the engineering auditorium; others will be charged a small admission fee to the afternoon dance.

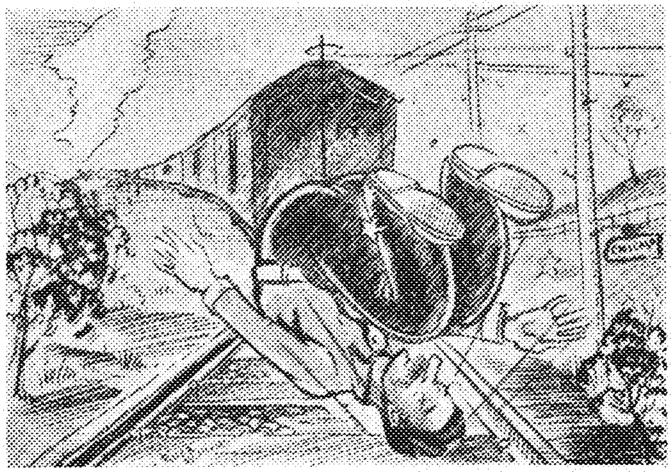
Engineers Choose May 19 for St. Patrick's Day

March Winds and Storms Necessitate Later Date

Engineers' Day was celebrated in March a few years back, on that historic 17th day when, according to tradition, a gallant knight of Erin drove all the snakes from Ireland and thereby invented the first worm drive. The lack of co-operation on the part of the weather bureau has, however, led to the transferring of this much heralded event to the third week in May.

While the Moon Goes Over the Campus

By RODERICK W. SILER
Assistant Professor of Mathematics



Freight trains do not, as a rule, make it a practice to stop for passengers thinking of disembarking.

ALMOST everyone connected with a college or university is interested in solving a certain problem these days. Students sit up nights thinking of it; profs are having headaches over it. One thing that makes this problem so difficult is that there is hardly a book to be found in a library dealing with it. Probably there have been men of genius in the past who have found a solution, but unfortunately they have left no record of their work. The sad part of the situation is that a solution can hardly be accomplished before October 1, 1933. The problem will require July, August and September for solution. But, it will be worth the time expended, because unless someone does find a solution and give it to the world before Christmas, next spring will see the same unsatisfactory situation existing as today: students distracted from their studies and profs from their duties by an overwhelming interest in the problem. Of course you know what the problem is. It is—how to live during the summer on nothing.

I was in Chicago a couple of weeks ago, and among other things saw the Chicago World's Fair buildings as they stand today. The Fair will be well worth seeing. I hardly know, if you are busy with the problem of getting by the summer on nothing, how you will get into the Fair grounds, unless possibly you swim in from Lake Michigan, landing on the water front which, as far as I could observe, had no fence along it.

The getting to Chicago will not be difficult, as there are freight trains going that way all summer. When I was in college we, in traveling hither and thither, sometimes went by freight, and I want to tell you that outside of dust, smoke, cinders, brakemen, the heat and smell of boxcars on hot days and their chilliness at night, there is no more delightful mode of transportation. You will find it comparatively easy to get on freight trains but not so easy to get off. Freight trains do not, as a rule, make it a practice to stop for passengers thinking of disembarking. You will find, after some experience, that the best way to leave a moving freight is, as might be expected, the simplest. When you have spotted your town, crossroads or farmhouse just fall off there, trying to strike on the most reliable part of your anatomy. Many travelers like to hit on their backs, but a friend of mine, a man always very considerate of his clothes,

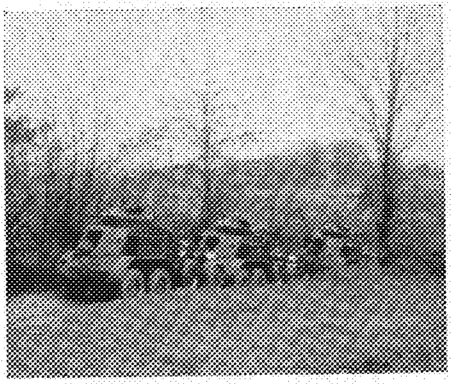
> ***This month the moon makes her last trip across the campus for this season, and at this time ye editor cannot refrain from remarking that much of the moon's journey has been via train. Perhaps the railroads are passing out; perhaps they are not, but at any rate railroad stories and railroad history ARE interesting.***

preferred to dive off with his hat in his hand, hoping to land on his head. Yes, if you are a college man and going to the Fair, you will find that no part of your trip offers greater educational value than such a journey as I have recommended. Travel by rail.

By the way, they have at the Chicago Fair now, and will have all summer, the ship in which Byrd was carried on his expedition to the South Pole. This will be interesting to everyone. Byrd's object was partly scientific, and the story of the trip should interest engineers for that reason. Perhaps the most absorbing story that has ever been told of a scientific expedition is that concerning the voyage commanded by a Frenchman, the Compte Jean Francois-Galaup de la Perouse. La Perouse sailed from Brest, France, in the summer of 1785 with two ships on a voyage around the world, to discover new lands and gain scientific knowledge. The expedition finally reached Australia in January, 1788, having visited on the way South America, Alaska, California, Hawaii, China, the Philippines, the Siberian coast, Japan, and the South Sea Islands. La Perouse and his two ships then left Australia. They were never again seen by any white man.

The French government offered a reward for proof of the fate of the expedition. For forty years not a bit of evidence was obtained. Then in 1826 Peter Dillon, an Irish captain of a trading schooner, noticed a half naked Lascar who boarded his ship at a little island in the South Seas. This man wore on a string about his neck as an ornament a silver sword guard on which were engraved the letters J F G P. The initials of la Perouse. Dillon knew of the reward, still standing, for proof of the fate of la Perouse, and suspected he had here a chance of gaining it. He sailed for India, obtained a ship and returned to Vanikuro, the island east of New Guinea where the Lascar had obtained the sword guard.

Dillon began his search. Lying submerged on a reef he found some cannon from the two French ships, a ship's bell, and other articles. This with some stories of old natives of two great strange ships wrecked on the reef in a hurricane many years before assured Dillon he had learned the fate of the expedition. He later went to France with his proofs, was presented to Charles X, then the French king, and was given a life pension and made a chevalier of the Legion of Honor. There is a monument at Vanikuro now, erected by the French government. Probably among all the dramatic stories of the sea there is none more dramatic than this one of the Compte de la Perouse and Captain Peter Dillon.



Four-wheel-drive armored cars halted in a position to observe and cover a highway which can be seen in the middle distance. These cars carry three-eighths inch armor, two .30 caliber and one .50 caliber machine guns, one .45 caliber submachine gun, and four men. Each is powered with a Cunningham V-8 engine.

IRON HORSES IN THE ARMY

By ROBERT W. GROW, C. '16

Major, 1st Cavalry Mechanized, Fort Knox, Kentucky

THE present 1st Cavalry (Mechanized) is the outcome of several earlier experiments with mechanization. During the summer of 1928 there was assembled at Fort George G. Meade, Maryland, a force of all arms as an experimental mechanical force. This force was disbanded at the end of four months. In 1930 there was assembled at Fort Eustis, Virginia, a second force of all arms, designated as the Mechanized Force. With the tactical and engineering lessons of the 1928 force as a guide, this later organization was more modernly equipped, had smaller supply units, no heavy trucks, and no Infantry units other than a machine gun company. In the fall of 1931 the War Department decided to alter their plans for mechanization. Instead of a force of all arms, wholly mechanized, it was decided to place mechanization in the hands of the Cavalry, that military branch being best able to capitalize the speed, fire-power, protection and shock-power of light, fast, motor vehicles.

A Detachment for Mechanized Cavalry Regiment was formed and moved to Fort Knox, Kentucky, for permanent station. This move of 722 miles was made in four days, the column consisting of 356 officers and men with nearly 200 vehicles of all types and sizes. In July, 1932, the designation of the Detachment was changed to Detachment, 1st Cavalry (Mechanized), it having been decided to mechanize that regiment as soon as it could be moved to Fort Knox from Marfa, Texas. This move was effected in December, 1932—January, 1933, by the Detachment going from Fort Knox to Marfa and transporting the personnel of the 1st Cavalry back to Fort Knox in trucks. The round trip of 3,250 miles was made in exactly one month, including two days lay-over at Marfa and two days lay-over each way enroute. This trip demonstrated the remarkable mobility of a mechanized unit.

The 1st Cavalry (Mechanized) as now organized consists of a Regimental Headquarters and Band, a Headquarters Troop, a Machine Gun Troop, a Covering Squadron of one Armored Car Troop and one Scout Troop, and a Combat Car Squadron, consisting of two Combat Car Troops. The Headquarters Troop is composed of a Staff Platoon which furnishes the clerks and office personnel for the regimental headquarters, a Transportation Platoon which is equipped with the necessary personnel and vehicles to transport one day's supplies of all kinds, including ammunition, for the regiment, a Communications Platoon which furnishes the radio operators and motorcycle messengers for the regiment, and a Maintenance Platoon which is equipped with a machine shop truck, wrecker, and spare parts trucks.

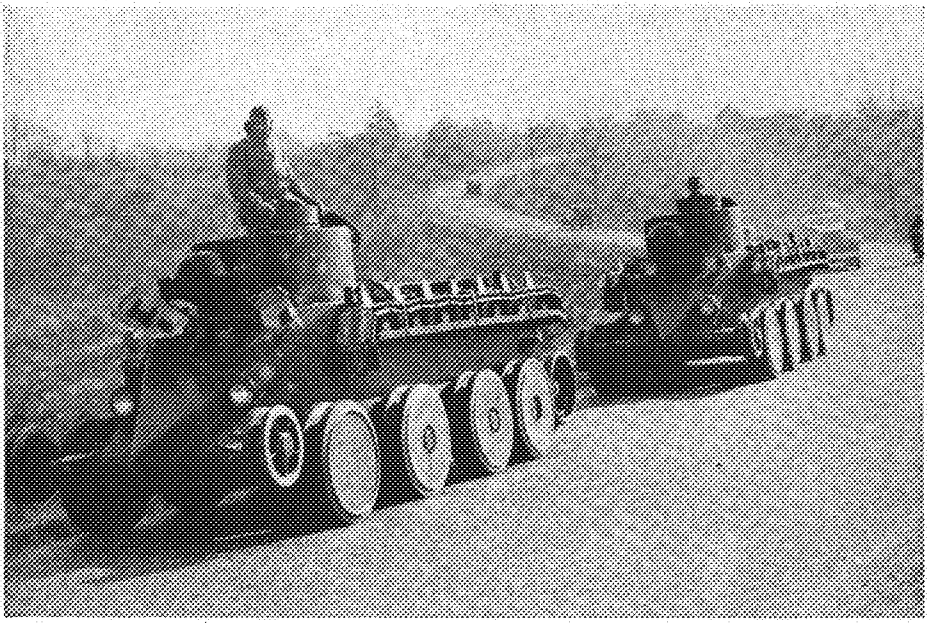
MACHINE Gun Troop, armed with .30 caliber air-cooled guns, is divided into three platoons of eight machine guns and a squad of riflemen each. The troop is transported in what are known as personnel carriers, a track-and-wheel vehicle with armored body, the gun being normally dismounted to fire, but capable of being fired from the vehicle in an emergency. The present vehicular equipment of this troop is substitutive, it being mounted on Chevrolet trucks.

The armored car Troop of the Covering Squadron is divided into four platoons of four cars each. The present armored car is an Ordnance product powered with a Cunningham V-8 motor. It has six wheels and drives on the rear four, weighs about five tons and carries a squad of four. These cars are armed

Christie combat car on tracks. Thus equipped, this vehicle has a speed of about 45 miles per hour, and can travel over the roughest terrain. The change from solid rubber tires shown above to the tracks shown in this picture can be accomplished in 20 minutes.

with .30 caliber and .50 caliber air-cooled machine guns on a dual mount in the turret. There is another .30 caliber gun for anti-aircraft work. The car squads are armed with pistols, and in each car there is a Thompson sub-machine gun, caliber .45, that can be used for close defense or in case the squad dismounts. The other troop of this squadron, the Scout Troop, is organized into two combat car platoons of three cars each and a machine gun platoon of eight guns. All of the vehicles of this troop are at present substitutive. The combat car platoons have obsolescent armored cars and the machine gun platoon uses Chevrolet trucks.

The Combat Car Squadron is organized into two troops of three platoons each. Each platoon has five combat cars, (one command car, three fighting cars, and a self-propelled 1.85″ semi-automatic gun). All of these cars are on the same chassis, but their equipment differs slightly. The fighting cars carry two .30 caliber and one .50 caliber air-cooled machine guns each. The command cars are armed in the same way and are also equipped with a voice radio and facilities for visual signalling. The self-propelled gun is a 1.85″ semi-automatic gun on a combat car chassis. Combat cars are the backbone of the fighting power of the regiment. They are track-and-wheel vehicles capable of making 70 to 75 miles per hour on wheels and 45 miles per hour across country on tracks. The change from wheels to tracks or the reverse can be made, with present equipment, in about twenty minutes.



A Christie combat car on wheels. Over hard surfaced roads these cars are capable of traveling at a speed of 75 miles per hour. They are the chief offensive weapon of the mechanized cavalry.

An Explanation

A mechanized unit is one in which specially designed vehicles are used as the means of carrying on combat. The vehicle is a fighting machine, armed and armored. It closes with the enemy, smothers him with fire, crushes him with its weight.

A motorized unit is one in which fighting personnel are transported to the scene of combat in cargo vehicle from which they then dismount to engage the enemy. Tractor-drawn artillery is an example of motorization, while self-propelled artillery (that in which the gun-carriage is self-propelled) is an example of mechanized artillery.

Mechanized cavalry is a unit composed of fighting vehicles which operate in much the same manner as cavalry has operated for centuries, but due to the greater speed, protection and armament of the vehicle, it is capable of extending the sphere of action of cavalry beyond that heretofore contemplated. It employs mechanization as defined above in its fighting vehicles, and motorization in its supply vehicles. Mechanized cavalry differs from infantry tanks in that the former is organized and equipped for cavalry missions either independent or in co-operation with other troops. Its vehicles are faster; they are built for quick, decisive, offensive action, and not to form the spearhead of an infantry attack in position warfare.

THE present combat car, known as the Christie, and of which the regiment now has four, is the invention of Mr. J. W. Christie of New Jersey, and is sometimes referred to as a tank. It is constructed of half-inch armor plate, weighs about eleven tons, is powered with a 330 horsepower, airplane type engine, and has a fuel carrying capacity permitting about four hours running. The engine and transmission take up the rear two-thirds of the car, the forward third being the compartment for the squad of three men, driver, gunner and car commander. The wheel suspension is the outstanding feature of the Christie. Each wheel is separately sprung, a heavy vertical spring acting upon the center of a floating arm, pivoted at one end to the frame of the vehicles and carrying on the other end the wheel. The car maintains an almost true level position in passing over quite large obstacles and does not careen as did the old tank. The track differs from conventional tractor type of track in that the track shoes are flat, square pieces of steel, alternate shoe being provided with a heavy tongue welded into the center of the base. This tongue guides the track as it passes between the double, solid-tired wheels, in addition to transmitting power to propel the vehicle, as it is driven by a heavy sprocket at the rear. The weight of the track is much less than any yet developed. Steering on wheels is by an automobile-type wheel, which guides the front wheels. On tracks the conventional steering clutches and band brakes are used. Since there is no differential, there is some slipping on turns when on wheels, but this is offset by using the steering clutch to assist the turning.

All command cars, regimental, squadron, troop and platoon, are equipped with radios capable of transmitting and receiving over comparatively great distances, either by voice or telegraph. These sets are very compact and light and use the vehicle battery as a source of power, and a small, steel, fish rod of ordinary commercial type for antennae. As an additional means of communication, each squadron, troop, and platoon headquarters has a messenger mounted on a solo motorcycle. There are also four motorcycle messengers at the Regimental Message Center, a total of twenty-eight in all.

IN addition to the cargo vehicles in the Transportation Platoon of Headquarters Troop, each troop has a kitchen truck, a water truck, and a light repair truck. Kitchen trucks are all equipped with gasoline-burning stoves and all cooking facilities so that meals may readily be prepared while troops are on the march. The cargo vehicles are of

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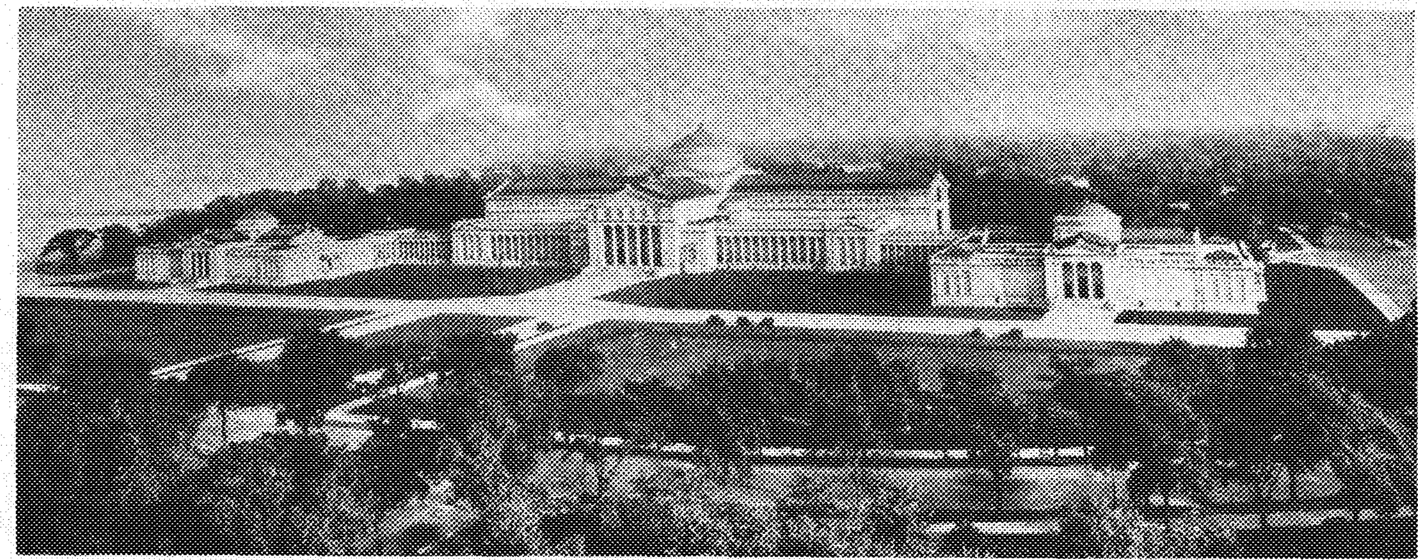


Bird's eye view of the buildings which will house the Museum of Science and Industry.

SCIENCE SPEAKS

In Unique Industrial Museum

(Photographs Courtesy Museum of Science and Industry)

By ERNEST J. TEBERG, E. E. '16

Curator, Railroad Transportation, Museum of Science and Industry

CONSTRUCTION is now nearing completion on the first section of the Museum of Science and Industry which, when opened to the public will establish a new method in this country for the dissemination of science and engineering information by popular methods. Natural history museums are well known, but institutions with the underlying purpose of educating large groups of visitors by means of operating machines—originals, replicas, and models—and charts and motion pictures are quite unusual.

According to present expectations the Museum will be completed in 1935. The exterior of the building is already finished and work is now under way on the first section of the interior. Sixty thousand square feet of exhibit space will be open to the public in June of this year. Exhibits of different industries, including operating model locomotives, demonstration of cutting steel under water with the electric arc, as is done in marine salvage, a paper-making machine, a number of metallurgical exhibits, including arc welding, and a full sized 2500 ton-per-day operating coal mine will be among this first group.

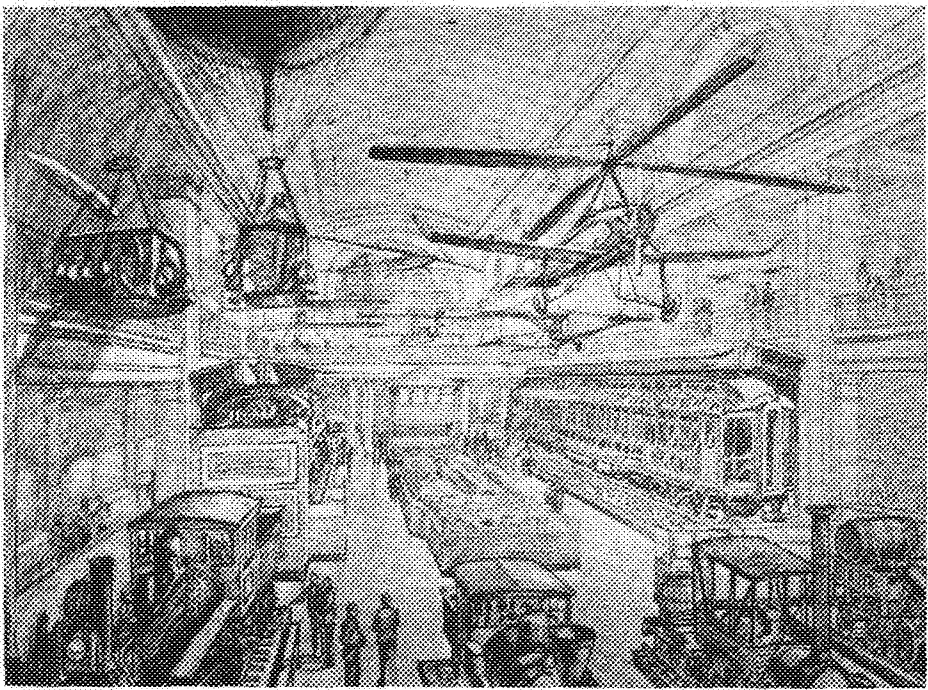
This operating coal mine alone will take up 40,000 square feet of space and will be the 1933 feature exhibit. On entering the coal mine space from the main rotunda, the visitor will see an end type headframe reaching up 65 feet from the floor, in front of which is an 11-foot electric hoist with cables operating in balance at 600 feet per minute. Surrounding the hoist and headframe will be other coal exhibits pertaining to geology, mine safety and rescue apparatus, historical mining machinery, and a colonnade of American coals.

The visitor will see the skip bring up coal from the mine. Alongside the skip, and in balance with it, is the cage in which the visitor will be lowered into the mine. The sensations received while in the cage will give the visitor the impression of having been lowered over 500 feet into the mine when the bottom of the shaft is reached. On leaving the cage, a full-sized rotary dump is seen unloading and weighing a trip from the workings at the rate of two two-ton cars of coal per minute. The coal can be heard dropping into the hopper leading to the skip.

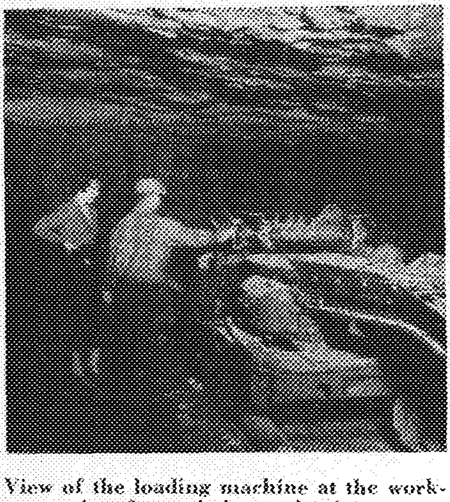
The visitor next sees the mine pumps at work drawing the water out of the mine, and thereby learning that several tons of water may have to be removed for every ton of coal taken out. Ascending a flight of stairs, the visitor now comes to a loading point on the main haulage way, leading to the workings. A train made up of two specially built mine cars and electric locomotive is boarded and the trip to the working face is commenced. Along the way different kinds of mining and mining equipment will be viewed from the train. The sensation of having traveled a mile or more at from seven to ten miles per hour will have been experienced when finally the train stops and the passenger detrains at the mine face.

Here will be seen men with machines preparing the coal for blasting. Passing through a cross-cut, a modern mechanical loader is seen completing the loading of coal, recently shot into a car. The coal and geology here is an exact copy of the number six coal seam at Mt. Olive, Illinois. Casts were made from the coal face of that mine and transferred to the Museum. From here the visitor passes up through other exhibits exemplifying other types of coal mining, finally returning to the main floor. Although less than an hour will have elapsed from the time of entering the cage, the visitor will have seen a greater variety of geological formations and inspected more modern mining machinery than would be possible in the average operating coal mine. The same principles will be adhered to in every section of the Museum as it is developed.

The Museum is housed in the reconstructed Fine Arts Building of the Chicago World's Fair of 1893. After the 1893 Exposition, this building was occupied by the Field Museum, but when that institution moved into its permanent home in 1920 the building deteriorated rapidly, due to its temporary construction of stucco, wood, and plaster exterior. The building, designed by Charles Atwood, had long since established itself as an architectural masterpiece, and public opinion guided by prominent citizens and civic organizations, including architectural groups, was aroused. In 1924 definite action was taken to restore the building in permanent construction and $5,000,000 was voted for the purpose. The reconstruction included the replacing of footings under 10,000 lineal feet of the old brick walls, the only part of the original building that was salvaged. All stucco was removed from the walls; wood, iron trusses and columns, all of temporary construction, were replaced by heavier materials. After a variety of marbles, granites, limestones, and terra cotta had been considered for the exterior walls, Indiana limestone was finally decided upon. The stone contract involved approximately 350,000 cubic feet weighing 28,000 tons and included 140 exterior free-standing Ionic columns, 135 built-in columns, and several miles of carved moldings as well as a large number of carved decorative pieces, twenty figures of which are twelve feet tall weighing five tons each.



An artist's conception of the Hall of Transportation of the Museum of Science and Industry as it will appear when finally completed. *Provision has been made to suspend aircraft from the ceiling of the room.*



View of the loading machine at the working face of the coal mine

In the old building the greater part of the roof area was covered with skylights which, due to high maintenance cost and greater satisfaction from electric light, were replaced with solid roofing materials which required heavier supporting construction. More than 200,000 pounds of copper were used in this part of the building, much of which went into the ridge crestings and other ornamental work.

The building is made up of three pavilions, all connected. The East and West Pavilions each have two stories while the main or central pavilion, the largest, has in addition balconies on the third and fourth floors in the east, west, north, and south courts. The central dome area of the main pavilion is open over the first floor to the dome trusses, a height of over 125 feet. Floor loading throughout provides for heavy industrial exhibits. The central dome floor area has a capacity of 400 pounds per square foot, while other first floor areas can accommodate loads up to 250 pounds per square foot. Of the 600,000 square feet of floor space, 450,000 is assigned to exhibits and the balance will be used for store-rooms, shops, and special services, such as cafeterias, lunchrooms, space for heating, ventilating and electrical equipment. A fifteen ton freight elevator will connect the different floors with the receiving room, which is accessible from the outside by a truck ramp.

Shortly after interest was aroused to save the building, attention was directed toward using the structure to house the proposed industrial museum, which was then in the initial planning stage. When it was finally decided to restore the building, Julius Rosenwald came forward with an offer of $3,000,000 to plan and develop the Museum, providing the building would be turned over to the institution when completed. When final bids on the work, which included changes in steel, concrete and supports to provide for the increased floor loadings, were received, it was found that the original bond issue of $5,000,000 was insufficient, whereupon Mr. Rosenwald agreed to pay whatever deficit might remain after its exenditure. Reconstruction commenced in the fall of 1929 and the exterior of the building was completed in the early part of 1932.

In 1926 the Museum of Science and Industry was organized and a board of trustees selected from the country's leading industrialists. After two years' preliminary study, a director was appointed and the organization staff developed. Since that time progress has been made in the immense task set by the founders who outlined the aims which will make the Museum of Science and Industry outstanding. Studies and research pertaining to scientific and engineering his-

[Please turn to page 247]

RESEARCHES AT MINNESOTA

Articles Selected and Edited

By RALPH FREDRICKSON, Ch. E. '35

We present the second installment of "Researches at Minnesota," hoping that as a result of these articles our readers will have gained a better understanding of the research work being done at Minnesota. The summary has by no means been exhaustive, and represents only a cross-section of the current research projects.

Had it not been for the fine response given our efforts by the departmental heads and research workers, an article of this nature would have been impossible. We take this opportunity therefore to express our appreciation for their co-operation.

Chemistry

Polymerization of Acetylene

When acetylene is subjected at room temperature to the complete radiation of a quartz mercury arc, it is polymerized to a yellow chemically-inert solid, called cuprene. The effect of maintaining the acetylene at temperatures between 250° C to 400° C, while it is irradiated, is being investigated. Preliminary experiments show that at the elevated temperatures, the speed of the photochemical reaction is greatly increased and that in addition to an inert yellow solid, a variety of liquid products are formed. Benzene has been identified as one of these products. Future work should include the identification of other products, the study of the reaction at temperatures between 250° and room temperature; and particularly, the determination of the lowest temperature at which benzene is formed. This work is being conducted with the cooperation of Mr. C. H. Shiflett.

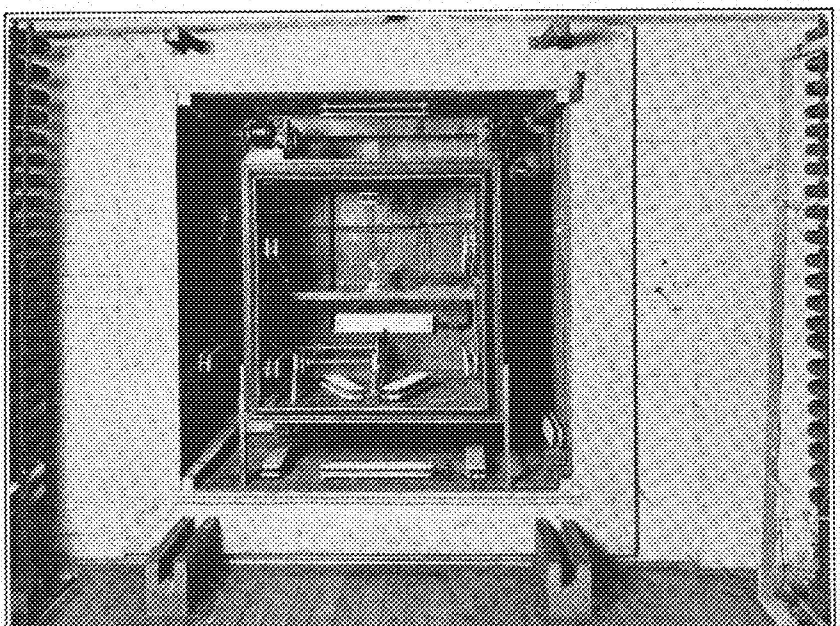
Analytical Chemistry

Mr. Noponen is studying the adsorbent properties of barium sulfate and the mixed crystal formation between barium and lead sulfate.

The experimental part of Dr. E. B. Sandell's thesis proves that the coprecipitation phenomena observed with calcium oxalate can be interpreted on the basis of the theory. In connection with the main problem, Dr. Rosenblum is studying the specific surface of ionic precipitates by applying radio active substances. Moreover, he is going to study the structural changes taking place in freshly prepared lead sulfate.

Mr. von Fischer studies the adsorption of wool violet and other dyes by lead sulfate, whereas Dr. Sandell is engaged in a study of the exchange adsorption with calcium oxalate.

Mr. Yutzy determines the adsorbent properties of the silver halides and the mixed crystal formation between silver chloride and bromide.



The conductivity of built up wall sections can best be determined by means of a hot box apparatus shown in the illustration. This apparatus was built into the wall of a refrigerator and made possible conductivity determinations at temperatures ranging from 35° F. to 150° F.

Mr. MacNevin is engaged in a study of the structural changes taking place on heating of barium sulfate and will study the coprecipitation of foreign ions with this slightly soluble substance.

Mr. Stenger has been studying the adsorption of various cations from ammoniacal solution by silica gel and is now making a systematic investigation of the coprecipitation of cations with hydrous aluminum oxide.

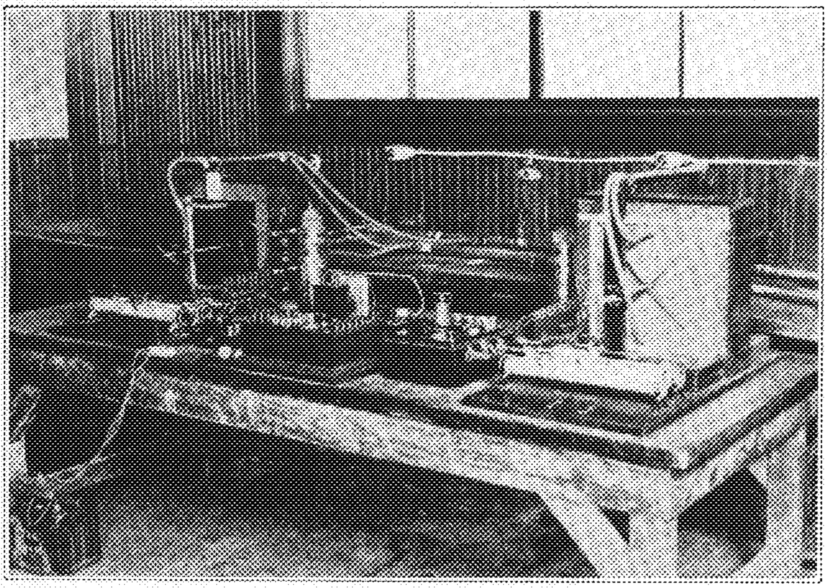
Mr. Moskovitz is working on a similar problem but uses hydrous ferric oxide as precipitant. A new method has been developed by which the hydrous oxides can be separated from other metal ions.

Studies on postprecipitation are being made by Mr. Moltzau and Mr. Griffith. Mr. Moltzau has found new interesting results on the postprecipitation of zinc sulfide in the presence of mercuric sulfide. Mr. Griffith is studying a few other combinations.

Mr. Wilman is working on the acid and basic properties of various substances in glacial acetic acid. Mr. Tomsicek is finishing a study on the oxidation potential of the ferro-ferricyanide and the molybdo-molybdi cyanide systems. Finally, Mr. Elmquist is busy with a study of the adsorption of organic compounds by pure activated charcoal.

Chemical Engineering

Fundamental studies of a number of unit operations are under way in the Division of Chemical Engineering. In heat transfer, studies of steam film coefficients are being made and studies of coefficients in an inclined tube evaporator are being continued. A study of the variables affecting crystallization is under way in a small batch crystallizer. The study of filtration reported in the January and February issues of the *Journal*



In engineering there is perhaps no process which has more general application than that of the flow of heat through materials. In order to determine exactly the heat conductivity through sections of homogeneous material, Professors Rowley and Algren have designed the apparatus shown above. It consists of a central heating element lined on each side with quarterinch copper plates. The test specimens are placed one on each side of the heating plate and each covered by a cooling plate clamped tightly against them. Thermocouples on both plates give the temperature difference between the two sides. From this data the conductivity can be calculated in the usual manner.

of Industrial and Engineering Chemistry is being continued particularly with regard to the variables affecting resistance of the cakes and the development of filtration equations from a theoretical basis. Studies on distillation include the effect of variables on the plate efficiency of bubble cap columns and also a study of packed columns.

Experimental Engineering

Pozzolanic Cements

Blends of Portland cement and pozzolanic materials are in common use in Europe but have received little attention on this continent. Their advantage over Portland cement lies in an increased resistance to corrosive agents such as alkali or acid ground water, and a slower rate of heat evolution. A paper on this subject presented to the American Concrete Institute in 1931 indicated decided technical advantages for a burnt clay pozzolana. The present investigation was planned to give further data on this material and includes strength, sodium sulphate, and freezing and thawing tests.

Durability of Cement Mortars

The object of this investigation is to obtain the relation between the durability of mortars as measured by freezing and thawing and by submersion in 10 per cent sodium sulphate solution, the constitution and other properties of the cement, and the strength, voids, and other properties of the mortar. The correlation, if any, between various recognized methods of testing for durability, and the relation between these methods and natural weathering will also be studied.

The investigation has included tests on over 3,500 specimens made from 28 different cements. A paper on the short time results will be presented to the A. S. T. M. this summer.

Physics

When electrons are passed through a gas at low pressure, some of them collide with gas atoms and literally bounce away. These are spoken of as scattered electrons. Some of these scattered electrons will retain their original velocity (elastic scattering) while others will lose some of their velocity at the time of impact (inelastic scattering). In either case the electrons may take directions anwhere from 0° to 180° with respect to their initial direction, i.e., the relative number scattered either inelastically or elastically through a given angle will be a function of the angle.

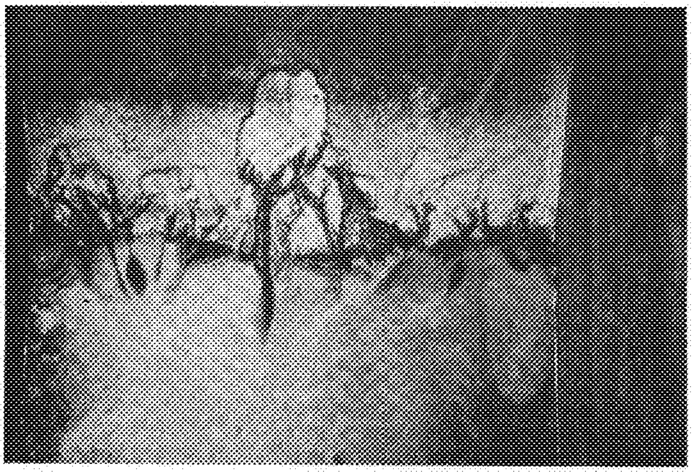
A number of theoretical calculations of such functions have been made. Mr. W. W. Wetzel of this laboratory has calculated these functions for scattering in Helium. An apparatus is being built with which, it is hoped, a check can be made on these results. This apparatus consists of an electron gun to give a well defined beam of electrons of definite velocity and a collector placed at an angle to the beam to collect the scattered electrons. The angle can be changed so as to get the relative numbers scattered at all angles from 0° to about 170°.

—Max Goodrich

Electrical Engineering

Sinusoidal Voltage Wave Analyzer

A recently completed experimental project has been the design, construction and test of an apparatus for the analysis of sinusoidal voltage waves along an artificial telephone line. This apparatus, intended to be used in the communication laboratory classroom, permits the measurement of the incedent, reflected and standing voltage waves at any point along the line for various terminations. Fundamentally the design is that of a type "22" telephone repeater adjusted for zero over-all gain.—M. O. C. Johnson.



No, this is not a specimen of modern art but represents when held in this position the manner of failure of a down-stream sand dam by the process known as piping. A model of the proposed dam is constructed into a reservoir and subjected to various water pressures. Under certain circumstances the rate of percolation of the water becomes so high that sand is carried from beneath the dam, progressively forming points of concentrated flow which eventually result in complete destruction of the dam.

HOW AN OSCILLO-VIBROGRAPH Records Minute Vibrations

By JAMES J. RYAN

Assistant Professor of Machine Design

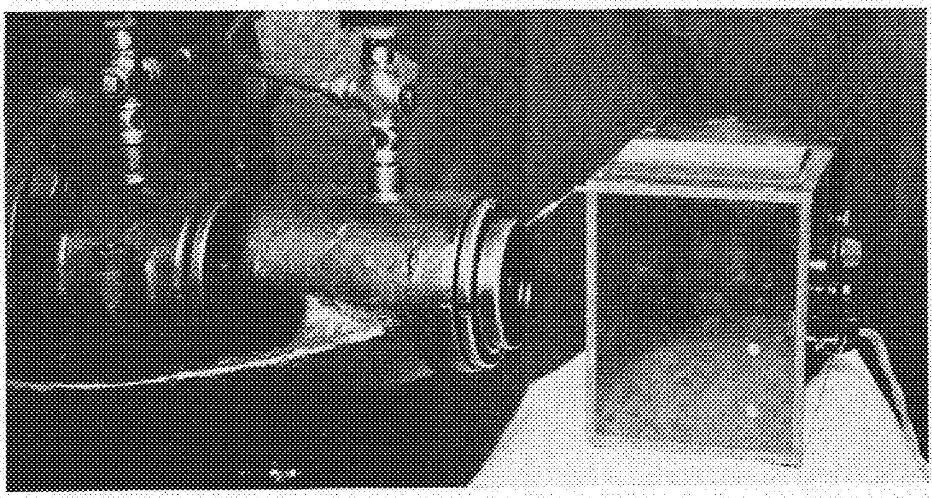
DID you ever stop to wonder why a street car makes so much noise or why an automobile may "jitter" in a most uncomfortable fashion at a certain speed? A little jinx called "vibration" is probably the cause. The most destructive vibrations are not usually audible, but they attack the foundations of structures, and wear out machines with useless vibratory movement. Noise, of course, is produced by those disturbances of higher frequency in the range of hearing, but frequencies of from five to 60 cycles per second are readily perceptible to the human sense of feeling. It is in the latter range that most power machines operate.

Thus, to get at the bottom of the reason why a street car makes so much noise, or to eliminate that vibration in an automobile, it is necessary to introduce factors which can cope with the various complexities of the vibrational disturbances. Street cars which do not run quietly and automobiles that have no vibrations in the running range are now made. Their use will be more widespread as methods of vibration measurement and analysis are developed.

The problem involved is one of analysis of the vibration disturbances so that suitable changes may be made in the mechanical structure to suppress the undesirable conditions. Due to the fact that the magnitude of the vibrations usually encountered in machines and allied structures is extremely small, it is difficult by mechanical means to magnify movements sufficiently for convenient interpretation. It has also been observed that where mechanical means are employed to translate movements to a recording mechanism, heavy seismic weights with attending heavy instrument framework are necessary to overcome the friction and inertia of the connecting parts. This results in a cumbersome and less portable instrument.

In research for the development of an applicable type of vibration instrument, it has been found that an instrument may be constructed for analysing mechanical vibrations which will not only magnify the vibrating movements to a high degree, but will also record them for immediate and convenient interpretation. Since the instrument does not transmit movements through mechanical means to the recording device, an instrument light in weight and readily portable is obtained.

The Oscillo-Vibrograph is such a vibration instrument developed in the Machine Design Division of the Mechanical Engineering Department, through the aid of a Research Grant from the Graduate School. It visually records amplitude wave form, and frequency of transverse and torsional vibrations by means of a mechanical and optical system. The mechanical system of the instrument is similar to the standard mechanisms used in laboratory seismographs and torsiographs, and the optical system is an adaptation of the oscillographic method of focusing a beam of light on a ground glass screen or film by means of a rotating polygon of mirrors.



An application of the direct follow element of the Oscillo-Vibrograph is illustrated in the measurement of high frequency vibrations at the bearing of a gear reduction case.

Four elements are involved in the mechanical system; a seismic element for indicating transverse vibrations, a direct follow element, a seismic element for indicating torsional vibrations, and a timing element. A light source is provided, and a small electric motor drives a set of rotating mirrors. Magnifications up to 1000 to one are obtained, and the upper frequencies are in the range of noise.

One element of the Oscillo-Vibrograph, the direct follow element, is used in the measurement of high frequency or noise vibrations. The instrument is mounted rigidly upon the foundation, or upon some support not subject to the vibrations of the machine. One end of a light adjustable rod is placed against the vibrating body, and the other end is connected with a bell crank attached to the instrument. The power cord, plugged into the station lighting system, delivers power to the transformer for the motor and lamp. The intensity of the light is adjusted by means of a rheostat. The maximum amplitude of the vibrating movement is indicated by a line on the viewing screen. The polygon of mirrors is rotated by switching on the motor. Since the speed of the rotating mirrors on starting is usually out of phase with the vibrating frequency, the curve of light moves rapidly across the screen, and it is necessary to adjust the speed of the driving motor until the wave becomes stationary.

The Oscillo-Vibrograph will be publicly demonstrated at the World's Fair meeting of the American Society of Mechanical Engineers in Chicago, June 25th to 30th. A complete description of the instrument will be published in the A. S. M. E. Transactions, Vibration Section of the Applied Mechanics Division, in June.

Left to right are Professor Charles Boehnlein, Thurman Erickson, Judson Crary, A. Donley Olson, T. R. Ohman, Raynold Caleen, H. W. Barlow, Walter Spivak, C. Howard Swanson, Professor Ackerman, Jean Barnhill, Loyal Domning, James Barr, Alfred Lau, Merrill Stiles, Edward Kierski, Harold Anderson, Walter Safford, Robert Lacy, and Donald Braillard. Other members of the club who do not appear on the picture are Herbert Swift, Roy Thompson, J. D. Weller, Rahland Zinn, Dr. Bruno Brandi, Nathan Buddish, Robert Burlingame, William Collins, L. E. Ide, Arne Holter, Robert Kissack, A. J. Kraemer, B. G. Morford, Leonard Proebstle, and David Prybil.

THE UNIVERSITY FLYING CLUB

gives inexpensive flight training

By JOHN D. AKERMAN

Professor and Head, Department of Aeronautical Engineering

MANY flying clubs have been organized throughout the country in order to provide inexpensive flying for a group of people interested in aviation, but few have succeeded to operate for very long. Most failures in the operation of flying clubs have been due to the same cause, namely, that after a group has been organized and the first plane bought, somebody damages the airplane, and flying for the other members is halted temporarily if not altogether. In many cases the question of providing proper maintenance for the plane has been a big handicap.

When, in the fall of 1932, the students of the University of Minnesota Aeronautical Department wanted to organize a flying club and purchase a plane, it was obvious that the life of the club would be short if the club was organized in the conventional manner, and therefore a plan was suggested by which damage to a plane or the problem of maintenance would not handicap the members in securing flying instruction.

First of all, the number of boys actually interested in learning to fly was determined by asking them to pay $5.00, to indicate their sincere desire to take flying lessons. Thirty members enrolled in this way. Then the average amount which the boys were willing to pay for obtaining necessary dual flying instructions, their solo flight, and some solo flying experience, was determined.

The members then agreed that they would be willing to pay a definite sum apiece for such instruction. Several flying schools and private pilots were then approached and asked to submit their figures for which they would give such instruction. At this point it was interesting to observe how many pilots are still living with the ideas of 1929, believing that they have to make a profit of at least $5.00 an hour for the plane, and that a pilot cannot instruct for less than $5.00 an hour. In some cases the total cost of flight instruction was quoted as high as $25.00 an hour.

Finally the club got in touch with the Northland Aviation Company, which recently started operations by buying out the plant and equipment of the former Universal Air Lines School, on a strict business basis without the bullabaloo of 1929. It was agreed that for a certain amount each the boys would receive a total of eight hours flying, dual or solo as necessary. The personnel of the Northland Aviation Company had had experience in training the Aeronautical Engineering Department students two years ago, when the University paid for twenty hours flying for every graduate of the Department of Aeronautical Engineering. At that time it was found that the group of boys as a whole was very well adapted to flying, that no damage was done to the planes, and that in the twenty hours available the boys not only learned enough flying to pass the Department of Commerce private pilots' examinations but also that they were able to have solo time in four different airplanes, i.e., American Eagle, kinner-powered, Waco O-X, Fleet Warner-powered, and Mohawk Warner-powered airplanes.

Having had this experience with the University students, the Northland Aviation Company could figure down to cents the cost of training such a group.

At the present time twenty-four members have already soloed. It was discovered that most of the boys could solo

[*Please turn to page 251*]

STUDENT ACTIVITIES

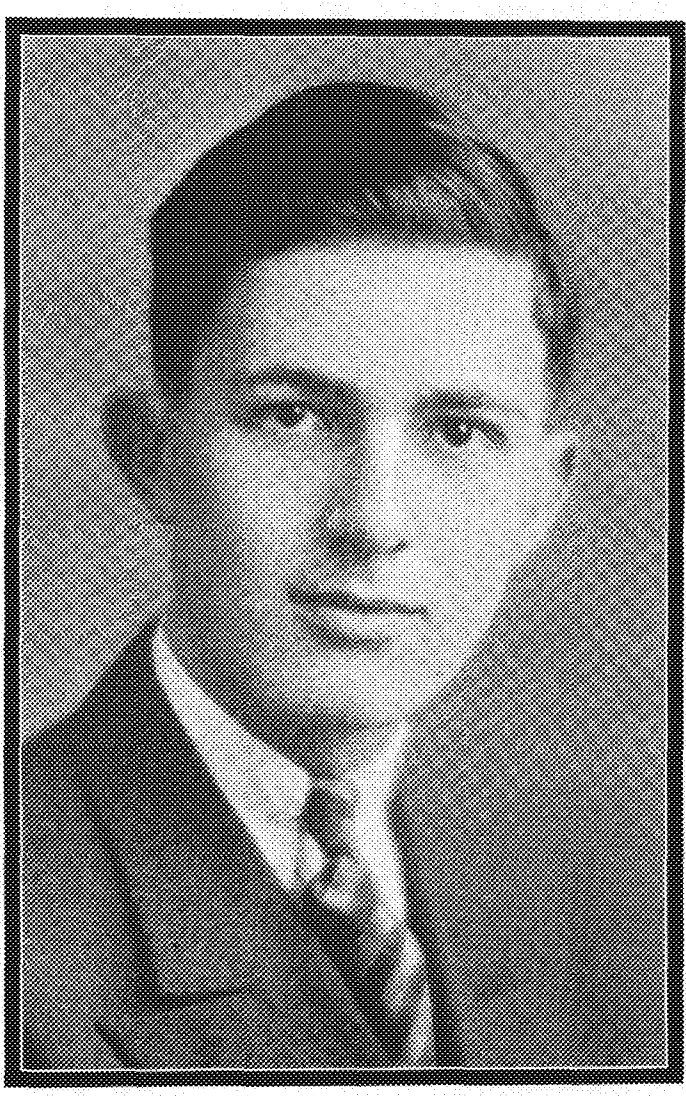
Edited by RICHARD PEDERSEN, Ch. E. '34

STUDENT engineering societies comprise a vital part of the extra-curricular activities of our students, and so the MINNESOTA TECHNO-LOG presents to its readers this section devoted to the ideals, activities, and membership of our various societies. To the 1933 Gopher we extend our thanks for the loan of four of the cuts,—to the heads of the different societies we offer our appreciation of their co-operation in giving the necessary information.

THE COURT OF HONOR

AT the Court of Honor, a Civic Appreciation Banquet given on May 11 by the Civic Associations of Minneapolis in recognition of Scholastic achievement in the graduating class of the University of Minnesota, the following engineering seniors were presented with certificates.

ALVIN ANDERSON	STANLEY LARSON	ALBERT OLSON
BENJAMIN AXILROD	DONALD LESLIE	JAMES PERHAM
FRED BAUMAN	SAM LEVY	GAYLE PRIESTER
BRUCE GILLESPIE	GORDON LINDNER	HENRY RAHN
KENNETH GOLDBLUM	GEORGE LINDQUIST	FREDERICK SCHMALZ
ZENAS HAVSTAD	KENNETH LUNDBERG	WILLIAM SHEPHARD
ROBERT HAXBY	LADDY MARKUS	HAROLD SUNDSTROM
SIGMUND JACOBS	FRANCIS MARTIN	GLENN ULLYOT
ARCHIE JAPS	RAYMOND MILNER	FREDERICK WALL



In Memoriam

MORRIS KNIGHT

Morris Knight, senior Mechanical Engineer, passed away April 20, just a few weeks before he would have graduated, after a very short period of illness. All students who knew Morris looked to him as one of the most respected and well liked members of his class. His success as a student is evidenced by the many activities in which he took part. Always admired by his professors and never neglecting scholastic requirements, he was elected to Pi Tau Sigma, honorary mechanical engineering fraternity in his junior year. He was active in the student branch of the American Society of Mechanical Engineers and served as vice-president during the past year. Morris was a member of Scabbard and Blade, honorary military fraternity, Beta Theta Pi academic fraternity and Theta Tau, professional engineering fraternity. He is survived by his parents, Mr. and Mrs. Ray R. Knight, 3245 Park Ave., Minneapolis, a sister and two brothers.

Members

Left to Right, First Row: Woodford, Baker, Julson, Shields, Simes, Connelly, Brockhoff, Penney, Schaeffer; *Second Row:* Abbett, Davis, Loishner, Weidlich, Larson, Huchthausen, Princell, Barnes, Swanson; *Third Row:* Anderson, Lofstrom, Kurtz, Grosz, K. Johnson, Friej, Burch, H. Johnson, Steinkeller; *Fourth Row:* Haatvedt, C. Johnson, Perkins, N. Sperry, K. Sperry, Tuscany, Isaacs, Lundholm, Selles, Leadholm, Frazer, Fugelso, Whittier, Kuito, Mackay; *Fifth Row:* Bend, Thatcher, Segerstrom, Ertz, Thompson, St. John, Lundberg, Tudor, Crommett, Galles, Bernstein, Fisher.

THE ARCHITECTURAL SOCIETY

Purpose

The Architectural Society of the School of Engineering and Architecture at the University of Minnesota is organized primarily to foster and create a professional attitude on the part of the members of the society and to bring them in closer contact with the latest developments in the field of architecture. It also serves to promote a spirit of fellowship among the members and to help them in becoming acquainted with the men in their field.

Officers

The officers of the organization for the school year, 1932-33, are Austin H. Lange, President; Kenneth Lundberg, Vice President; and L. Y. MacIntosh, Secretary-Treasurer.

Activities

At present the members of the society are chiefly concerning themselves with the framing of a new constitution. Alterations are necessary because the course in architecture has been changed from a four-year to a five-year curriculum. Grant LaFarge, New York architect, spoke on "Modernism in Architecture," at one of the meetings during the year. Later on this quarter, an alumni get-together is contemplated.

Purpose

The Minnesota Society of Aeronautical Engineers, an unaffiliated group, is organized to promote a spirit of fellowship and to create a professional attitude toward aeronautical engineering among the members of the society. It enables the members to come in contact with the men in the field and it fosters closer cooperation between the members of the society and the faculty.

Officers

The following men held office during the past year: George Brimhall, President; George A. M. Anderson, Vice President; Walter Spivak, Secretary; and Robert Segal, Treasurer. The following men were chairmen of the various committees: Harold Yesnes, Membership Committee; Bernard Schroder, Arrangements Committee; Leslie Ide, Social Committee; Mirza Gregg, Publicity Committee, and John Hardy, Picnic Committee.

Activities

Meetings were held every three weeks during the year and during the winter quarter a social dance was sponsored by the group, in cooperation with the Minnesota Flying Club. At the various meetings during the year prominent men in the field of aviation gave talks on various aspects of the profession. Some of the speakers were Mr. Armstrong, who spoke on the National Honorary Aeronautical Fraternity, Tau Omega, Jerry Lamb of the Northland Aviation Company, Professor Akerman, and Mr. Kinsman, Traffic Manager of the Hanford Air Lines.

MINNESOTA SOCIETY OF AERONAUTICAL ENGINEERS

Members

Left to Right, First Row: Yesnes, Kierski, Swanson, Spivak, Brimhall, Segal, Berman, Moe, Ohman; *Second Row:* Domning, Brueckner, Boeke, Professor Akerman, Professor Barlow, Welles, Bernier, Collins, Caleen; *Third Row:* Budish, Quam, Severance, Bennetsen, Petry, Kramer; *Fourth Row:* Carman, Hegi, Driscoll, Ruder, Mitchell, Lau, Holter; *Fifth Row:* Thompson, Barthelmy, Withee, Vye, Norsen, Nienaber, Ide.

Members

Left to Right, First Row: King, Leslie, Hedback, Petersen, Carlson, Hoffman, DeGraaf; *Second Row:* Nemec, Lund, Mengelkoch, Ventura, Tangen, Hammerski, Priester, Rollins; *Third Row:* Borgeson, Larsen, Ripken, Hutchings, Pratt, Diamond, Getsug; *Fourth Row:* Rogers, Johnson, Sternal, Sandburg, Fisher, Laitala, Sines, Thomas, Graetz.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS

Purpose

The University of Minnesota Student Branch of the American Society of Mechanical Engineers has for its purpose the fostering of fellowship among the student members of the society and to bring them in closer contact with the faculty. Valuable training is given to the student members by the sponsoring of technical talks, reports, and abstracts by the students themselves. Regular meetings are held and inspection trips are made to places of engineering interest in the Twin Cities at least two times each quarter. Speakers are obtained and interesting programs arranged for each meeting.

Officers

The officers for the year 1932-33 are Norman E. Carlson, president; Frank Ventura, vice-president; Norbert Mengelkoch, treasurer, and Russell W. Johnson, secretary. Norbert Mengelkoch is chairman of the program committee and George Graetz is in charge of inspection trips to local industrial plants.

Activities

Student technical papers were presented during the year by Don Leslie on "Free Wheeling," by Chester Sines on "Locomotive Maintenance," and by John Enblom on "Modern Anti-Aircraft Artillery." Dean A. A. Potter of Purdue University and National President of the American Society of Mechanical Engineers addressed the group on April 25. Delegates of the society attended the National Convention in Chicago on April 28 and 29.

Purpose

The Minnesota Student Chapter is one of the ninety-six Student Chapters affiliated with the Society. The purpose of this Society is to promote the highest efficiency and ideals among the students in the Department of Civil Engineering, and to enable the students in this department to act as a unit in all matters concerning the general welfare and advancement of the Department, the College and the University.

Officers

The following men were officers for the year 1932-33: James Nelson, president; Roy E. Oltman, vice-president; Paul Wagtskjold, treasurer; and Lewis Martin, secretary. The program committee consisted of Roy E. Oltman, chairman; Marcus Mattison, Robert Bruntlett, Walter Gustafson, and Harold Sundstrom. The membership committee consisted of Paul Wagtskjold, chairman; Lewis Martin, Harold Matlin, Donald Childs, and Robert Kreiss.

Activities

During the school year various speakers were obtained for the meetings and several movies were shown to the society. An inspection trip of the University of Minnesota heating plant and system was made. The principal speakers heard by the society have presented a variety of subjects. At a joint dinner meeting with the Northwest Section of the A.S.C.E., Mr. Stack, President of the Commodore Construction Company, told his engineering experiences in Russia. A very interesting talk was given by Mr. George Schroepfer, Principal Assistant Engineer of the Metropolitan Drainage Commission.

AMERICAN SOCIETY OF CIVIL ENGINEERS

Members

Left to Right, Top Row: Matlin, Holmquist, Englund, Andrus, Swanstrom, Flaata; *Second Row:* Bina, Bruntlett, Britzius, Lenhart, Lohn; *First Row:* Professor Nowicki, Sundstrom, Oltman, Nelson, Gustafson, Lincoln.

Members

Left to Right, Top Row: S. Larson, McDonough, Steinmetz LaBonte, Benston, Ziegler, Haxby, Hanson; *Fifth Row:* Kernkamp, Getsug, Hyvarninen, Johnson, Phillips, Skamser, Levy; *Fourth Row:* Davids, Cundy, Morgan, Collins, Anderson, Stoddart; *Third Row:* Bohrer, Lowell, Diekhoff, Professor Todd, Carlson, DeLaHunt, Perham; *Second Row:* Heitmiller, Robinson, Tangen, Mangan, W. Larson, Axilrod; *First Row:* Shepherd, Turnquist, Professor Kuhlmann, Erickson, Gregerson, Hancock, Kupka.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS

Purpose

The purpose of the Minnesota branch of the American Institute of Electrical Engineers is to foster the advancement and dissemination of knowledge of the theory and practice of electrical engineering, the presentation of the proper perspective of engineering work, and the opportunity to become acquainted with the personnel and the activity of the national chapter. Regular meetings are held in which papers, reports, and abstracts are discussed and the group makes inspection trips to places of engineering interest.

Officers

The officers of the organization are as follows: Paul L. Erickson, chairman; Arvid Turnquist, secretary-treasurer; Kenneth Gregerson, vice-chairman; John H. Kuhlmann, professor of Electrical Engineering and Design, counselor. John Hancock is chairman of the Committee on Meetings and Papers, W. G. Shepherd, Publicity chairman, and A. J. Kupka is chairman of the Membership Committee.

Activities

The group sponsored the Electrical Show, which was held during the spring quarter, and a student prize paper contest. It has held combined meetings with the Twin City section of the A.I.E.E. Inspection trips were made to the Northwestern Bell Telephone Company and to General Mills. During the year student talks were given by Laddy Markus on "Neon Signs," by Everett Miller on "Western Electric Sound Equipment," and by Harold Sanderson on the "Manufacture of Small Arms Ammunition." At one of the meetings Professor Ryan talked on "Power Development in Europe," and exhibition boxing and wrestling matches were held.

Purpose

The Engineers' Bookstore Board was organized to facilitate combined student and faculty management of the store. Its purpose is to control the policies and administration of the store so as to represent the best interests of the College of Engineering and Architecture in its management.

Student members of the Board are elected each Spring by students registered in the engineering colleges. Through the Board, the Bookstore gives its support to many engineering activities and organizations each year.

Officers

The officers of the group are Clarence Lund, president; and C. Herbert Starkey, secretary. The three advisers of the bookstore are Professors Kirchner, C. A. Mann, and Zelner of the faculty. Harold D. Smith, E.E. '25, is the full-time bookstore manager.

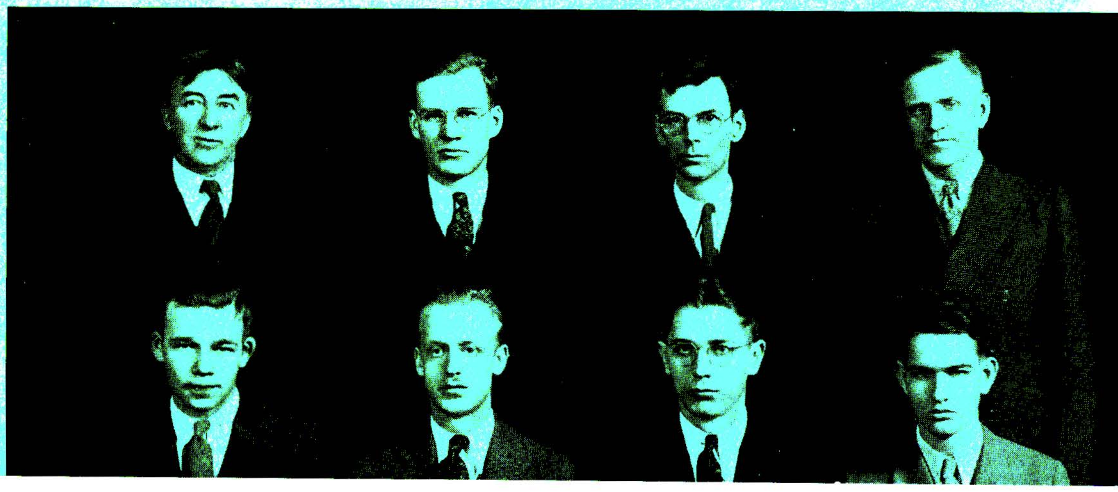
Activities

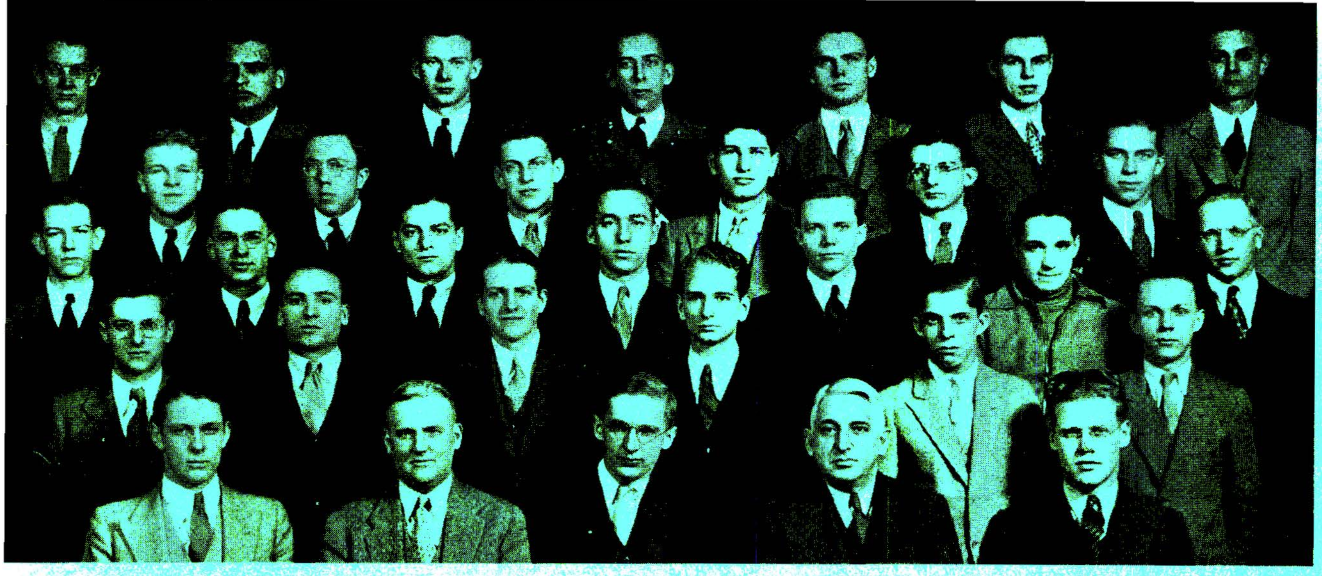
The group holds dinner meetings of a purely business nature every two weeks at which time reports are given and policies are determined. They are held on the second and fourth Thursdays of each month. As all engineers know, the bookstore offers a valuable service to the students in giving them fair prices on all books and supplies needed. Because the magazine stand is taking on all the aspects of a free public library, the store is expecting to discontinue this service and give free subscriptions instead.

THE ENGINEERS' BOOKSTORE BOARD

Members

Left to Right, Top Row: Professor Kirchner, Paul Erickson, Harold D. Smith, Professor Zelner; *Bottom Row:* Edward Hammerski, C. Herbert Starkey, Clarence Lund, Malcolm Hope.





Members

Left to Right, Top Row: Weldy, Leistiko, Dickson, Hanscom, McDonough, Grahame, Williams; *Fourth Row:* Hammond, Kershaw, Rosholt, Levy, Ebert, Mengelkoch; *Third Row:* Marshall, Buck, Bolline, Jensen, Ruble, Budish, Sundstrom; *Second Row:* Axilrod, A. Gadler, Cohen, Monson, Brockhoff, Fredrickson; *First Row:* Lowell, Dean Leland, Markus, Professor Cutler, Rogers.

THE MINNESOTA TECHNO-LOG STAFF

Purpose

The main excuse for the existence of the TECHNO-LOG staff seems to be the production of what is called a monthly magazine in which representative engineering articles and news of the various campus engineering societies are published. A feature section is included for the benefit of those engineers who would like to get all of the punning out of their systems before they graduate. The magazine boasts an alumni section, but don't let that fool you—it's only an attempt to get more alums to subscribe. Advertising at the lowest rate possible is taken because the staff wants to lose money on each issue.

Officers

Laddy Q. Markus is first lieutenant of the outfit. Tom Q. Rogers thinks he is, but he is sometimes allowed to sharpen pencils for the assistant copy boy. Markus, on the other hand, has fallen in love already this spring and he is gradually weakening under the strain. We might add that Rogers has also succumbed—in fact the whole staff has—but we won't go any farther. We would like to keep the staff on as high a moral plane as possible so as to set an example for the rest of you bozos.

Activities

The main activity of the organization is to wait as long as possible before the month's deadline and then get up the issue in five minutes, just for the fun of it. The business end of the game is rather weak now, too. I just asked Rogers how much we were in the hole and he said he could already hear the guns in China, so I guess we may come out on the top after all. Some of the guys plead guilty to putting their feet on the desks, but, we ask, what don't they do over in the Daily office?

Purpose

The student branch of the American Institute of Chemical Engineers at the University of Minnesota was organized to aid students in orienting themselves in the chemical engineering profession and to help them create a professional attitude. The members become acquainted with the Code of Ethics of the national organization. The group sponsors the Chemical Show every other year and such activities aid in creating fellowship among the students and among the members of the faculty.

Officers

The officers for the school year, 1932-33 are K. C. Johnson, President; Harry Kaess, Vice President, Robert Conary, Treasurer; Eugene H. Eyster, Corresponding Secretary; and Harry H. Cottingham, Recording Secretary. Officers elected for next year are: Robert E. Conary, President; Eugene H. Eyster, Vice President; William Lundquist, Treasurer; Roger Bossen, Corresponding Secretary; and Harry H. Cottingham, Recording Secretary.

Activities

Prominent men in the chemical engineering profession are obtained as speakers for the meeting and students' discussion groups are held. At the beginning of the year, a smoker and mixer is held to allow the incoming freshmen to become acquainted with the upper-classmen. During the year Mr. M. A. Mellen, engineer of the Minneapolis waterworks, gave a speech on "Water Purification," and, at another meeting, Mr. Jesse Tindall, of the Minnesota Linseed Oil Company, gave a talk on "Linseed Oil." The national chapter awarded Richard S. Olson a badge for his high scholastic average during his freshman year.

AMERICAN INSTITUTE OF CHEMICAL ENGINEERS

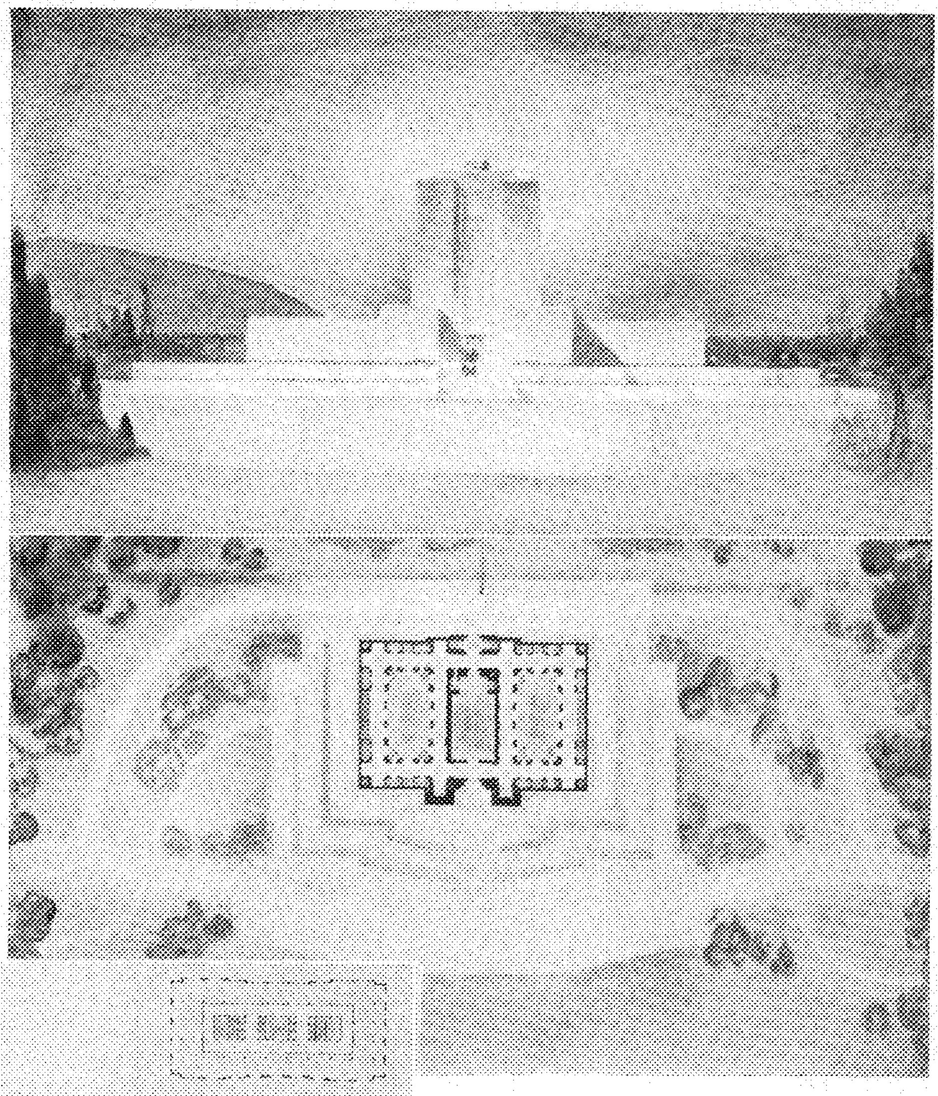
The rain making division of the Minnesota Chapter of the American Institute of Chemical Engineers functioned in all glory on the very day scheduled for the taking of the photograph which was to occupy this space. The lads were very brave, however, and wanted to go out and expose themselves to the rigors of the inclement weather. On the other hand, the photographer had a hole in his shoe, which made it necessary for him to remain inside. Yes, it would have been a nice picture too. . .

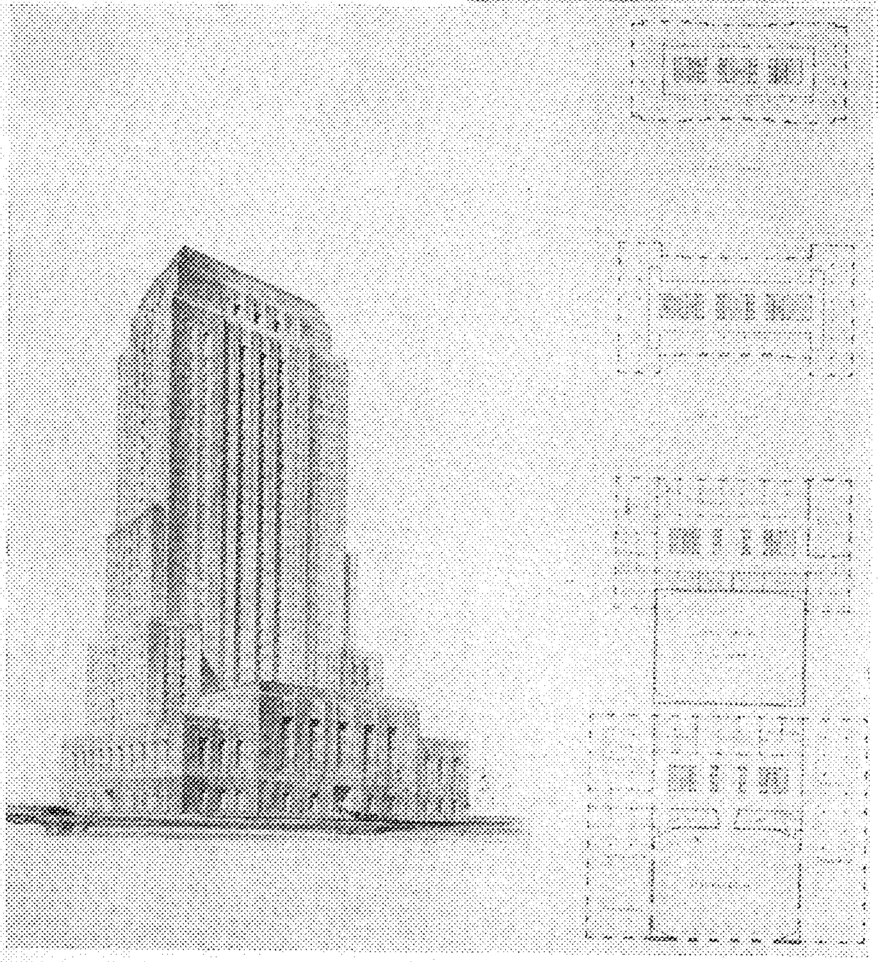
ART AND ARCHITECTURE

By MARION ANDREWS, Arch. '33

A Necroneos

The Gargoyle Club, an association of Saint Paul Architects, each year offers prizes of $35 and $15 in books to the winners in a special competition of the junior year in Architecture. The subject of this year's competition was a Necroneos, or "Temple of the Dead." The program reads in part, "The cemetery in which the proposed building is to be built lies on the upper slopes of a range of high hills which are separated from the neighboring city by a river. The immediate site of the building is a natural terrace overlooking the river and the city beyond. Access is by a road which ascends the slope by easy grades. The building will contain a funeral chapel seating 300 people, and containing a choir and organ space, a crematory, a mausoleum providing a total of 200 burial units, and a columbaria providing 500 niches for ashes of cremated bodies."





A Stock Exchange

The problem shown at the left, a Stock Exchange by Jarl Seppanen, is representative of the winning designs in the first senior competition this quarter. The building was to be in the chief city of one of the Federal Reserve Districts and was to include a large trading room with easy access for brokers, a transfer department, safe deposit vaults, investigation department, directors' board and trial room, ticker service, a stock exchange club, and other elements. In judging the project, more consideration was given to the character of the perspectives than to the plans themselves.

A comparison was made between the solutions presented by Walter Lindström and Harry Johnson. The former was very similiar to the one shown here and is a typical modern building of the conservative type. It placed first because it was well thought out and well presented. As Prof. R. C. Jones expressed it, "The problem speaks for itself."

The MINNESOTA TECHNO-LOG

UNIVERSITY OF MINNESOTA

CAPS AND GOWNS

AN age old custom of parading in cap and gown was again repeated by the graduating seniors last week. Strangely enough, the flowing robes of black seemed to have a new significance this day—the somber color was suggestive of black crepe at a funeral procession. All was not black, however, for the gold tassels, waving to and fro, atop the square academic caps reminded the onlooker that always above the darkness there is a hopeful ray of light.

To the graduating seniors, the future seems barren of all hope of pursuing their field of study out of school. Some are planning to come back for graduate study. Those who are not fortunate enough to do so are in a state of acute bewilderment. It is absolutely necessary to continue one's study after graduation, if one ever expects to follow his specialized work. Those who conscientiously pursue their studies after graduation will eventually reap their rewards; the rest will drop by the wayside. Graduation does not mean the end of study, it is the opening of a door into one's life study.

ELECTRICITY

ELECTRICITY—the essence of all matter, the source of all life—that singular, impalpable thing which inculcates in the electron its power to form material bodies and make life possible. It is no wonder that man finds electricity essential and an undeniable necessity.

It is electricity which at a finger touch, instantly dispels the gloom of darkness and brings cheer and light into each home. Electricity is the perfect servant which quickly and efficiently washes and irons his clothes, cleans the carpets, cooks his meals, and ventilates the rooms of his happy home.

It is electricity which responds to the prayers of the dying mother and brings to her the voice of her son from far across the continent. It is electricity which generates the X-rays that enable the doctor to diagnose the exact ills of the consumptive child, and it is the electrically produced ultra-violet rays which restore his health. It is because of his electrically operated tools that the dentist is able to repair an aching tooth and dispense with its extraction. It is electricity which comes to the aid of the despairing aviator, pointing out to him his lonely way through the darkness with a beckoning finger of light. It is electricity which brings succor to the sinking ship at sea.

It is electricity which runs the printer's presses, bringing the news of the world to everyone. Electrical power runs the factories, electrical energy lights the cities, electrically driven locomotives span the country, and electricity makes the world go around.

It is electricity which is the true and faithful servant of man in every walk of life. Electricity—a magic, potent word—the spirit of all existence. M.C.

TEA-TOPERS

YOU have no doubt heard of tea-topers—persons who drink tea for breakfast, lunch, dinner, and at any appropriate times between meals. Perhaps you have never known such a person and find it difficult to picture him in your imagination. At any rate, he seems far removed from the rough and rugged sort of person usually pictured as an engineer.

Here is where we are about to let you in on a secret. Some of your best friends—yes, some of these hard boiled engineers—have taken to drinking tea. But, who wouldn't, when one can get a cup of tea, poured by a good looking girl, and some cookies to eat with it? What do we mean?—what are we talking about? Come up to the green tea on the third floor of the engineering building on the afternoon of Engineers' Day and find out for yourself. The young ladies in the architectural department guarantee you a pleasant surprise.

SERVICING TECHNOLOGY

ENGINEERS are being blamed quite generally, for the recession which is hurting everybody these days. The public is in the same frame of mind regarding technological advances in production, as a small boy might be toward a Christmas jackknife which had cut his fingers badly. Whittling instructions are as essential to effective generosity as a keen blade, for a knife that cuts fingers is certainly worse than no knife at all. Just as the donor of the knife cannot avoid accusing eyes, so the engineer cannot escape condemnation.

Engineers seem to have spent too much time in the past, in merely sharpening the tools of industry, and too little effort on giving instructions in the economic use of the lengthening processes of production. We have given such little thought to ultimate social utility, that most of us do not even know, ourselves, how the clever methods and machines we have devised, ought to be handled. Yet, when they go wrong, engineers will be blamed.

Certainly, as the cycles of round-about production have been extended, the time required for readjustment has been greatly increased. It takes years to progress through mine, and mill, and forest, and factory, and other factories again, and through wholesaler, and retailer, to the satisfaction of the wants of the final consumer. It takes years to increase activity all along the line, to make up a housing shortage for instance, and it takes years to stop the extra activity again, once it is started. Meanwhile, men grow old, and are hungry. The technology of production, when it is unskillfully handled, becomes destructive.

Stabilization has been proposed to keep the huge, though efficient production machine running steadily, to avoid disaster. Society would lock the governor, or at least introduce friction to oppose change. We have been trying to stabilize wage rates, to fix prices, and even to maintain government expenditures. Consumption, however, has all the variation of any other demand load. The ultimate personal wants to be satisfied, change from day to day, and year to year, with all the fad and fancy of a hundred million individuals.

We might, of course, go to the very root of the matter, and try to do away with all personal preferences, but our nation is not prepared to pre-ordain the lives of each of us from birth to death. Even in Russia, dictatorship has had to yield to personal choice, with piece rate pay, and certain "voluntary" plans. Moreover, with our present knowledge, we could not hope to control the more important chances which nature shuffles for us. We cannot stabilize our wants.

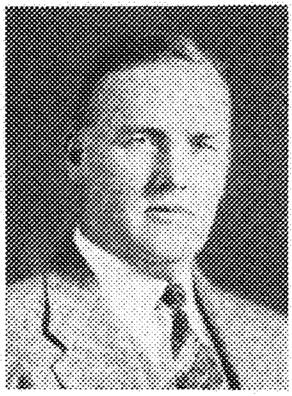
We have tried to stabilize with a flywheel of over-production, but the work put in could never be fully recovered again. Even if people's desires did repeat with the so-called business cycle, nobody would accept old goods at full price. No one would buy a three, or a five, or a seven-year-old automobile even if it had never been used, or would relish three, five, or seven-year-old eggs, butter, or meat, no matter how well stored.

The results of attempted stabilization have been just what an engineer would expect of a sticking governor with a varying load, "institutional frictions in a changing world," in the words of Professor Alvin Hansen. The technological machine "hunts." Adjustments do not take place until they are catastrophic. The more engineers build up the production machine, and add to its inertia, the longer and more violent will the swings become, under stabilization.

Engineers must edit instructions for the production system they have created, or they can expect to be cursed by the public. Engineers will not be allowed to continue to sharpen knives that cut people. They will not be allowed to go on applying technology, if it operates dangerously. We must put on the overalls, and service technology right out in the field.

—K. A. P.

DEAN LELAND SAYS - - -



Thinkers and Others

EDITORIAL writers in student newspapers are accustomed to stress the idea that high scholastic grades result from memorizing text material and cramming for examinations, implying that these processes should have no place in university education. Invidious comparisons are made between the students who are able to "think" and those who achieve scholastic success in the usual way by passing examinations.

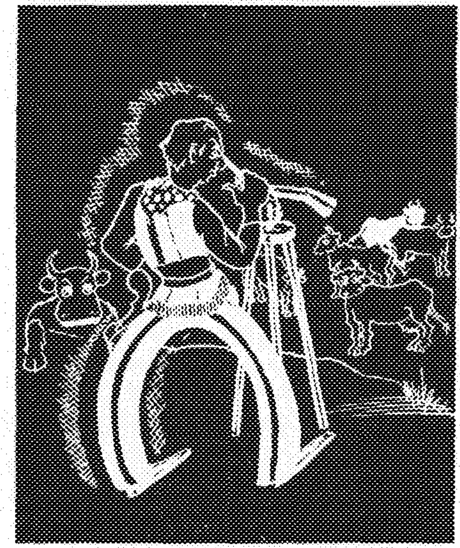
The presumption is that the thinkers receive low grades because of their lack of knowledge concerning unimportant details, notwithstanding their ability to think in general terms, while the more brilliant students memorize facts and methods, learn how to solve the problems, pass the examinations, and automatically receive high grades while lacking common sense and ability. In other words, ability is accompanied by low grades while the less important knowledge earns scholastic recognition.

The student editorial writer invariably attacks the system which permits such obvious "injustice" and frequently advocates the abolition of grades as a remedy, in order that the real students, the thinkers, may pursue their college courses enjoyably, as befits university men, without the necessity of competing with the "grinds" who merely seek knowledge but who capture the scholastic honors. Evidently the student who thinks without studying is at a disadvantage as compared with the one who studies with or without thinking.

The inherent error in this reasoning lies in the assumption that knowledge and ability are unrelated. Ability without a foundation of knowledge would be of little consequence. Bacon wrote that "Knowledge is power." A professional education must include the acquisition of knowledge as well as the cultivation of ability,—the knowledge of basic principles, facts, and methods, and the ability to apply this knowledge to the problems of the profession. The student who has a thorough knowledge of his college courses will earn and receive high grades without seeking them. The assertion that he is unable to think for himself is idle and probably never comes from a student with a creditable scholastic record.

Employers of engineering graduates attach significance to high grades as indicating certain desirable qualities such as industry, thoroughness, intelligence, accuracy, and ability to meet tests and surmount difficulties with success. In other words, high grades result from the very important habit of doing one's work as well as he can and better than he is required to do it.

OUR ENGINEERING GRADUATES



'68—H. H. Knowlton, Route No. 2, Fowler, Colorado, writes that he is "Looking after ranch properties. Civil engineer or cowboy — both sight over wide open spaces."

Architecture

'13—Ralph W. Hammett, the Associate Professor of Architecture at the School of Architecture of the University of Michigan at Ann Arbor, writes that he has recently had a small but important addition to his family in the person of Dorothy Jeanne, who is now four months old. He also mentions that he has been with the University of Michigan since 1931.

'22—Stanley Worth Hahn is at present rather interestingly engaged. As he writes, "I am just now designing exhibits for the World's Fair and have a big one to do for the Cord Corporation and several others." Stan is a registered Architect in Chicago, and has offices at 605 N. Michigan Ave. His home address is at 547 Wellington Ave., Chicago.

'22—H. N. Haines, 1019 Rose Hill Avenue, Durham, N. C., is at present an Architect for the Durham College Station. He is also in charge of the Durham office of the Department of Architecture, Board of Church Extension of the M. E. Church, South.

'27—Arthur H. G. Kastner is the Instructor in Architecture at the Boys' Technical High School of Milwaukee, Wisconsin. Arthur lives at 3334 N. 14th St., Milwaukee, Wisconsin.

'27—Porter W. Kilpatrick is Head of Architectural Engineering and Engineering Drawing Departments of the University of North Dakota.

'28—Paul W. Jones is the Assistant Professor in Architecture at the North Dakota Agricultural College, Fargo, North Dakota. Paul's home address is 1463 Hythe St., St. Paul, Minn.

'28—Jane West, an interior architect, who was working as a designer in the office of M. LeCorbusier in Paris, is going to conduct a European tour this summer. The party will sail June 20 for Holland and Germany where they will study modern architecture and housing experiments.

'31—Earl Cone, a former member of the Techno-Log staff, is back in town and paid a visit to the architects some time ago.

'32—Vera Kates is working part time as an Interior Architecture. Her home address is at 3715 Oakland Ave. S., Minneapolis.

Chemical Engineering

'30—Clinton MacMullen, formerly chemical editor of the Techno-Log and now teaching assistant in organic chemistry at Minnesota, has recently proved that in springtime even chemists turn to thoughts of love. On April 21, at the Alpha Chi Sigma formal, Clinton announced his engagement to Miss Beatrice McRae.

Civil Engineering

'06—M. H. Hanaver writes that he is still with the Minneapolis Steel and Machinery Division in Los Angeles, California. He has been working here ever since graduation which is a fine record indeed. Mr. Hanaver's address is 933 Chapman Bldg., Los Angeles.

'07—Lewis A. Jones is Chief of the Division of Drainage and Erosion Control, Bureau of Agricultural Engineering, U. S. Department of Agriculture, Washington. Lewis lives at 7131 Chestnut St., Tacoma Park, Washington, D. C.

'15—Edgar W. Johnson of 3821 Elliot Avenue, Minneapolis, is the Senior Engineer of the City Water Works, 229 City Hall, Minneapolis.

'20—Byron F. Johnson is a Captain of the U. S. Marine Corps. Captain Johnson has two children, a boy and a girl. Any international secrets will reach the Captain through the headquarters, U. S. Marine Corps, Washington, D. C.

'21—Carl S. Johnson notes that at present he is unemployed but has had considerable experience in design, estimate, and detail of bridges and other building structures. Carl at present resides at 3619 West Park Road, Cleveland, Ohio.

'21—Alphonse N. Johnson is Construction Engineer for the Northern States Power Company of Minneapolis. He notes that he is married and has two children and lives at 2322 Irving Ave. N., Minneapolis.

'26—F. J. Halbkat writes, "Laid off in Detroit on October 1, 1930, but found temporary employment in Joliet, Illinois, until August of 1931. Saw Cosgrove (C. E. '26) the other day. Would like to hear from the 'Civil Camp—Tent No. 11' Gang." Mr. Halbkat is now staying at the Y.M.C.A. in Joliet.

'27—Walter F. Hagman is at present in the same boat as some of the rest of us and writes that though he has had five years of experience in the Structural Steel Engineering field, both in the office and out on the actual job, he has been unemployed since last year. Walter's present address is in Wright, Minn.

'27—K. A. Johnson, R. R. 3, Box 246, Elgin, Illinois, is the Junior Engineer for the Illinois State Highway Department, 35 E. Wacker Drive, Chicago, Illinois.

'31—Wendell E. Johnson writes that he was employed by the Minnesota Highway Department from graduation until February, 1933, but at present is unemployed. So one can now find Wendell at his home at 1832 Kenwood Parkway, Minneapolis.

'31—William S. Johnson, 1977 Grand Avenue, Little Falls, Minnesota, is Engineer with the Bernard S. Andrus Construction Company, of Little Falls.

'31—Earl L. F. Porter is at present with the St. Paul District of the U. S. Engineers in Alma, Wisconsin, and has written a very interesting letter to Prof. Zelner here at the University. He says, "I have just completed 15 months' work in the Duluth District. Fishing and hunting is excellent any place outside of the city limits and an overcoat is comfortable in July. Gene Weber, Art Johnson, Verne Erikson, Floyd Peterson, and Jack Schradle are on the job with the Duluth Engineers, and Grant Waldtes is with the D. M. and Nat. at Duluth." Earl is expecting to remain in Alma, Wisconsin, for the next two or three years at least.

'32—George Millman is taking work in education at Augustana College to qualify as a high school teacher. He is also busy at times doing odd jobs. George is living at 2103 S. Duluth Sioux Falls, S. Dakota.

Electrical Engineering

'10—Leonard T. Johnson is the Power Engineer for the Grasselli Chemical Company, 1400 Guardian Building, Cleveland, Ohio. Leonard's home address is at 1276 N. Lockwood Avenue, East Cleveland, Ohio.

'10—C. M. Jesperson is Treasurer of the Swann Corporation of Anniston, Alabama. He certainly can't complain of a lack of money, being a treasurer.

'11—Edward J. Johnson is Special Equipment Engineer for the Bell Telephone Laboratories at 463 West St., New York.

'13—Allen K. Haines is now President of the Dick X-Ray Co. of St. Louis, Missouri. Mr. Haines is at home to his friends at 417 North 8th St., in East St. Louis, Illinois.

'15—Carl J. Johnson is Director of Sales for the Otter Tail Power Co. of Fergus Falls, Minnesota. Carl lives at 519 So. Mill St., Fergus Falls.

'23—G. Adolph Johnson, whose home address is 2420 Pierce St. N. E., Minneapolis, is the Transmission and Protection Engineer for the Northwestern Bell Telephone Company in Minneapolis.

'25—Enan C. Johnson is the Transmission Engineer for the Northwestern Bell Telephone Company in Minneapolis. Enan's home address is 1516 10th Avenue So., Minneapolis.

'27—Gustave F. Johnson is with the Northern States Power Company of Minneapolis. Gustave is their Rate Engineer and resides at 3412 Park Ave., Minneapolis.

'26—Lawrence R. Hafstad is at present a Physicist for the Carnegie Institute of Washington, D. C. He is living at 5241 Broad Branch Road, Washington, D. C.

'26—Welton V. Johnson, the Electrical Designing Engineer for the Westinghouse Electric of New Jersey, writes that he is broke but happy. Welton now lives at 241 S. Arlington Avenue, East Orange, New Jersey.

'28—Sam R. Hamilton, 105 W. Adams St., Chicago, is now the Associate Editor of the Railway Age and other Simmons-Boardman publications.

'28—Sheldon F. Johnson has liked this year's Techno-Log very much and sends his congratulations to the staff. Sheldon is in the Advertising Department of the Westinghouse Electric Co., and his home address is now at 749 Princeton Boulevard, Pittsburgh, Pa.

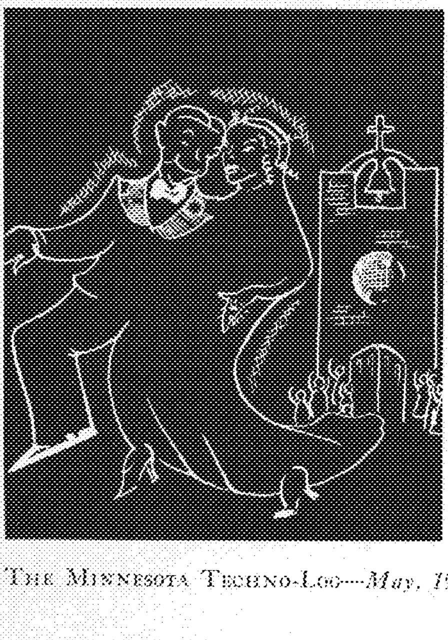
'28—Robert W. Ackermann is in the engineering department (transmission) of the American Telephone and Telegraph company district 61, 750 Huron Road, Cleveland, Ohio. He writes that he was married on April 5, 1932 to Miss Marie Langkammerer '28N.

'30—Elmquist—Melvin Elmquist is with the Detroit Edison company. Mel was married to Miss Lorraine Hill of Detroit on April 2nd of this year. They will be at home at 3410 West Chicago boulevard, Detroit, Michigan.

'31—Thorson—Harry Thorson has been transferred from the Erie works of the General Electric works to Schenectady, and is rooming together with his classmate, Dick Cady, at the "Y." Harry has been following the G. E. test course since his graduation.

'31—Soules, Webster F.—Webster F. Soules is still in town working for the Northern States Power company, Minneapolis. His present address—56 27th avenue S.E.

'31—Howard G. Harvey, Assistant District Engineer of the 6th District, St. Louis County, went through the age old custom of saying, "I do," on March 28, 1933. Howard may be reached very consistently now at Apartment "C," Winkler Apts., Virginia, Minn.



Mechanical Engineering

'11—W. F. Kasper is the vice president of the Fairmont Railway Motors, Inc., in charge of Sales and Engineering. His address is 814 Albion Ave., Fairmont, Minnesota.

'15—E. H. Adler is an industrial engineer with the Montana Power company, Butte, Montana, where he has been on a natural gas project for about a year in charge of industrial and heating applications. His home address is 1126 West Woolman St., Butte, Montana.

'18—Oliver S. Hagerman, engineer for the American Light and Traction Co., 105 W. Adams St., Chicago, Illinois, is still living at 1436 Edgewood Lane in Hubbard Woods, Ill.

'23—Herbert O. Halden is with the Kansas City office of the Fuel Economy Engineering Co. as manager. He is staying at the Berkshire Hotel, Linwood Blvd., of that city.

'23—A. C. Zimmerman was recently back to visit the home folks at Hopkins, Minn., and while here he dropped in to have a chat with Professor Zelner. Mr. Zimmerman is at present in the Contracting and Marine Construction field with R. O. Reid Company in Miami, Florida. He was married way back in 1927 and has been also visiting his wife's family in Ellendale, N. Dakota. With his vacation over, he may again be reached in Miami, Florida, at P. O. Box 228.

'24—Theodore F. Schilling is the Engineer in charge of the Furnace Division of The Gas Manufacturing Co. of Cleveland, Ohio. His division develops and manufacturers special industrial furnaces for metallurgical purposes. His home address is 2120 Lenox Road, Cleveland, Ohio.

'24—C. W. Teal is serving as the director of the Engineering Club of Omaha and as its secretary. His club was recently honored by an excellent talk on Air Conditioning by C. E. Lewis (19G). He writes that Mr. Lewis is now in that business in Minneapolis, and that "he certainly upheld the standard for Minnesota Engineers." As you know, Mr. Teal is married to the former Valentine Moline ('25 SLA) and recently they had a baby boy. He was born on St. Valentine's day and so was named Peter Valentine Teal. Mr. Teal at present resides at 914 North Forty-ninth Ave., in Omaha.

'25—S. P. Bordeau, who is an electrical engineer with the Electric Machinery company, Minneapolis, has recently made a survey of the steel industry from the standpoint of synchronous motor application. He has also recently submitted two papers to the American Society of Iron and Steel Electrical Engineers on the same subject. His present address is 215 Melbourne S. E., Minneapolis.

'10—Eliot R. Josephson has applied his highly technical knowledge of voltage vectors in selling suits to gentlemen with a high sales resistance. Eliot is Manager of the Josephson's Clothing Store of Red Wing, Minnesota.

'27—Wilfred W. Lowther, who is working with the Donaldson Company, Inc., has recently developed a new hydraulic type of air-cleaner for tractor motors which is very efficient. Bill's business address is at 666 Pelham, St. Paul, Minn. Frank Donaldson, '12 M. E., the president of the company, is also an old grad.

'28—Arthur M. Braaten is now an engineer with the design division of RCA Communications, Inc., Riverhead, New York. He is engaged in the development of frequency standards and commercial frequency measuring apparatus for high frequency transmitters. His home address is Box 979 Riverhead, Long Island, New York.

'29—Manford P. Hanson is with the Results Department of the Northern States Power Co. at the Riverside Station here in Minneapolis. He is still living at 1907 McKinley St. S. E., in Minneapolis.

'30—John R. Hall is a Mechanical Engineer for the U. S. Air Conditioning Corporation, 2101 N. E. Kennedy St., Minneapolis, Minn. He lives at 5305 37th Ave. S., here in town.

'30—Ellwood L. Johnson is Assistant Master Mechanic for the John Morrell and Company of Sioux Falls, South Dakota. Ellwood's address is 16 Seville Apartments, Sioux Falls.

'31—W. S. Jorden is an Engineer with the Babcock and Wilcox Company in the Erection Department, having been employed there since graduation. His address is 24 24th St. N. W., Barberton, Ohio.

"B'LARNEY"

By OSCAR Q. FEGAS, P. D. Q.

For lamenting in an audible manner! Guess the old calendar put one over on your aged and decrepit scrivenir. Apparently worn low by his infirmities none other than this humble Oscar Fegas has let slip his little page of written antics till way past the time it should be in the editor's hands.

It happened this way. I breezes into the office this morning leisurely and says to the editor, "When's the deadline, big boy."

He came right back at me quick like, and says, "Two days ago, Ossie. But what's two days to a turtle like you?"

Well, I can't think of anything to say to that. He sort of catches me unawares, y'know. So I keeps my mouth shut.

He continues, "You got one hour to write your lines, so get busy."

Well, I thinks to tell him Rome wasn't built in a day, but I don't tell him that, because, after all, I ain't building Rome anyway.

But I got one theme to work on anyway. You know St. Pat's day is here, and maybe we can build something around that. Bear with me, gentlemen, but don't bear at me, 'cause I'm scared of animals.

▼ ▼

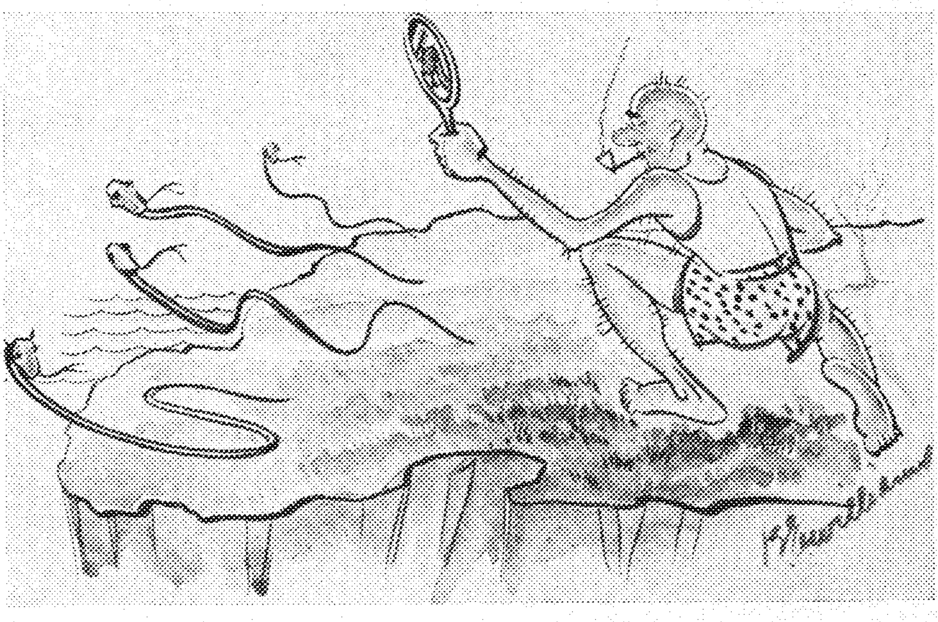
Sign in a boiler room: Have faith in the Lord, but keep a full gauge of water.

practical joke

The great cathedral-like theatre was filled. The orchestra had just finished the soft, sweet strains of the overture. Not a sound was heard except the tense breathing of the vast audience as the curtain was about to rise. Suddenly a man leaned over the balcony rail and screamed in piercing tones: "Mr. Smith! Mr. Smith!" His face was transfigured with torturous pain, as he screamed again and again, "Mr. Smith! Mr. Smith!" The audience looked in awe at the man in the balcony; it seemed as if the man was at death's door. "Mr. Smith! Mr. Smith!" his voice wailed, echoing and re-echoing through the vast dome of the theatre. Just as the man in the balcony was about to scream again, a small timid gentleman sitting on the first row, arose and held up his hand. "I'm Mr. Smith," he said. The facial expression of the man in the balcony suddenly changed from one of unbearable pain into one of uncontrollable mirth. "Ha, ha," he roared, shaking with laughter, "it never fails. There's always a man named Smith."

deep as a well

Make a sentence with word "fascinate" thus: I have six buttons on my shirt, but I only fasten eight.



"You snake in the grass !!xx— Amseray xx - - ——" and thus did Saint Pat drive the snakes out of Ireland. We wonder whether it was the reflection, the pipe, or Saint Pat himself which caused the snakes to jump into the ocean.

spring

We might ask the riddle, why is a good bed like this season of the year; and then answer, because it's spring. But we won't. It's too old.

Nevertheless, some peaceful and serene sights may be seen these days (and nights) if you know where to look. Some evening drive along the river drive and see if you can catch a glimpse of a beautifully illuminated house boat cruising the placid waters of the Mississippi.

It comes up from the distance, a silent, moving body. It nears and you hear the big water-wheel churning the water as it propels the boat along. Then it is past and the sounds die away, but the star-like lights continue to emit their peaceful rays till they are hidden by some bend in the river.

This monstrous floating vehicle gives one the idea to paint up the dusty canoe and skin down the river too. There's nothing like it, except maybe floating a toy boat in the bathtub.

it's still a still

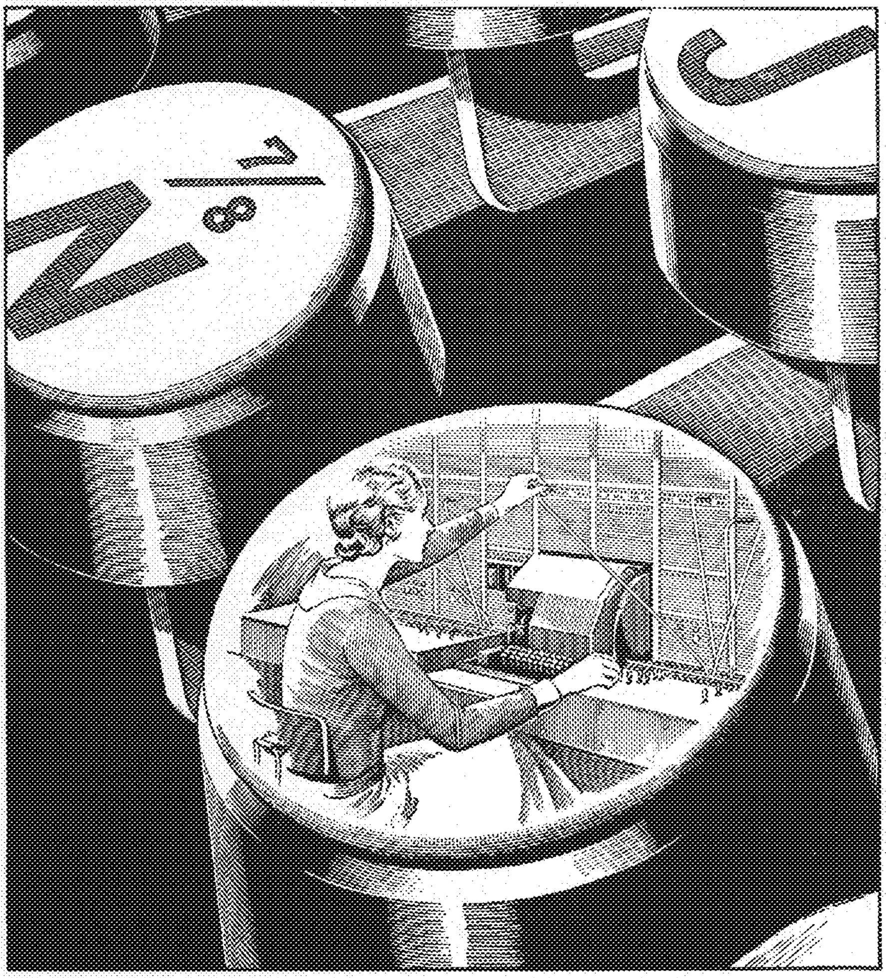
In Doc Mann's chemical engineering class a discussion was in order with reference to this now very important piece of chemical apparatus—stills. The doctor was explaining how the still could be preserved by adding bars of zinc to react with a certain otherwise harmful mixture. In conclusion he added, "And by so doing, gentlemen, you save your still—and it's 'still' good."

Just another teacher that likes puns with his lectures, eh?

caps and gowns

When ye mighty seniors promenaded May 11 in all their infinite glory to the grand finale in the act of cap and gown day convocation, strange sights were visible to the naked eye.

Marchers ranged from young to old, and how! One of them was seen to be carrying a baby, although not through the whole parade. Another could barely keep up with the aid of a stout cane. Of course there were the usual youngsters. And for all we know, there might even have been a father and son in the procession. Such is the course of a college education.



Another aid to business

. . . a *Teletypewriter* "Central"

Working out new ways to serve the communication needs of the public is an objective always in the minds of Bell System men. The new Teletypewriter Exchange Service—typing by wire—is an example.

For some years Private Wire Teletypewriter Service has speeded communication between separated units of many large organizations. Telephone men—anxious to make this service more widely useful—have now established Teletypewriter central offices, through which any subscriber to the service may be connected directly with any other subscriber. Both can type back and forth—their messages being reproduced simultaneously at each point.

This new service provides fast, dependable communication and does for the written word what telephone service does for the spoken word. It is one more Bell System contribution to business efficiency.

BELL SYSTEM

TAKE A TRIP HOME BY TELEPHONE
. . . TONIGHT AT HALF-PAST EIGHT!

AROUND THE CAMPUS

Quad-Honorary Banquet

Four honorary engineering fraternities gathered around the banquet table at the Radisson Hotel last week. The toastmaster, Professor Harlow C. Richardson, introduced the representatives of each fraternity who in turn presented the respective spring quarter initiates.

Donald Leslie, president of Pi Tau Sigma, introduced Leander J. Fischer, Helmer E. Hanson, Russell W. Johnson, Clifford N. Sonnesyn, and Honorary Member Professor C. A. Koepke. Raymond E. Milner, president of Eta Kappa Nu, introduced John M. Clarey, Jennings F. Johnson, Stanley M. Norris, and Laurence E. Peterson. John C. Hubbard, president of Chi Epsilon, introduced Robert L. Fefferman, Goodwin H. Holmquist, Roy E. Karlen, and Lewis F. Martin. Kenneth Sundberg, president of Tau Sigma Delta, introduced Gordon M. Comb, and John R. Bergan.

Dean O. M. Leland presented the 1933 awards to sophomore engineers having outstanding scholastic averages. The Eta Kappa Nu prize was awarded to Homer Hagstrom. The Pi Tau Sigma prize was awarded to Harold Shaw. The Chi Epsilon prize was awarded to Edward Silverman. The major address of the evening was given by H. L. McCracken, who gave a very interesting talk on current economic topics.

A. I. E. E.

Spring elections resulted in the placement of the following students as officers of A.I.E.E.: Chairman, S. I. Pearson; Secretary and Treasurer, W. Hartman; Vice-Chairman, R. Qually.

On May 15, the group took an inspection trip through the Western Union Telegraph Company. Electrical engineers acted as guides, answering the questions of the students. During the time of the visit, traffic was heavy due to the stock market quotations.

Ray Qually, chairman of the float committee for Engineer's day, has designed an interesting float. The details of construction and the type of float are being kept secret, since the idea is so unusual.

During the last week of this month, the annual banquet will be held in the Minnesota Union. This will also be the last meeting of the year, and a very interesting program is being arranged.

A. S. M. E.

The local student chapter of the American Society of Mechanical Engineers was represented by four delegates at the regional convention in Chicago on April 28 and 29. Roy King headed the delegation with Frank Ventura, Irving Pratt, and Philip Hedback as delegates-at-large.

On April 25 Dean A. A. Potter, national president of the A.S.M.E., spoke before the local branch and also announced the winners in the local A.S.M.E. contest. Don Leslie won the first prize of $25 and an engineering handbook for his paper on "The Gyroscope in Marine Work." Gayle Priester's treatise on "Temperature Control for Human Comfort" was awarded the second prize of $15 and a handbook, while Frank Ventura won $10 and an engineering handbook for his paper on "Water Power Development in Minnesota."

Phi Lambda Upsilon

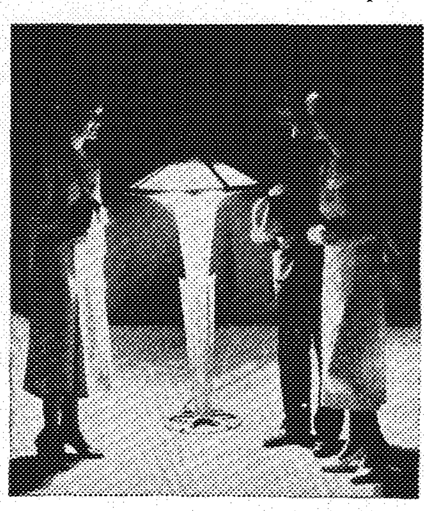
Phi Lambda Upsilon, honorary chemical fraternity, announces as its initiates for the spring quarter the following: Henry C. Reitz, Melvin Calvin, Oscar Skovholt, Harold P. Lundgren, John W. Nelson, Frank S. Griffith, Anthony Juettner, Delbert F. Jurgenson, Glenn E. Ullyot, Charles Morrell, Everett J. Hoffman, George A. Lorenz, Russell Denyes, William D. Larson, David C. Grahame, Charles E. Calverley, Edward W. Kaiser, Robert C. Conary, Arthur W. Wishart, Ross A. Gortner, Jr., Sigmund Jacobs, Hilary Jozwick, Gordon F. Lindner, Russell A. Nelson, Henry W. Rahn, Frederick D. Schmalz, and Stanley J. Shima.

The Scholarship award made annually by Phi Lambda Upsilon was presented this year to David C. Grahame. The prize, consisting of fifteen dollars, is given to that sophomore in the school of Chemistry whose work for the two years has been most outstanding.

This Month's Cover

This month's cover design done by Russell Williams shows the famed patron saint of the engineers, St. Patrick, in a pose that brings memories of old Irish legends. St. Patrick who is regarded as one of "the three wonder-working saints of Ireland" was once a slave boy who herded on the slopes of Sliabh Mis (Slemish) the flocks of his master. He was abducted at the age of sixteen and carried off into Ireland, where he was a slave for six years. His life was devoted to missionary work in Ireland. It shows courage and devotion to high ideals. He is a fitting example for the patron saint of engineers. The legend goes that he rid Ireland of all its snakes. The cover design gives a clever interpretation of "St. Pat" doing his good turn for the Irish.

Odd Mushroom Lamps



Visitors to the Century of Progress, in Chicago, will walk about in a shallow sea of colored lights—all the colors of the rainbow—created by new "mushroom" luminaires. More than 2000 of these new units are being built in the Cleveland lighting division of the Westinghouse Electric and Manufacturing Company for this purpose.

The "mushroom" luminaire consists of a short aluminum stem on which is mounted an inverted cone of translucent Micarta. Concealed under the cone is a set of refracting prisms surrounding an electric lamp. The height from the ground to the lower edge of the Micarta cone is 45 inches and the cone is 30 inches in diameter. The light directed by the refracting prisms to the grass and pathways will be ordinary clear light, while that transmitted to the eye from the cones will be of low intensity in glowing colors. The "mushroom" will be spaced approximately 80 feet apart and the sensation of walking about, in an aura of color emanating from sources close to the ground, will be mysterious in the extreme.

Duluth Junior College Notes

ENGINEERS at Duluth Junior College had their "day" on May fifth. Those in charge of arrangements were: Sylvester Laskin, general chairman; convocation, Marvin Bennett and Robert Rhode; afternoon dance, Millard LaJoy; evening cabaret, Arthur Wright and Frank Hickory; advertising, George Pearson and Horace Newton. This year's king, selected by unanimous vote of the Engineers' club, was Carlyle Burton. His queen for the festivities was a sophomore, Marjorie Williams.

Activities for the day were started Friday morning, at which time the king and queen occupied seats of honor at the convocation. The hour, in charge of engineers, included the formal introduction of the festival officers as part of a cabaret scene, a short skit and music by LaJoy's Royal Collegians.

Attendance at the city-wide afternoon dance sponsored by the engineers was far above expectations. The two Duluth high schools, always bitter rivals, assisted with the dance program. Such a "mixer" fulfills the long felt need for such an activity. An admission fee of two dollars per couple did not discourage attendance at the Engineers' Cabaret, climax of the day's activities. The event was held in the ballroom of the Spalding Hotel, Friday evening.

* * *

The "Blueprint," engineers annual, has put up a bold front and decided to fearlessly publish the idiosyncrasies of the faculty members of Duluth Junior College. The publication, which will appear about June 1, will be thirty cents per copy. News of junior college alumni will be greatly appreciated by Arnold Cohen.

Junior College Researches

Two research projects, unusual for a junior college, were completed recently under the direction of Charles J. Cosandy, instructor of physics and electrical engineering. The first of these, a test of the audibility range of a large number of persons, was conducted by Carlyle Burton, Arnold Cohen, Sylvester Laskin, Ray Nelson, and Arthur Wright. Approximately one hundred persons—mainly psychology students—were tested for audibility at each of a number of frequencies which covered the entire range of human hearing.

The procedure, in brief, was as follows. The output of an audio oscillator was controlled by an audibility meter to determine the point at which each frequency was "just fairly audible." After the audibility values were plotted logarithmically against frequency, the average curve of all the tests made was compared with the normal curve of audibility (from Wegel and Fletcher—pioneers in the field) to determine the necessary corrections for each curve—made necessary by the resonance points of the apparatus. A copy of his own audibility curve, together with a copy of the normal curve, was given to each person undergoing the test, and several volumes of the complete report were made. One of these volumes will be placed in the college library.

The second project, conducted by Arnold Cohen and Carlyle Burton, was an investigation of the characteristics of a photo-electric cell. Foot-candles of illumination were plotted against amperes of current passed by the cell. The amperage was measured with a moving-coil galvanometer. Curves were made for several operating voltages, all of which showed nearly linear characteristics. When the illumination was held constant, and the current plotted against the voltage, a hyperbolal was formed whose asymptotes were zero current and the voltages at which the vapor in the cell became ionized—the flash-point voltage.

"The Technical Man Sells His Services"

Reviewed by ROBERT MARSHALL, E. E. '34

TIMELY methods for obtaining engineering jobs during the depression are presented in a most interesting manner in a book entitled "The Technical Man Sells His Services" by Edward Hurst and published by McGraw-Hill Book Company, New York. A private edition of the book was published as an experiment by the Massachusetts Institute of Technology last December and the chairman of the placement committee of the Institute reported the following:

"Though still too early to measure its effectiveness, we feel that Mr. Hurst's book relates itself to the needs of the engineer more closely than any other available material. We are looking forward with interest to the final results of this experiment and are confident that the author's specific suggestions will prove of real value to our students.

"We have been impressed with Mr. Hurst's extraordinarily wide experience in the placement of technical graduates as well as the unusual efficacy of his methods, particularly where they have been employed by men who have complemented a technical education with industrial experience."

Avoiding generalities, ballyhoo, and academic theorizing, the author shows the reader how, by selling his services instead of asking for a job, he can convert the employer's "no" into a "yes." "One of the chief errors made by technical graduates in seeking jobs," Mr. Hurst says, "is that they fail to apply to their own situations the methods of analysis and study that they have spent at least four years to learn." "Too many men," the author says, "merely apply for jobs; they fail to 'sell' their abilities and training; they do not study the organizations to which they apply for jobs to find the position or activity in which their training will make them most useful; they fail to examine themselves from the prospective employer's point of view."

Mr. Hurst declares, "Make no mistake, he is searching for exceptionally competent help. He has plenty of troubles and plenty of unsolved problems. He will meet you more than half way if you first go your half. It will be a great relief to him not to be required to dig out of you pertinent data indicative of your value to him. From this point of view you are more of a problem than you might imagine. In spite of your best efforts to reveal, and regardless of his best efforts to determine, your maximum usefulness may remain hidden. The chances are he may mean it when he says he is sorry that he cannot use your services."

Throughout the book Mr. Hurst emphasizes the point that employers hire technical men because they expect to make a profit on the training and abilities of the men they hire. It is up to the applicant, the author adds, to show any prospective employer that he will make a profit by hiring the applicant. The profit may come from improved production methods, improved purchasing plans, new designs or from any other source, but a profit must be shown, before employment can be expected.

"There are many college men utterly unable to solve their own personal employment problems, yet possessing ample ability to perform infinitely more difficult tasks, and it is for them, principally, that this book is written."

SCIENCE SPEAKS

[*Continued from page 227*]

tory and development, and logical methods and arrangements for presentation of material, were made. Cooperative meetings with domestic and foreign industries, educational institutions and government representatives, and the organization of representative industrial groups to assist in the arrangement and selection of exhibit material have been among the duties of those associated with the institution. A large amount of historical and modern exhibit material has been collected and much has been prepared for exhibit.

A brief description of some of the exhibits already prepared or planned for each sequence will give a clearer picture of the general appearance of the completed museum. Under the classification of Fundamental Sciences come mathematics, measurements, weighing, gravitation, heat energy, electricity, and magnetism; sound and music; optics and optical instruments; the subject of astronomy, not as it relates to the universe, but as it affects science, and its application to industry. The Hall of Timekeeping will contain exhibits of ancient chronometers, as well as the most up-to-date time pieces, and will show the principle upon which all time mechanisms are based, and the importance of timekeeping in modern life. Exhibits will also show how industries have been developed from the principles of fundamental sciences; as examples, the optical, music, photography, and radio industries. Chemistry like physics will have experimental exhibits to show the basic principles of chemical reaction, performed by the visitor.

Following fundamental sciences come basic materials, and geology with mineral industries will be first under this classification. Geology, like astronomy, will be represented only as it affects industry. Here will be demonstrated the formation of mountains, low lands and rivers, and their relation to mineral deposits. Agriculture, the oldest of all industries, will follow geology, and its history will be told by dioramas depicting agricultural life of earliest man with his crude implements down through the ages to modern times. Historic reapers, plows, and other forms of farm machinery, as well as the modern tractor, will tell the story of progress in agriculture.

Motive power follows the fundamental sciences and basic industries. The story of man's use of nature's resources to do work will be told in this sequence. Starting with the earliest forms of power, the inefficient water wheel, Newcomen and Savery's clanking steam mine pumps, and passing down to the latest type of steam and water turbines, the development of generation, distribution, and transmission of power in the different forms will be told.

Eighty thousand square feet of space has been assigned to Transportation, and there will be exhibited the many different ways that have been used since primitive times to get somewhere in a hurry. The subject of transportation has been sub-divided into road, water, rail, and air, and each will be treated separately. In the case of land and water transport, the development of road and right of way will be shown with the evolution of vehicles. In the Hall of Transportation will be included exhibits of historical and modern locomotives and cars. Full sized originals and replicas of famous locomotives, including a replica of Stephenson's "Rocket" will be exhibited here.

In the area assigned to Graphic Arts and Communication will be exhibits depicting man's long and laborious ascent from the period when the printer used a hammer and chisel for type and a stone slab for paper; when no one worried about bringing home the evening news. A replica of Franklin's printing office will be seen here. The progress of signalling from earliest times down to modern radio-telephone will be shown by exhibits, most of which will be operable.

The concluding sequence in the Museum will be "The City." The development of the city from its earliest form of a group of crude cave dwellings to the modern metropolis, which uses as tools, the multitude of industries and services, examples of which have already been touched upon. Neither the modern city nor a single one of its units, as for example, the skyscraper, would be possible without steel and its alloys, concrete, electric power, rapid transportation (both vertical and horizontal), water supply and sewage disposal, and many other products of today's industry and engineering; a fact which will be brought out in this section. Finally, city planning, its economic aspects, its modern problems of commerce, transportation, traffic, housing, and zoning will complete the story. The museum thus aims to produce what it believes to be a unique method of combining entertainment and education.

JUST REMINISCING

By MORRIS COHEN

LADIES and gentlemen! Look on and marvel. The greatest electrical creation of 1933. The tin can motor that runs on ether waves, no more—no less!" The exotic blonde gazed wide-eyed at the gilted tomato can spinning crazily around on the green table.

"What do you call that—thing?" she fluttered.

I started. We had always called it just the "tin can motor," never attempting to devise a six-cylinder name for it, but I couldn't disillusion sweet nineteen. The devil! As I looked into her languishing eyes, I fumbled in thin air—in despair I stuttered "Cosmo-polyphase-proton-beta-motor." The blonde paled, gasped, "Good God!" and faded away.

Her boy friend was still incredulous. "It works by ether waves, does it?"

"Absolutely!" (I believed it myself by this time.)

"Aw, I don't believe it."

He wasn't the first one who had said that, so I carefully assembled my arguments. Raising the revolving can from the table, I proceeded to pour forth a veritable stream of faultless arguments.

"Please note, this motor has no material connections."

"Yes—."

"Therefore its source of energy must be in the form of radiations in the surrounding air."

"Yes—."

"These radiations are caught by this antenna system—over here—carried to this polarizer which converts the cosmic radiations from the ether into a form of energy applicable to this machine. Now you see?"

"Aw, I don't believe it."

The loud crackle of the high tension apparatus suddenly filled the lab and my audience hurried over to watch weiners roast under a hundred thousand volts.

Feeling in need of physical exercise, I started throwing water pipes at the ton electro-magnet, but after finding my last quarter sticking to the thing, and my watch running backwards, my yearning for exercise was quite satisfied.

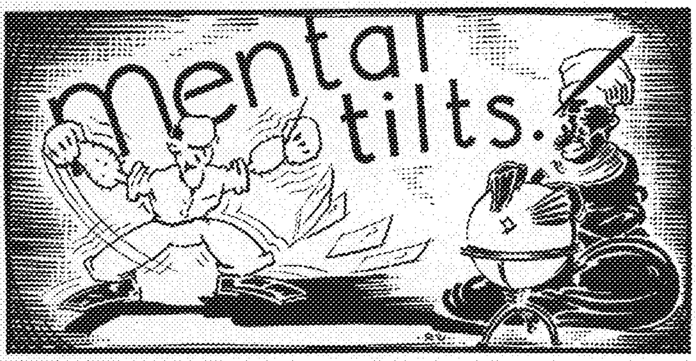
So downstairs to wash up and dropped into the combination foundry and beer testing department. There the lead-melter, goggles in hand, was lecturing in profoundly technical verbage to a wide-eyed audience of high school youngsters on the operation of electric furnace. After respectfully paying my due full minute's attention to the lecturer, and pocketing a few lead souvenirs, the interesting display of chemical glassware in one corner of the room attracted my eye, and the close by glasses of beer attracted much more. A little coaxing, a hearty gulp of the amber fluid, then it was obligingly explained that the beverage was a solution of brown sugar and hydrochloric acid. I staggered out—.

Upstairs in a little room two fellows were spreading their favorite orchestras over a dancing screen. One could actually see what a battering effect some music has upon the eardrums.

I wandered back to the lab. The mechanical robot was getting his share of the excitement. It was getting late, and Throckmorton Tweep was showing the effects of the unusual day's activities. "Start-the-train," and the train would start off and jump the track. "Rock-the-baby-carriage," but for some reason the buggy would stick. "Turn-on-the-radio," but the radio would require a few minutes to warm up; the audience couldn't tolerate that. "Add-two-plus-two," and Throckmorton Tweep would get his fingers stuck in the dials and ring up 94 instead of 04; everyone would chant, "Ain't he dumb!" Then someone would shout into the microphone, "Add-two-plus-nine-minus-four-times-six-plus-seven," and the poor fellow would shake on his chair and ring up some number not more than 99 off. Fearing the audience would totally condemn this mechanical genius, I asked Mr. Tweep if he had tasted the new beer. Receiving in response a waggling of the head meaning either yes, no, or maybe, I succeeded in convincing the crowd the robot was drunk. Upon asking him the alcoholic content of the new beer, he immediately rang up 3 (pause) 2. I offered up a prayer of thanks. I knew the fellow wouldn't fail me on that point. Then again and again—ad infinitum—"Start-the-train," "two-plus-two," "rock-the-baby-carriage," "two-times-two,"—until poor Tweep's head dangled from exhaustion.

Eventually the crowd began to dwindle; exhibits were deserted, the show was over.

I plodded down the stairs, out into the rainy night, muttering to myself—"two-plus-two"—"start-the-train"—.



TO David Keros, sophomore engineer, goes the year's subscription to the TECHNO-LOG for his solution to last month's Mental Tilts. Although they were turned in almost two weeks after the distribution, his solutions were the first (and only) correct ones received. As the business manager isn't feeling very kindly towards the present swing of the financial pendulum, the award of a year's subscription will again be offered for the first correct solution to this month's tilts.

THE SHADOW ON THE WALL

THE other night as one of our disciples of St. Pat was coming home from a bit of whoopee with the boys, he noticed that his shadow, as it fell on the wall directly across his path was acting as no other shadow should. He stopped to investigate and found that the light forming the shadow was 40 ft. from the wall and 10 ft. from his path. If he were 30 ft. from the wall and walking at a rate of 12 ft. per second toward the wall, at what speed was his shadow moving along it?

ROPES AND TREES

If a rope is tied from the tip of a tree 60 feet high to the bottom of a second tree 20 feet high and another rope is tied from the top of the second tree to the bottom of the first, assuming no sagging in the rope, how far from the ground will they meet?

Answers to April Mental Tilts

OSCAR'S DOG HOUSE

The ridge of the house must be 24 inches from the floor for a maximum volume per square inch of roof.

EXPONENTS

989 raised to the 330th power has 989 figures.

CIRCLES

The diameter of the second circle will be increased 1.59 inches.

Iron Horses in the Army

[*Continued from page 225*]

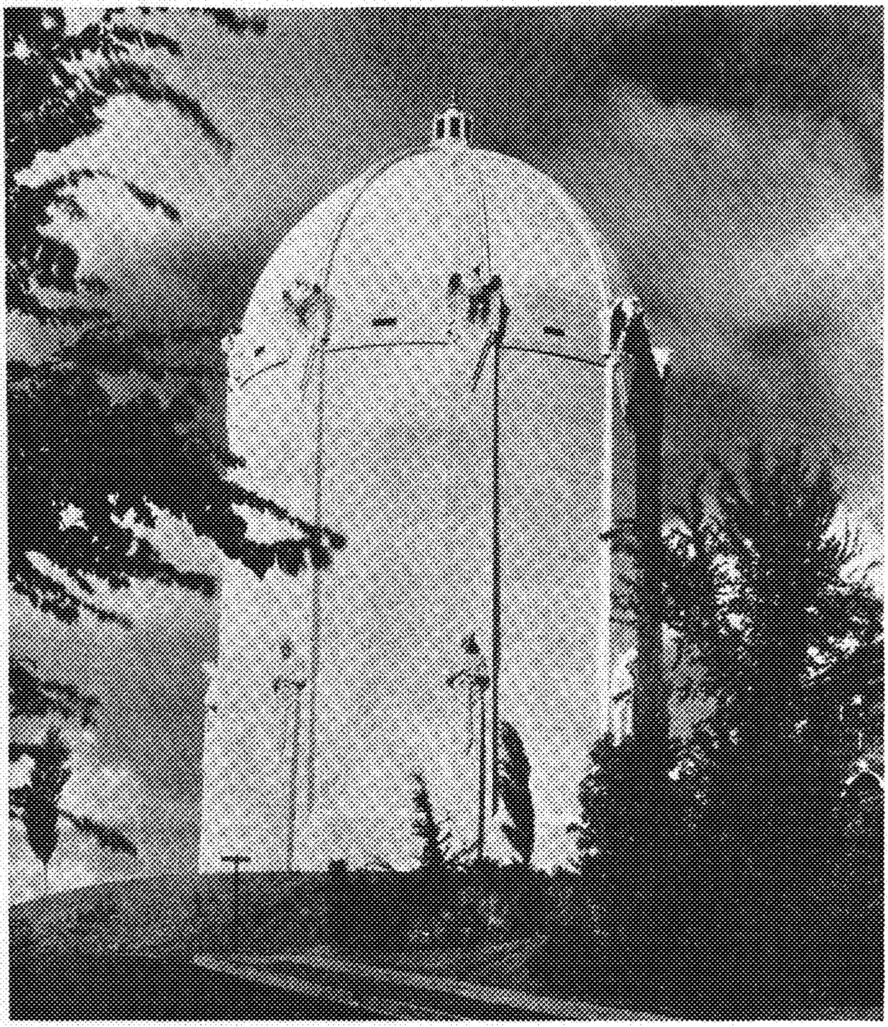
two-ton capacity, pneumatic tired, with duals on the rear, are driven on all four wheels, which gives considerable cross-country ability, and are capable of a sustained speed of 45 miles per hour. The light repair trucks are of one and one-quarter ton capacity, four-wheel drive, and powered with a Franklin air-cooled engine. All of these vehicles carry a gasoline supply sufficient for a run of two hundred miles.

From an engineering point of view greatest interest is attached to a comparison of military automotive equipment with civil equipment. Generally speaking, commercial vehicles will not answer military requirements. From the foregoing discussion you have noted that several commercial types are part of the present equipment, but that these were designated as substitutive. That is, they are the most suitable vehicles at present available. You have noted, also, that there are two general classes of vehicles: combat and supply. Of course, there is no civilian counterpart of the combat vehicle. That is the principal reason why the development of standard types of fighting cars is slow. The experience of battle, the proving ground for combat vehicles, is lacking in peace time. Leaving out of consideration arms and armament, fighting vehicles must possess tremendous strength and ruggedness and must be able to negotiate all types of terrain. The former implies weight beyond what would be dreamed of in a commercial vehicle carrying the same load. The latter implies tractive ability greater than a wheeled vehicle can attain. To meet this requirement the vehicle must be of the track-laying type.

The matter of its spring suspension is of the greatest importance, since it should maintain a generally level position while passing over obstacles. This is accomplished in the combat car by a relatively long wheel base and individually suspended wheels over which the track rides. For purposes of greater speed and economy of operation, combat vehicles are built with detachable tracks so that they can be operated on wheels when tactical consideration permit.

It would seem at first glance that standard commercial vehicles could be used for cargo or supply purposes. To a large extent they can, and will be, especially in the zone of the interior and in Quartermaster trains. However, the fighting units require overpowered cargo vehicles and those with much greater tractive ability. Aside from Western Europe, it is seldom that we may expect to fight in an area completely supplied with hard-surfaced roads. Even under such conditions military operations of regimental units will require their supply over secondary roads, trails, and across country. The concealment of vehicles from the air, bivouacs, and concentrations of supply vehicles all require cross-country operation. From experience we are convinced that all military wheeled vehicles must be front as well as rear driven. Also their chassis weight, in comparison with cargo capacity, will always be proportionately greater than is the case with commercial trucks. The present standard program of the Quartermaster meets these requirments. Although commercial stock vehicles are not standard, all parts for military vehicles are standard, and the assembly of trucks can be immediately undertaken by a number of manufacturers, using commercial standard unit assemblies, whenever an emergency demands. There is an annual procurement of a small number to meet peace time needs.

A mechanical cavalry regiment is a self-contained tactical unit. It provides for its own information and security, its own striking power and holding power, its own command, communications and supply. It is the Army's effort to adapt to military use the latest products of science and invention in the automotive world. Cavalry's job has not changed. It did not change with gunpowder. It did not change with the machine gun. But its methods did change, and they are changing now. Cavalry's job through the centuries has been to fight—to strike hard and swiftly at the crucial time in battle. But conditions have frequently been such that horsed cavalry was unable to carry out its task. We expect that mechanization will be, at least in part, an answer to the problem of the proper equipment for cavalry, to enable it to carry out its primary mission—mounted combat.



—Courtesy Hardinge Company.

In the Washburn Park residential district of Minneapolis is this one and one half million gallon water tower. Concrete and reinforced steel are combined here in such a manner that the steel rather than the concrete carries the stresses created by internal loads. This method, developed by Mr. W. S. Hewett, structural engineer of Minneapolis, provides for the stressing of the steel after the concrete is poured, by means of turnbuckles in steel bands imbedded within the concrete.

The University Flying Club

[Continued from page 231]

at the end of approximately five hours; in some cases they were able to solo at the end of three and one-half hours, but due to the insurance stipulations, the company would not let anyone solo before the expiration of six hours of dual training. At the end of six hours, the boys solo, and have about two hours of solo flying left, for the original price of sixty-five dollars.

The success of the club has been so encouraging that in the spring group we expect approximately twenty more students to take flying instructions. The membership of the club is open not only to students in the Department of Aeronautical Engineering, but also to the entire student body of the University, provided each applicant is investigated and accepted as a member into the club. We have one girl in the club, who is a Junior in the Department of Aeronautical Engineering, Miss Jean Barnhill, and she has proved herself to be the most well adapted to flying in the group. She is going further to obtain her limited commercial pilot's license.

It Wasn't Told to Me —
I ONLY HEARD

In one of the beginning classes in Chemistry there is a young lady student who wore a very thin and wispy dress to the laboratory. Forthwith, the assistant, whose initials are E. L. P., spent a large time of the period helping the young lady, and in the time not spent helping her, he observed her from a distance in such a position that the brightly lighted window was on the other side. Furthermore, the whole proceeding was noticed and commented on at intervals during the afternoon by none other than Dr. Pervier.

▼ ▼ ▼

Ralph Peck, assistant instructor in Chemistry is sporting a new (?) Ford which seems to have proved a great success—he has added about ten names to his calling list already. And by "list" we don't mean his class record book.

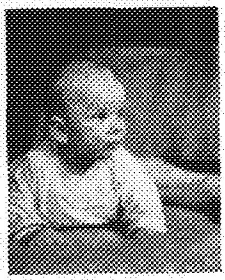
▼ ▼ ▼

Called upon at a Tau Beta Pi banquet to say a few words, Archie Japs seemed to forget what he had planned to say, and in stalling for time decided to offer some information of the election of the day. Said he, "We had to count the votes four times before we were sure the right man won the title of St. Pat."

Then, there are 80 seniors scattered about who don't think the right man won. You remember the vote was 81 to 80.

▼ ▼ ▼

Well, Sam, was it a threat or a dare? But I promised to put you on the razz sheet and there you are.



Well, look who's here! Upon my word, it is none other than Robert Smith, age four months, a little more—no less. He is the first and latest offspring of Harold D. Smith, E.E. '25, manager of the Engineers' Bookstore.

▼ ▼ ▼

Even though grades don't mean everything, how many instructors do you know who use the same system of marking that Mr. Boehnlein does? He claims that when he makes out the grades, he puts down the mark, then looks in his book and finds he's *always* right.

▼ ▼ ▼

Reports of the A.S.M.E. convention in Chicago include rumors about a burlesque show and budding romances fostered through the efforts of the dashing cavalier, Frank V— — —.

▼ ▼ ▼

Some mechanicals have calculated that a student chewing gum uses approximately .006 H.P. during an ordinary lecture. (We didn't know engineers chewed gum—we thought they used tobacco.) However, if this is so, will the M.E.'s kindly calculate how much energy is consumed in the same manner during a quiz?

▼ ▼ ▼

To a feminine contributor who styles herself "The Black Hand's Secretary" we are indebted for some of our news besides the following definition of this bird, the mugwump. It is a creature that sits on a fence with its mug on one side and its wump on the other.

An orchid to you, honey, whoever you are, and how about a clue as to your identity??

▼ ▼ ▼

Accidental spontaneity sometimes provides excellent entertainment, especially when it comes from an inanimate object. Up in the University broadcasting studio Jerry Shepherd was experimenting with some kind of a talking machine that was running, but making no sounds. Just as he finished making a remark about how good his experiment was, the machine spoke up and gurgled, "Even if it was good I wouldn't like it."

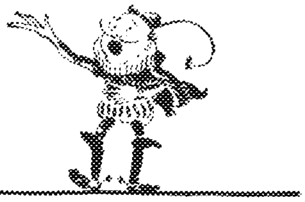
▼ ▼ ▼

Four hours before the deadline, the editor requested one of the lesser members of the staff to write something funny about students who sleep in class. The student came back at him by saying, "I'm asleep too much of the time to notice what's going on!"

▼ ▼ ▼

Sam Rockney, E.E. '34, is still trying to find out who overheard his crack about the two Hammonds and put it in last month's dirt column.

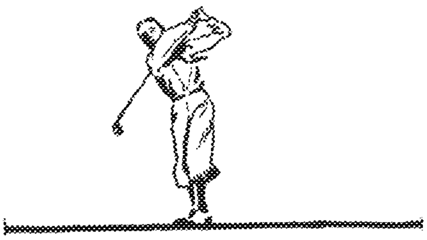
G-E *Campus News*



IN A PADDED CELL

RESEARCH moves in devious ways its wonders to perform. G.E. has a padded cell in its general engineering laboratory at Schenectady—for the isolation of extraneous sounds. Confined in it, at intervals, are motors, fans, and other equipment which serves best when heard least. The cell is a room within a room. The outer wall is of sound-absorbing plaster; then come hollow tile, air space, felt, another layer of plaster, more air space, sheet iron, air space, lathwork, and a thick layer of cotton waste. Total thickness, a foot and a half. Within the chamber a "noise meter" tracks down outlawed decibels.

Last year, the noise meter left its padded cell and traveled to Manhattan's Metropolitan Opera House. Ensconced in a grand tier box next to that of Manager Giulio Gatti-Casazza, it measured voices, orchestra, and applauding hands while "Rigoletto" was sung. The meter discovered that Beniamino Gigli registered 77 decibels,—a street car in full progress makes only 65. Laboratory devices do have their big moments.

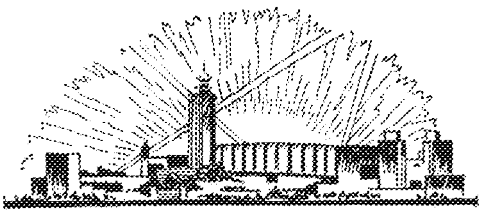


FORE!

"WOW! What a drive! If I could hit 'em like that, I'd sure break a hundred." Just a few comments as a national driving champ smacked a golf ball out of sight. Occasion—the demonstration of a new G-E device for measuring speeds heretofore not measurable because of their nature. The apparatus registered the speed of the champ's club head at 125 miles per hour; an average player is lucky to register 70. No wonder the champion can hit them so far.

The ball is driven from a low platform. Just back of the ball, two parallel beams of light are at right angles to the path of the club head. Each beam hits an "electric eye" or photoelectric tube. A split second before striking the ball, the driver cuts the first beam, and almost immediately afterwards cuts the second beam. Both phototubes operate Thyratron tubes, the first one causing a condenser to begin charging and the second one stopping it. The charge is measured by a meter which is calibrated in terms of miles per hour.

And don't worry about swinging too fast. H. W. Lord, who perfected the apparatus, says it will measure speeds up to about a thousand miles per hour. What a drive that would make! Incidentally, Lord is a '26 grad of the California Institute of Technology.



"A CENTURY OF PROGRESS"

THIS summer, if you go to Chicago, you will visit an Aladdin fairyland; "A Century of Progress" will be the greatest night exposition ever held. You will see a veritable aurora borealis, artificially produced. Walter D'Arcy Ryan, veteran G-E illuminating engineer, is working in Chicago to help make the exposition the most spectacular ever seen. And well qualified for the job he is. An engineer-artist—schooled at St. Mary's, in Halifax—he has directed the illumination for many similar events. When you go to Chicago, you will agree that a masterpiece has been created.

And you should not miss the G-E "House of Magic," the most amazing part of the General Electric display at the exposition. There, recent discoveries and developments of our Research Laboratory will be presented in a fascinating manner. "Bill" Gluesing, a '23 grad of the U. of Wisconsin, will have charge of the lectures and demonstrations. In addition, many G-E machines and appliances in the great circular hall of the electrical building will dramatize the rapidity of electrical progress. We'll see you at the exposition. Remember, it's from June 1st to October 31st.

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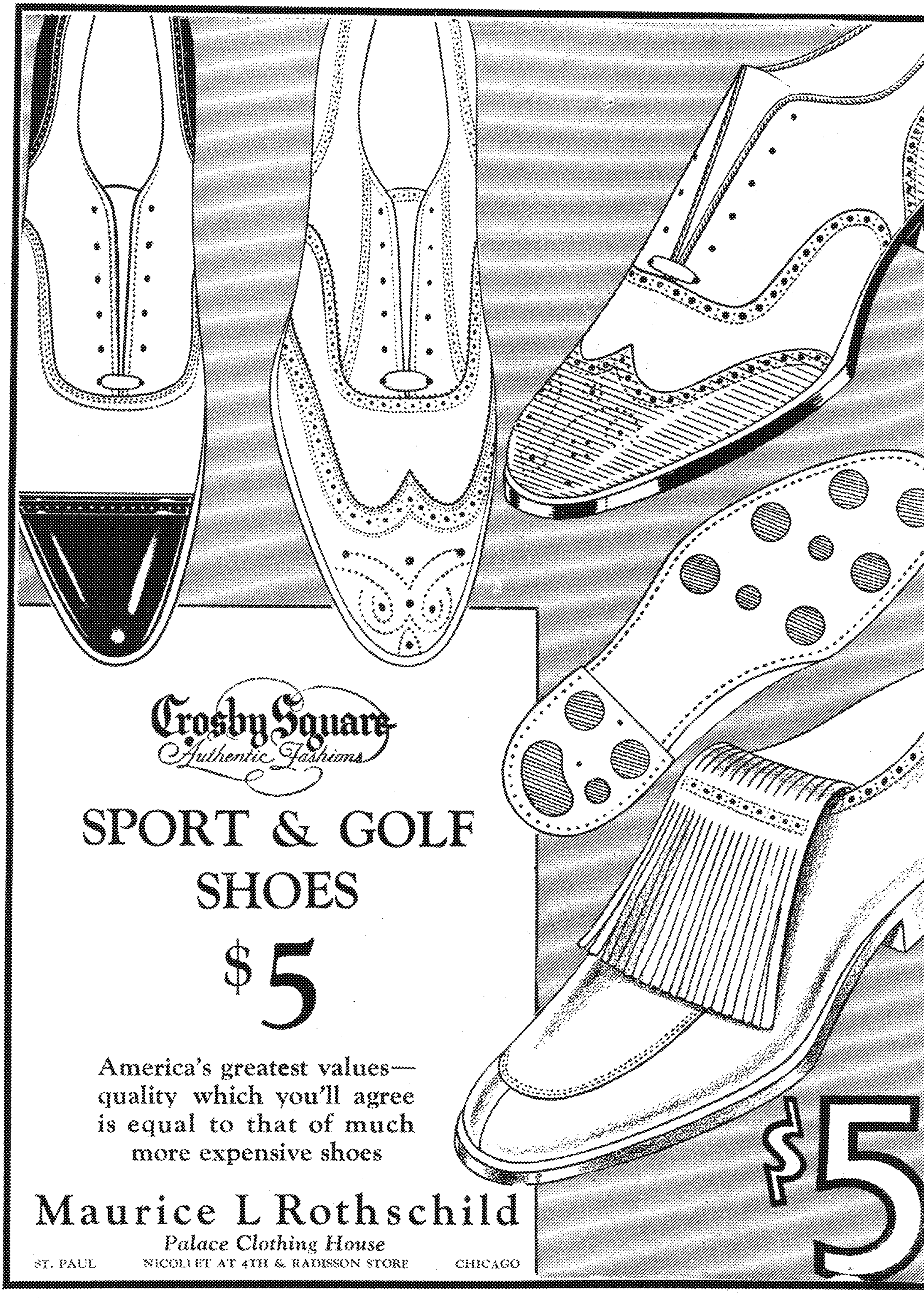
GENERAL ELECTRIC


Minnesota
ALUMNI DIRECTORY NUMBER
WILLIAMS
Member Engineering College Magazines Associated.
JUNE, 1933
Vol. XIII
No. 9


Crosby Square
Authentic Fashions
SPORT & GOLF SHOES
$5
America's greatest values—quality which you'll agree is equal to that of much more expensive shoes
Maurice L Rothschild
Palace Clothing House
ST. PAUL
NICOLLET AT 4TH & RADISSON STORE
CHICAGO
$5

JUNE, 1933
VOLUME XIII, NUMBER 9

Minnesota Techno-Log

37 • ELECTRICAL BUILDING • • • U of M

Published monthly from October to June inclusive, by the students of the College of Engineering and Architecture, the School of Chemistry of the University of Minnesota

Laddy Markus, Managing Editor
Thomes Rogers, Business Manager

THIS MONTH

THE EDITOR SAYS

To our printer, The Lund Press, must go the credit for the fine printing which has characterized this and past volumes of the Techno-Log. To Martin, who has made up the pages of this year's issues to our exacting specifications, and who has worked many nights to get our issues out on time; to Einar, who makes queer noises when we come with some outlandish new idea, but always does what we want in the end; to Wally, who places those brilliant colors upon the covers; to Etta, who must check our ever messy copy and see that all mistakes are corrected, and to Bill Lund, who though he is big chief of the gang, is ever ready to wade in and help when things get rushed—to all we extend our thanks for the hearty cooperation you have given us this year in printing the Minnesota Techno-Log, and we hope you'll be printing our magazine in the same fine manner for many years to come.

MEMBERS OF THE ENGINEERING COLLEGE MAGAZINES ASSOCIATED

Chairman: ROBLEY WINFREY, Engineering Hall, Iowa State College, Ames, Iowa

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	Minnesota Techno-Log	Purdue Engineer	

Entered as second-class matter April 9, 1925, at the post office at Minneapolis, Minnesota, under the Act of March 3, 1879. Office, 37 Electrical Building, University of Minnesota. Telephone, Dinsmore 2760. Contents copyrighted and permission must be secured for re-publication. Subscription rate, $1.50 a year. Single copies, 25 cents. Advertising rates upon application. Alumni Directory, 50 cents.

E D I T O R

1932-33

B U S. M G R.

Laddy Markus

Tom Rogers

LADDY MARKUS, E. E. '33, piloted the journalistic ship of state in good fashion this year, and managed to get out a few issues now and then. The staff really appreciates an editor for whom it is a pleasure to work. Previous to acting as managing editor of the Techno-Log this year and driving a 1929 Ford coach, he served two years on the staff as campus news editor and associate editor, respectively. Laddy hauled off plenty of other honors besides, and is a member of Tau Beta Pi, Eta Kappa Nu, Plumb Bob, Alpha Tau Sigma, and A.I.E.E. Next year Laddy expects to continue burning out vacuum tubes somewhere or other.

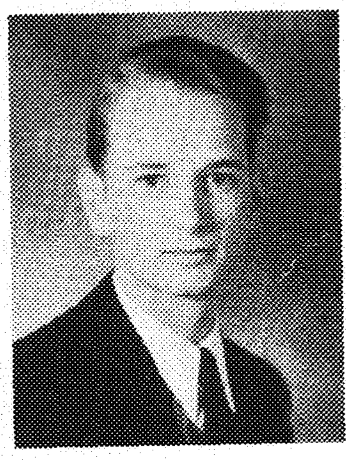
THOMAS ROGERS, M. E. '33, served faithfully as our business manager during the past year. Next year he will be demoted to the position of business manager of the Ski-U-Mah. Amongst the honors garnered by Rogers while at Minnesota are Iron Wedge, Phoenix, Alpha Tau Sigma, A.S.M.E., Techno-Log Board (Pres. 1931-1932), President Junior class in engineering 1931-1932, and Tech Frolic chairman 1933. Tom drives a 1930 Nash, just loves blondes and brunettes, but prefers strong cigars. Next summer he expects to devote his spare time working for a farm journal, now that wheat is up, in "exclusive" territory in Southern Minnesota.

OUR editor next year will be the Hon. Ralph Monson, C. E. '34, who hails from Wausau, Wisconsin. He is fully capable of holding down the job, we can assure you, as he has served on the staff as assistant managing editor, has a good line of bologney, and knows what an em is. Ralph is a member of A.S.C.E. and secretary of Lead Hammer. This summer he expects to attend the civil engineering camp at Cass Lake, and spend the rest of the time wondering how to edit the Techno-Log. Ralph drives a 19?? Chevrolet with an armstrong starter, and spends his week-ends writing reports for C. E. 53—that's his story, anyway.

DAPPER Mr. Gordon Rosholt, Ch. E. '35, has been hooked for the posish as business manager next year. He has been associated with the business end of the game for two years now so he ought to know how to write with red ink. Gordie hails from Chi and is a member of Lead Hammer and Alpha Tau Sigma. He likes blondes—and how—but he says that he likes to take a bath on Saturday night. He weighs 150 pounds, has blue eyes, girls, and drives a 1920 Flivver. Next summer he expects to take in the World's Fair and incidentally, to come back before school starts to sell next year's ads.

Ralph Monson

Gordon Rosholt



E D I T O R

1933-34

B U S. M G R.

THOSE HONORED

Many technical students are included in the annual announcement of prizes, awards and elections to scholastic fraternities

Iron Wedge

Iron Wedge, a senior honorary organization, has elected Tom Rogers and Parker Lowell.

Phoenix

Phoenix, a junior men's honorary organization, has elected Roger G. Bossen, Wes Johnson and Gordon Williams.

Grey Friar

Grey Friar, senior honor society, has this year initiated Malcolm Hope, Alva Kaliher, and Gayle Priester from the engineering colleges.

Silver Spur

Silver Spur, a junior men's honorary group, has this year elected to membership out of the engineering college, Russel A. Baker, J. Goffe Benson, and Earle L. Fredine.

Tau Beta Pi

Tau Beta Pi, the honorary engineering fraternity for all engineering groups, has this year elected to membership Helmer Brockhoff, Paul Erickson, John Hancock, Roy King, Adolph Kupka, Jack Lenhart, George C. Lindquist, William G. Shepherd, Bert Q. Wood, Walter Gustafson, Myron Hall, Laddy Markus, Alvin C. Anderson, Roman Arnoldy, Henry Rahn, Courtland Agre, Roger Bossen, Reynold Caleen, Robert Conary, Edward W. Kaiser, Miles Kersten, S. Ivar Pearson, John Ripken, William Sears, Hugo Shogren, Wilbert Trepp, Ralph Hammond, Gordon Hollingsworth, Marvin Sedam, Edward Kells, William Lundquist, Charles Martin, Ottakar Prachar, and Peter Riede.

The Tau Beta Pi Prize

The Tau Beta Pi prize awarded on the basis of high scholarship and merit to a freshman in the College of Engineering and Architecture, the School of Chemistry, or the School of Mines and Metallurgy was given to *Sherman L. Pease* of the School of Mines.

Alpha Tau Sigma

Alpha Tau Sigma, an honorary journalistic fraternity in the College of Engineering, has this year elected to membership Clayton E. Ebert, Frank Leistiko, Robert W. Marshall, Charles J. McDonough, Ralph E. Monson, James E. Moore, Gordon Rosholt and James E. Weldy.

Plumb Bob

Those initiated to Plumb Bob honorary engineering society, this year are: Norman Carlson, Paul Erickson, John Hancock, Philip Hedback, John Hubbard, Malcolm Hope, Archie Japs, Austin Lange, Laddy Markus, Gayle Priester and Harold Sandstrom.

Bookstore Board

The 1933-34 Bookstore Board will be in the hands of William Collins, Elmer W. Ekroot, Fred Haverland, William Kaiser, and Robert Marshall.

ARCHITECTURE

Tau Sigma Delta

Tau Sigma Delta, national honorary fraternity in architecture, this year elected to membership N. Hillis Arnold, Gordon M. Comb, Helen S. Hammond, John R. Bergen, and Hubert H. Swanson.

The American Institute of Architects Medal

The American Institute of Architects Medal has this year been awarded to Kenneth R. Lundberg.

Gargoyle Club Prizes

The Gargoyle Club awarded its first prize to Robert Hansen, and its second prize to Theresa Wells.

ELECTRICAL

Eta Kappa Nu

Elections to Eta Kappa Nu, honorary electrical engineering fraternity, included: Benjamin Axelrod, Robert L. Carlson, John M. Clarey, Morris Cohen, Joseph Getsug, Ralph Hammond, John Hyvarinen, Orville Jensen, Jennings Johnson, Charles Martin, Stanley Norris, S. Ivar Pearson, Laurence Peterson, and Arvid Turnquist.

Eta Kappa Nu Prize

The Eta Kappa Nu prize for 1933 was awarded to Homer D. Hagstrum, a sophomore in the Electrical Engineering School.

CHEMISTRY

Phi Lambda Upsilon

Phi Lambda Upsilon, a national honorary society in the field of Chemistry has this year initiated Charles E. Calverly, Everett J. Hoffman, Delbert J. Jurgenson, Harold P. Lundgren, Oscar Skovholt, Melvin Calvin, William D. Larson, John W. Nelson, Russell O. Denyes, Frank S. Griffith, George A. Lorenz, Charles E. Morrell, Henry C. Reitz, Sigmund J. Jacobs, Anthony A. Jostner, Arthur W. Wishart, Ross A. Gortner, Hilary J. Joswick, Frederick Schmaltz, Glenn E. Ullyot, Gordon F. Lindner, Russell A. Nelson, Henry W. Rahn, Stanley J. Shima, Robert E. Conary, and Edward W. Kaiser.

Phi Lambda Upsilon Prize

The Phi Lambda Upsilon prize for 1933 has been awarded to David C. Grahame, a sophomore chemical engineer.

Alpha Chi Sigma Prize

The Alpha Chi Sigma prize was won by David C. Grahame of the School of Chemistry.

The Shevlin Fellowship

Clarence L. Moyle has been awarded the Shevlin Fellowship in Chemistry for this year.

Iota Sigma Pi

Iota Sigma Pi, a national honorary chemical society for women, has this year initiated Caroline Chamberlain, Florence Aperry, Isabelle M. Webster, Avis Beyer, Ruth Davis, and Elsie Zohner.

Chemistry Faculty Prize

The Chemistry Faculty has this year honored Frederick T. Wall for his good work during the past year.

CIVIL ENGINEERING

Chi Epsilon

Chi Epsilon, an honorary engineering fraternity in the department of Civil Engineering has this year initiated Alvin G. Anderson, Robert L. Fefferman, Miles S. Kersten, Lewis Martin, John F. Ripken, Hugo T. Shogren, Goodwin Holmquist, Ray Karlen, and Phillip Kilpatrick.

Chi Epsilon Prize

The Chi Epsilon prize in Civil Engineering has been awarded to Edward Silberman.

A. S. C. E. Prizes

The northwestern section of the American Society of the Civil Engineers awarded first prize to Robert Kreise and second prize to Jack Lenhart.

MECHANICAL

Pi Tau Sigma

Pi Tau Sigma, an honorary fraternity in the Mechanical Engineering department, has this year initiated George M. Oraetz, Roy L. King, Morris C. Knight, Donald E. Leslie, Norbert F. Mengelkock, Gayle R. Priester, Donald C. Rollins, Clifford N. Sonnesyn, Norman E. Carlson, Helmer F. Hanson, Roman F. Arnoldy, Clayton E. Ebert, Leander J. Fischer, Russel W. Johnson, Edward L. Kells, Ottakar P. Prachar, Peter M. Riede, and Robert B. Wherland.

Pi Tau Sigma Prize

The Pi Tau Sigma prize for 1933 has been awarded to Harold W. Shaw.

A. S. M. E. Prizes

The A. S. M. E. prizes were won this year by Donald E. Leslie, Gayle R. Priester, and Frank J. Ventura.

Technical Commission

The Technical Commission, whose membership consists of the presidents of the student engineering societies will have for its membership next year Ivar Pearson, American Institute of Electrical Engineers; Lewis Martin, American Society of Civil Engineers; Robert Conary, American Institute of Chemical Engineers; Loyal Domning, Aeronautical Society; and Loren Abbot, Architectural Society.

This MACHINE AGE....

How Can We Meet It

By RUSSELL E. GIBBS

Assistant Professor of Steam Engineering, University of Minnesota

MUCH has been written recently regarding the machine age and the part technological development has played in the present world wide business depression, from which we are just now emerging. There are those in the most radical groups who would do away altogether with machines and labor saving processes. In many parts of this country one sees evidences of this hostile attitude toward machines. Both municipal and state construction are being carried out in hitherto progressive localities by pick and shovel methods while modern machinery lies idle.

The machine has been accused in these bitter times of being responsible for all our economic ills. It has been charged with becoming a heartless cruel tyrant threatening to crush civilization by its ruthless rule. Arguments have even been put forth that the machine is carrying us rapidly toward a complete collapse of our industrial and economic system, and spoken of in terms of unemployment, eviction from homes, debt accumulation, poverty and destitution. Is the machine or those concerned with its development guilty of these stinging charges? Or, has the machine simply presented new problems and thrown us into a period of maladjustment because our social system has not kept pace with the advance of the machine?

WHATEVER the machine has done in the past or may do in the future, there is certainly no substantial evidence that it or technological processes are destined to rule or destroy us. General employment figures show that employment in this country in per cent of population has not decreased during the great machine developments of the past 30 years.

However, many economists argue that permanent displacement of men by technological processes and machines never becomes a reality. New distribution and service functions serve to absorb unemployment, caused by installing more efficient machinery or processes, as the demand is increased by decreased cost of production, so that, in time an increase in capita earning power actually results from increased mechanization of an industry. Our present period is not due to a collapse of our social system brought about by the march of science and engineering, but a period of maladjustment caused by our social system not keeping pace with the machine and its effects on our lives.

STEAM, electric, and oil power and machines driven by these sources have produced cities, provided rapid transportation between distant parts, and have completely revolutionized our everyday life. The automobile has greatly aided in the development of suburbs, affected the growth of villages and towns and is now rapidly changing rural life. The old county boundary lines have been rendered practically absurd, and consolidations of church and school districts have been already affected in many localities.

The machine has been instrumental in the rise of great industrial centers, corporations, and the subsequent problems of regulation and unemployment. What the next development or invention will be few are willing to hazard a guess. One of our greatest industrial leaders believes that we are just entering the age of machines. If this be true how are we to cope with the machine to prevent the recurrence of this or even worse maladjustments in the future? The solution lies in bringing the social system into harmony with the machine development.

Customs and institutions change slowly and fail to keep pace with either technological changes or their effects. County boundaries, school districts and governmental jurisdictions over territories remain as they were originally laid out when distances were thought of in terms of the time it took to travel by horse. In some states there exists thousands of local units, boards and commissions through which society conducts its supervisory and regulatory functions.

Recent tax surveys have shown our tax system, developed at a time w wealth was in farms, to be wholly adequate and fraught with inequal of assessment. And while science technology have been rendering physical institutions obsolete and in quate, the social sciences and every experiences have been showing our toms and popular beliefs to be out harmony with our circumstances.

FOR several generations man fought to protect himself from h ger and cold, and to prevent wild be and his enemies from destroying or rying off what little he possessed. has developed into a creature domina by fear and greed, bent on sav hoarding and investing everything he could to gain a sense of secur Thus he finds himself not in danger suffering from a scarcity of necessi but suffering in the midst of plenty. finds himself in a condition of actual flation of productive security aga want—due of course, to the mach and technological development. M must adapt himself to the new circ stances and begin the battle for hig standards of living on other points the frontier. He must reckon with truths being brought out by the so sciences, sociology, economics and tory.

We must bring our social life in s with the new circumstances. Our so engineering is just where our phys sciences were about 150 years ago. must use a new and different techni in handling our machines considering ways the social or human side of problem. Our social order should be entifically planned and managed benevolent intelligence on the part disinterested men who have the co dence of the people. The special des and vested interests of sections of country must be put aside in the int ests of common good.

These changes are not going to made without difficulties. Social sci tists, experimenters, and engineers need to make their discoveries, formul methods, and develop new social syste necessary to meet and control the m chine, if they are to reap the benefits p sible under its development and prev the recurrence of depressions.

AROUND THE CAMPUS

Cake Icing and Thixotropy

A subject of considerable importance to the house wife desiring to make good cake icing was presented at a recent chemistry colloquium by Dr. Elliot L. McMillen in his lecture on thixotropy. Thixotropic substances are materials which are rendered more fluid by disturbances such as shaking, stirring, and agitation, and upon cessation of the disturbance revert with time to their former consistency. Common examples of this sort are shaving cream, cake icing, and paint. An idea of the practical importance of thixotropy may be gained from the fact that a paint for example in which the thixotropic change is too rapid will show very plainly the brush marks, owing, of course, to the fact that the paint loses its fluidity too rapidly. On the other hand, a paint in which the change is too slow will tend to run. The setting properties of cake icing are also dependent upon its thixotropic nature.

Aside from practical considerations of thixotropy mentioned above, Dr. McMillen discussed the theoretical relationships between plastics and thixotropic substances. From his point of view all plastics are thixotropic.

Power History Added to Engineering Library

In one of the recent additions to the engineering library, "The Quest for Power," Mr. H. P. Vowles gives a simple and connected account of man's endeavor through the ages to augment his own bodily power.

Particulars are given of some of the ingenious devices invented before the Christian era, such as Plato's alarm clock, a coin-in-the-slot machine, a torsion machine gun, and even a taximeter for recording distances traveled in a chariot, in the first part of the book.

"The Age of Power," title of the second part, tells of the earliest known experiments with steam, of the origin of the water wheel and the windmill, of the evolution of the steam engine, and of the development of modern power machinery. Here also is given a general survey of modern practice together with the latest developments in the production and distribution of power.

In the third part past and present methods of winning and treating the fuels and metals without which the power plant as we know it could not exist. The mining and treatment of coal and the manufacture of steel are covered in an interesting manner.

Chemistry Aids Archeology

Problems of a diverse and varied nature, which spring from a lack of understanding of the basic character or property of a substance, are often sent to the School of Chemistry with the hope that some satisfactory solution or explanation may result. Samples and specimens arrive from farms, industrial plants, hospitals, homes and even department stores. In every case some representative object or sample is sent to serve as a clue to the chemist who attempts to investigate the particular problem in hand.

As an interesting example of the type of strange questions chemists are often asked to solve mention might be made of some of the things sent to the School of Chemistry by the department of Anthropology. In preparing specimens for study and exhibition purposes from materials dug up in the Mimbres Valley in Arizona, technicians found many pieces stained and crusted by reason of centuries of weathering, dampness and temperature changes. The problem of removing these stains could not be solved and specimens were therefore sent to the chemists to see what could be done. After some investigational work a satisfactory solution was finally arrived at.

Another instance pertains to the study of bones. Archeologists have no method of identifying or classifying bone fragments. There are often cases when definite information of this nature would be of great value in propounding or establishing theories in the field of anthropology. Samples of bone fragments analyzed in the School of Chemistry indicate that absolutely no information may be gained concerning the age of bones from analysis. However, a very important possibility was brought to light, that of studying bones by physico-chemical methods to ascertain the structure or physical properties of different types of bones. Whether or not investigations along this line ever prove of value to archeology remains to be seen. The facts will survive and add to the achievements of chemical science.

Furniture Manufacturing Made a Practical Study

A course in general woodworking, offered in the department of mechanical engineering, has been completely reorganized by Mr. Richards, assistant professor of woodworking, to meet the demand of engineering students for advanced training in furniture design and manufacture.

The selection and use of materials is stressed and the applications of their use in the construction of domestic and commercial furniture is introduced.

The use of modern decorative materials and their applications to household and office furniture is introduced in the course. Studies are also made of the various mechanical devices used in the application of color blending and surface finishing. Inspection tours of large furniture manufacturing plants will be made to give the students a broader knowledge of production methods.

Mr. Richards stated that the course will be of especial value to architects who are interested in the production of built-in furniture and to engineers who may become teachers of the industrial arts.

"Queen of Sciences" Is in Engineering Library

Another of the recent additions to the engineering library is "The Queen of the Sciences," by E. T. Bell, of the California Institute of Technology. This book is one of a series of volumes by well known scholars of today, published in cooperation with the 1933 Century of Progress exposition, and presenting the essential features of those fundamental sciences which are the foundation stones of modern industry.

In this volume, the development of mathematics is traced through the ages, beginning with Euclid and the other famed Greek mathematicians. Professor Bell, in the introductory chapter, states that "textbooks and treatises are a very necessary evil, but the very crudities of the first attacks on a significant problem by a master are more illuminating to a student of mathematics than are all the pretty elegances of the standard texts which have been won at the cost of perhaps centuries of finicky polishing."

The MINNESOTA TECHNO-LO

UNIVERSITY OF MINNESOTA

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▼ ▼ ▼

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IN PARTING

TO the succeeding editor of the Minnesota Techno-Log I present my congratulations. I know that he will carry out his duties in a commendable manner, and maintain the high position which our magazine now holds in Engineering College Magazines Associated.

To the Techno-Log staff I extend my appreciation for the co-operation which has been so whole-heartedly given me this year. To those especially, who have worked for the joy of working, knowing that recognition of their work could not be given, and to the faculty and alumni, who have so cheerfully co-operated this year with articles and with suggestions, I want to express my thanks.

I have made many changes in the Techno-Log this year, in an endeavor to make it more interesting to the students; I have tried to put out a magazine which was technical and at the same time interesting enough to catch the attention of the busy engineering student, and not catch the ire of the faculty.

I have enjoyed greatly my work upon the Techno-Log, and know that the many hours spent in making up each issue were not wasted—that the experience which I gained in technical journalism and in printing will some day be of great value to me. I have made many new friendships through the magazine—some in school—some in local engineering firms—some in other engineering colleges—and these friendships I will treasure in the years to come.

Now, at the close of my university career, the time has come to say adieu to my university and to the Techno-Log—to the magazine that has done so much for me—that has made the last year of my university work so enjoyable and so profitable.

—Laddy J. Markus.

THE FIRST CALL

STUDENTS! Faculty! Alumni!—to you is issu this preliminary call for suggestions. The Techn Log is published for you. Do you think that this j is well done? Has the Techno-Log contained the ticles which you would like to see it carry? Is th anything which you would like to see added to magazine or taken from it? Your suggestions, yo contributions, and your interest measure the success the work done by the staff.

The work of the newly appointed staff members gins long before the publication of the first issue n October. In fact, many hours of planning and stu have already gone into the makeup of next year's sues. During the coming summer, many more hou in fact, days, of work will be put in by the staff me bers in the effort to make the Techno-Log ful every purpose to the fullest extent.

We want next year's Techno-Log to be so int esting that every reader will anxiously await the p lication day. We need ideas and suggestions from ev reader. Your article, your joke, your idea, or your s gestion is just as valuable to us as those offered by a one else. If you have heard, seen, read of, built, or any other way come in contact with something of int est to engineering students, write and tell us about If you have an opinion of something that ought to done or changed or ought not to be done, write to about it. We need just such suggestions for these e torial columns. Whatever you may know or whate your views may be, jot them down on a slip of pa and mail them to the editor. Thus, and thus only, the Techno-Log really be *your* magazine. Noth can contribute more than some good student arti and student editorials.

—Ralph E. Monson

Corrections and Additions to the

1932 ALUMNI DIRECTORY

for the College of Engineering and Architecture and the School of Chemistry of the University of Minnesota

Engineering alumni are changing their addresses nore frequently than ever before; many addresses which are given today may be incorrect in a few nonths. The Minnesota Techno-Log believes that it vould be folly to incur the expense of publishing an entire alumni directory this year and has, therefore, decided to publish only the material needed to bring the last directory, of June 1932, up to date.

Copies of the June 1932 Directory will be given free to students if they will leave their names at the Minnesota Techno-Log office, and will be mailed to alumni subscribers if they so request.

CHRONOLOGICAL DIRECTORY ADDITIONS

College of Engineering and Architecture and School of Chemistry

1932

Bachelor of Aeronautical Engineering

Anderson, Lester M.
Baak, Albert F.
Breakey, Thomas W.
Burke, John Francis
Clousing, Lawrence
  Adrian, B. E. E.
Gustafson, Lester W.
Harris, Kenneth B.
Hovde, John E.
Jones, Kelyth Glynne
Mokres, John Andrew
Murphy, Frank W.
Newman, Prescott H.
Odell, Raymond Hensel
Peilen, Ellis
Stanley, Harold H.

Bachelor of Agricultural Engineering

Schwantes, Arno R.
Woolery, Herbert M.
Young, Earl Robert

Bachelor of Architecture

Ball, Dean Grayson, B.S.
Beddow, Earl Fredrick
Bloom, Clifford Donald
Bronet, Henri Bernard
Cerny, Robert George
Daley, Harvey S.
Gates, Joseph A.
Green, Gilbert Bingham
Hayes, Mark Nicholas
Jyring, Eino Arthur
Knobla, Bernard H.
Knutsen, Lloyd B.
Koester, William R.
Lampe, Bernard Gerald
Petersen, Earl George
Seashore, Ferris Leo
Skillman, Frank S.
Stenrud, Melvin C.
Wall, Gordon A.

Bachelor of Architectural Engineering

Anderson, David H.
Bailey, John Townsend,
  B. S. in E. E.
Becchetti, Etalo J.
Beddow, Willard G.
Brynteson, Harold R.
Ericson, Adolph Edwin
Fardahl, Nels
Field, Eino M.
Hunt, Don Wilson
Koplen, Clifford H.
McGrath, William L.
Nelson, Raymond A.
Robinson, Richard C.
Thompson, Randal T.
Townsend, George B.

Bachelor of Civil Engineering

Anderson, Robert G.
Bayoff, Alexander
Benson, Kenneth E.
Bodien, Gordon E.
Brockman, Frederick H.
Casey, Joseph Tamney
Dahl, Sophus Manuel
Darling, Wilfred Delos
...kar, Rudolph
Eriksen, Erik Gustav
Fredericks, John Carl
Hallin, Laurence Henry
Hanich, Henry William
Hill, William Crawford
Holmstrom, Helmer A.
Johnson, Clarence E.
Jordahl, Melvin Orlando
Katz, Leonard Milton
Hooper, Roger Bryand
Lehtinen, Arne Vernon
Lein, Olaf, Jr.
McElroy, Wyllys F.
Markkanen, Carl A.
Mellin, Clifford Oliver
Moore, Thomas R.
O'Marr, James Lewis
Pierce, Alton Louis
Russell, Charles J.
Santelman, Walter W.
Schmidt, Milton Elmer
Shepard, Seth F.
Timmins, Gerald F.
Warner, Roy Ferdinand
Weigel, George F.
Whitmon, Edward Gray
Wrucke, Adrian George

Bachelor of Electrical Engineering

Adams, John T., B. A.
Ahlstrom, Elmer W.
Anderson, Allan S.
Anderson, Dean E.
Anderson, George R.
Anderson, Nelson E.
Bloomquist, Walter C.
Brack, Russell C.
Brunetti, Cledo
Brucke, Karl Henry
Christenson, Carl W.
Devoy, Edward H.
Feyder, William John
Gadler, Steve
Galles, Boniface P.
Gilloth, Paul John
Goldberg, Joe
Hanson, Earl Anthony
Hauge, Clifford J.
Hendrickson, L. E.
Huey, John Joseph
James, Vir Norval
Kutzler, Robert John
Linsley, Scott Ellsworth
Lommen, Robert M.
McDermott, Scott J.
Melloh, Arthur W.
Norton, Lowell E.
Olson, Milton Perry
Prideaux, Cyril F.
Risley, Max Irvin
Sahr, Frederick
Sanderson, Harold A.
Sarff, Clifford Lionel
Scheibe, Walter Karl
Sewall, Joseph S., Jr.
Shulel, Frederic Charles
Simpson, Page M.
Specht, Walter A.
Stadtherr, Henry A.
Swanson, Martin G.
Swenson, Ilot C.
Uttley, Gerald P.
Waligora, John Martin
Wallin, Milton Andrew
Waltz, John C.
Waltz, Kenneth W.
Watson, William W.
Westbee, Robert Lyle
Weyer, Herbert
Willox, J. Hebden
Wilson, John Milton

Bachelor of Mechanical Engineering

Altstatt, Raymond C.
Anderson, Clifford O.
Anderson, Harold R.
Anderson, Wilford A.
Appert, John Martin
Backlund, Oscar E.
Berman, Hyman E.
Byrne, John P.
Christoffer, Forton A.
Dowd, James E.
Elfes, Donald R.
Elstrom, Alden George
Erickson, Russell F.
Farchmin, Ray H.
Gartner, Walter Erick
Hagedorn, Erwin S.
Hawkinson, Franklin E.
Hayes, Roger Jackson
Juten, Milford Amandus
Kanniainen, Henry A.
Lander, Robert Masters
Lilia, Albert Emil
Lowe, Howard H.
McDonald, Neil John
Marple, Perry
Miller, Kenneth Henry
Millman, George
Mooney, George Meyer
Norton, Maurice Earl
Parkinson, Lindley A.
Radow, Himan
Smith, Willis H.
Sturgeon, Lloyd Robert
Vonck, Frank J., B.E.E.
Waidelich, Clarence O.
Windal, Sverre
Wood, Rodney R.

Bachelor of Interior Architecture

Bjodstrup, Eugenia L.
Boss, Harlan David
Goldberg, Lillian D.
Kates, Vera
Marx, C. Cheffe
Meleck, Minnie
Ohrbeck, May Edith

ADVANCED DEGREES

1932

Master of Science in Architectural Engineering

Swanstrom, Alfred E. (B. AE 1931)

Master of Science in Civil Engineering

Campbell, Ralph L. (B. CE 1930)
Clark, Kenneth M. (B. S. CE 1927)
Kurzwell, Arthur C. (C. E. 1928 (Cornell)
Murer, Eldred B. (B. S. CE 1930 (St. College of Wash.)
Nowicki, Albert L. (C. E. 1930 (Marquette University)
Thomson, Gordon H. (B. S. 1930 (Texas Tech. College)

Master of Science in Electrical Engineering

Gray, Wesley (B. EE 1929)
Kochevar, John S. (B. EE 1931)
Roe, John H. (B. EE 1930)
Schnell, Louis J. (B. S. EE 1924 (Colorado)

Master of Science in Hydraulic Engineering

Neubauer, Loren W. (B. S. CE 1926)

Master of Science in Mechanical Engineering

Dawson, Eugene F. (B. ME 1921 (Ohio State University)
Martenis, William W. (B. ME 1930)

Civil Engineer

Schroepfer, George J. (B. S. CE 1928, M. S. 1930)

School of Chemistry

1932

Bachelor of Chemistry

Chamberlain, Caroline A.
Johnson, J. Harry
Mark, Arthur M.
Martinson, Lawrence E.
Neevel, Max L.
Noponen, George E.
Peterson, Oliver H.
Yotzy, Henry
Von Fischer, Wm.

Bachelor of Chemical Engineering

Ambrosich, Frank
Beach, William E.
Borken, Gabriel
Clarke, George L.
Condiff, Howard L.
Flanagan, George W.
Foster, Winfield W.
Graves, Harold E.
Hama, George
Hoffman, Maurice B.
Hollman, Ambrose L.
Kaim, Frederick J. H.
Karpen, Raymond J.
Katz, Julius R.
Kempe, L. L.
King, Maurice
Knox, C. Kenneth
McAdam, Robert M.
March, Cecil C.
Meindl, Hugh F.
Michaelson, George
Michalson, Einar R.
Miller, Russell L.
Reiter, F. Leonard
Salo, Paul W.
Schuster, Joe W.
Stein, Alex H.
Taft, George H.
Tenenbaum, Martin J.
Tholstrup, Walter W.
Johnson, Kenneth C.
Peck, Ralph E.
Piret, Edger L.

ADVANCED DEGREES

1932

Master of Science in Chemistry

Elmquist, Ralph C. (B. Ch. E. 1929)
Plummer, Louisa G. (B. A. 1929, Hanover)

Master of Science in Chemical Engineering

Beber, Adolph J. (B. S. 1930, Montana)
Beyer, Frederick C. (B. Ch. E. 1930)
Gernes, Donald C. (B. Ch. E. 1931)
Graves, Harold E. (B. Ch. E. 1932)
Hammer, Edwin J. (B. A. 1927, Augustana)
Jurgensen, Delbert F. (B. Ch. E. 1931)
Miller, Robert M. (B. Ch. E. 1930)
Peterson, Earl V. (B. Ch. E. 1930)
Wakefield, Ray B. (B. Ch. E. 1931)

Doctor of Philosophy

Cameron, Angus E. (B. A. 1918, Oberlin)
Cornell, Lew W. (B. S. Ch. E. 1927)
Gilmore, Keren E. (A. B. 1925, Western; M. A. 1927, Smith)
Larian, Maurice G. (B. S. 1926, Iowa State)
Mitchell, William J. (B. Ch. E. 1929, M. S. in Ch. E. 1931)
Sandell, Ernest B. (B. S. 1928, M. S. 1929)
Smith, Grant W. (B. A. 1928, Grinnell)

ALPHABETICAL DIRECTORY CORRECTIONS

College of Engineering and Architecture

Only those alumni whose addresses have been changed from those given in the June 1932 directory and who have notified the Dean's office of the changes are given in this list. Graduates are urged to send in address changes as soon as possible so that they will be listed correctly in the complete directory which will be published next year.

ABBREVIATIONS

Courses

Ae, Aeronautical Engineering; Ag, Agricultural Engineering; A, Architecture; AE, Architectural Engineering; ID, Interior Decoration; IA, Interior Architecture; C, Civil Engineering; E, Electrical Engineering; M, Mechanical Engineering; G, General Engineering; Ch, Chemistry; Ch E, Chemical Engineering.

Advanced Degrees

CE, Civil Engineer; EE, Electrical Engineer; ME, Mec eal Engineer; MS, Master of Science; MS (Arch), Mast Science in Architecture; MS(CE), Master of Science in Engineering; MS(EE), Master of Science in Electrical Engi ing; MS(ME), Master of Science in Mechanical Enginee ChE, Chemical Engineering; PhD, Doctor of Philosophy.

*Deceased

Abbott, Arthur L. '97 E
Engr., Uniform Legislation Dept., Nat'l. Elec. Mfgrs. Assn., 470 Lexington Ave., New York, N. Y.

Adams, John T. '32 E
Const. Dept., Minn. Highway Dept., Minneapolis, Minnesota.

Ahlstrom, Elmer W. '32 E
Engr., Interstate Mining Co., Hibbing, Minn.

Alstatt, Raymond C. '32 M
235 East Congress, St. Paul, Minn.

Anderson, Allan S. '32 E
Colfax, Wisconsin.

Anderson, Arthur P. '25 E
Asst. Engr., Public Service Co. of Northern Illinois, Crystal Lake, Ill.

Anderson, Clifford O. '32 M
1054 Argyle Street, St. Paul, Minn.

Anderson, David B. '32 AE
4430 Nicollet Ave., Minneapolis, Minn.

Anderson, Dean E. '32 E
Temple Produce Co., Minneapolis, Minn.

Anderson, Frank A. '08 E
F. A. Anderson Mfg. Co., Portland, Ore.

Anderson, George R. '32 E
Municipal Light Plant, Austin, Minn.

Anderson, Harold R. '32 M
Bloomington, Minn.

Anderson, Henry A. '27 E
General Insurance Agcy., 403 Commerce Bldg., St. Paul, Minn.

Anderson, Irving E. '29 C
Jr. Engr., U. S. Geological Survey, Montgomery, Ala.

Anderson, Lester M. '32 Ae
Scarville, Iowa.

Anderson, Lester R. '31 C
Draftsman, Minn. State Highway Dept., Detroit Lakes, Minn.

Anderson, Milton L. '21 A
Architect, 608 Transamerica Bldg., Los Angeles, Calif.

Anderson, Nelson E. '32 E
Russell, Minn.

Anderson, Oscar V. '10 E
Field Engr., Toronto Hydro-Electric System, Toronto, Ontario, Canada.

Anderson, Robert G. '32 C
106 Parkland Ave., Duluth, Minn.

Anderson, Wesley J. '26 M
Commonwealth Edison Co., 3501 South Crawford Ave., Chicago, Ill.

Anderson, Wilfrid A. '32 M
Salesman, Hayden Motor Co., Mpls., Minn.

Appert, John M. '32 M
628 Ninth Ave. S., St. Cloud, Minn.

Ashbaugh, Lewis E. '00 M, '07 CE
Erkard Hotel, 1940 Broadway, Denver, Colo.

Asleson, Hans J. '10 C
Minn. Welding and Construction Co., 1408 Foshay Tower, Minneapolis, Minn.

Baak, Albert E. '32 Ae
Johnson, Minn.

Backlund, Oscar '32 M
Deer River, Minn.

Bailey, Charles N. '31 M
Sales Engr., Gen. Elec. Co., Commercial Refrigerator Dept., O. F. Stuefer Co., Minneapolis, Minn.

Bailey, John T. '29 E, '32 AE
Radio Engr., 1215 Nicollet Ave., Minneapolis, Minn.

Bakken, Lawrence H. '22 A
Mfg. Agent, Bldg. Materials, 4224 Cedar Ave., Minneapolis, Minn.

Baldock, Fred C. '29 M
7900 Frs. Campau, Detroit, Mich.

Ball, Dean G. '32 A
Spec. Agent, Bankers Life, 1015 Tenney Bldg., Madison, Wis.

Banovetz, John A. '25 C
Supt., Foley Bros., Inc., Colstrip, Mont.

Barger, Harold L. '21 E
President, Lab. Elec. Co., 53 West Jackson, Chicago, Ill.

Barthelemy, Carl R. '28 M
Plant Results Engr., Minn. Valley Steam Plant, Northern States Power Co., Great Falls, Minn.

Bayoff, Alexander '32 C
2944 Pillsbury Ave., Minneapolis, Minn.

Becchetti, Etalo J. '32 AE
Hibbing, Minn.

Beck, Vernon S. '10 E
Beck Engr. Const. Co., 2332-38 Pine St., St. Louis, Mo.

Becker, Ward E. '17 E
Chief, Metal Components Dept., Picatinny Arsenal, Dover, N. J.

Beddow, Earl F. '32 A
Huron, S. Dak.

Beddow, Willard G. '32 AE
Panama Canal Zone.

Beeman, Harry J. '21 G
Partner, Harold H. Egan Co., Real Estate, Chicago, Ill.

Benham, Claude F. '12 E, '13 EE
Asst. Engr., Operating Dept., Pacific Gas and Elec. Co., San Francisco, Calif.

Bennett, Walter J. '03 C
Structural Engr., Great Northern Ry., St. Paul, Minn.

Benson, Kenneth E. '32 C
1813 Univ. Ave. S. E., Minneapolis, Minn.

Bergford, Lester M. '23 C
Engr., Cutler Magner Co., Minneapolis, Minn.

Bergh, Charles J. '26 E
Public Service Co. of Northern Illinois, 72 West Adams, Chicago, Ill.

Bergquist, Edwin T. '24 C
Appraisal Engr., Pure Oil Co., 35 East Wacker Drive, Chicago, Ill.

Berman, Hyman E. '32 M
644 Ellwood Ave., Minneapolis, Minn.

Bestor, George C. '24 C
Importer, 1720 James Ave. S., Mpls., Minn.

Bevan, R. Louis '24 C
Construction Engr., Treasury Dept., New U. S. P. O., Cincinnati, Ohio.

Beyer, Randall R. '27 E
Northern Elec. Co., Ltd., Montreal, Quebec.

Bezek, Albert J.
Ely, Minn.

Bingham, Stanley E. '0
784 Linwood Place, St. Paul, Minn. Bingham & Norton, Inc., Motor Cars, St. Paul, Minn.

Bjodstrup, Eugenia L. '3
811 West 3rd Ave., Mitchell, S. Dak.

Bjonerud, Earl S.
Salesman, Gen. Elec. Co., San Francisco,

Bjorge, Oscar B. '0
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SOUTH BEND
McCrady, Archie R. '24 C
Mehandra, Behari L. '24 M
Muessel, Robert W. '21 C
VALPARAISO
Lauritzen, Carl W. '24 E
WHITING
Kuentzel, Ward E. '17 ChE
Malmgren, Richard V. '25 E
Reiter, Alfred A. '25 ChE, '26 ChE
Rogers, Marvin '26 ChE, '27 ChE
Selund, Robert B. '30 ChE

IOWA

ALGONA
Young, Clifford L. '28 E
AMES
Countryman, M. Alden '25 E
Willis, Benjamin S. '17 E
BOONE
Lantz, Reuben S. '25 A
CALMAR
Preus, Christian K. '27 C
CEDAR RAPIDS
Blomquist, Hjalmar F. '07 C
Triem, Ralph H. '20 E
CLARKSVILLE
Cribbs, Harry E. '23 C
CRESCO
Lauh, George E. '31 AE
DAVENPORT
Laupher, Murray N. '24 E
McEwen, Alexander D. '25 E
DES MOINES
Ash, J. Wesley '08 C
Reeve, Howard E. '23 E
Rome, Robert C. '22 E
Sampson, Clifford L. '23 E
Wallfred, John E. '20 M
Weibler, William M. '08 E
Zimmer, William A. '06 E
FORT DODGE
Weatherill, Cedric S. '15 C
INDEPENDENCE
Dunlap, George M. '24 E
LOGAN
Bradley, Byron H. '14 C
MARION
Christianson, Hilmar B. '15 C
MARSHALLTOWN
Flaaten, Percy H. '26 C
NEWTON
Stanius, Godfrey '21 E
OGDEN
Lorens, Edward R. '26 C
SCARVILLE
Anderson, Lester M. '32 Ae
SIOUX CITY
Arzt, Emmanuel A. '97 E, '99 EE
Donauer, Max '18 ChE, '25 ChE
Kab, Benjamin J. '30 C
Williams, Wilbur S. '09 M
WAVERLY
McMeekin, Glenn D. '21 G

KANSAS

BAXTER SPRINGS
Bisek, Peter P. '34 E
ELDORADO
Ayers, Ellsworth B. '25 Ch
PAOLA
Hill, Ralph W. '31 Ae

KENTUCKY

Carlisle
Breeden, James R. '26 C
Dublin
Donahue, Stephen '25 C
Fort Knox
Grau, Robert W. '16 C
Louisville
King, Harvey M. '18 A

LOUISIANA

Baton Rouge
Fieger, Ernest A. '20 ChE, '21 ChE
New Iberia
O'Donnell, Lawrence '26 M
New Orleans
Affleck, Dean H. '28 AE
Hilgedick, Winfred C. '26 E

MARYLAND

Annapolis
Winslow, Harry J. '25 E
Baltimore
Billau, Lewis S. '05 E
Looks, Roger B. '27 C
Rask, Olaf S. '17 Ch, '23 PhD (Stanford)
Schmidt, George H. '12 Ch
Seestrom, Hjalmer E. '28 ChE
Chevy Chase
Kracek, Frank C. '20 ChE, '24 PhD
Dundalk
Peuble, Carl A. '31 Ch

MASSACHUSETTS

Amherst
Markuson, Miner J. '23 A
Boston
Beckford, Walter E. '09 E
Damberg, Rheuben P. '21 A
Evton, Paul F. '27 A
McVean, Norman S. '21 E
Webster, Harry M. '15 E
Brookline
Groat, Benjamin F. '01 G
Cambridge
Bergstedt, Milton V. '31 A
Berman, Florence C. '28 ID
Dietrichson, Gerhard '10 Ch
Kay, William C. '30 ChE
Franklin
Tomlinson, L. C. '04 E
Gloucester
Stansby, Maurice E. '30 Ch
Lynn
Freeman, Raymond C. '29 E
Norwood
Karslund, Harry J. '20 A
Pittsfield
Cederstrom, Curtiss M. '29 M
Goodwin, Victor E. '04 E
Springfield
Briggs, Maynard R. '29 E
Jones, Ivar V. '15 C
Waltham
Emery, George C. '19 A
Winthrop
Walker, Frank B. '97 C
West Roxbury
Woodward, Herbert M. '90 M
Wollaston
Reuter, Peter T. '21 M

MICHIGAN

Amboy
Sturgeon, Lloyd R. '32 M
Ann Arbor
Badger, W. L. '08 Ch
Barnum, Charles R. '24 A
Benson, Moss H. '28 C
Dow, William G. '16 E, '17 EE
Hammett, Ralph W. '19 A
Jakkola, Arne A. '26 C, '27 CE
Orbeck, Martin J. '11 C
Tuttle, Stanley B. '24 M
Battle Creek
Miller, Russell '32 ChE
Scott, Leonard D. '30 ChE
Bessemer
Perotti, John J. '29 E
Crystal Falls
Lindstrom, Clarence G. '31 ChE
Snell, Leonard J. '31 C
Udd, Kermit W. '31 C
Dearborn
Ascher, Raymond C. '23 M
Hoppin, Glen H. '08 E

Detroit
Babcock, Vernon M. '23 E
Baldock, Fred C. '29 M
Bjerre, Folmar I. '25 M
Brewster, Wm. E. '12 E, '13 EE
Brooke, Harold L. '18 E
Dedic, Richard J. '24 C
Elmquist, Melvin L. '30 E
Everett, Erwin R. '30 E
Grisson, Aubrey H. '25 AE
Gutsche, Edward J. '04 Ch
Hamilton, Herbert C. '97 ChE
Huntoon, Milton B. '99 E
Koehler, Edwin F. '24 M
Lang, George M. '27 E
Lundquist, Reuben A. '05 E
Malmstrom, Alex L. '17 E
Rand, Lars '13 M
Richardson, Ralph A. '27 M
Riddington, Frederick W. '21 ChE, '22 ChE
Staehle, Haswell E. '24 M
Walker, George W. '09 Ch
Wennerlund, Elias K. '99 M
Wilk, Benjamin '13 C, '14 CE
Flint
Anderson, Joseph A. '24 M
Murray, John H. '17 M
Rhame, Paul W. '21 M
Shurman, Gabe '21 E
Simms, Charles G. '24 M
Wagner, John W. '24 M
Fremont
Wakefield, Ray B. '31 ChE, '32 ChE
Grand Rapids
Lyon, Glenn H. '20 A
Mahoney, William L. '13 E, '14 EE
Houghton
Swenson, George W. '17 E, '21 EE
Ironwood
Holmberg, Abner W. '15 M, '16 ME
Sears, Dow L. '14 C
Ishpeming
Olson, Elmer J. '23 C
Jackson
Briggs, William G. '21 E
Tallmadge, Hiram '16 E
Laurium
Swanson, Philip G. '23 M
Midland
Allen, William W. '31 ChE
Edmunds, Alvin M. '25 ChE
Lundquist, Joseph T. '30 ChE
Otis, L. B. '29 ChE
Muskegan
Olson, Arthur O. '10 C
Royal Oak
Gutsche, Frank C. '10 ChE
South Haven
Smith, Sidney H. '11 C
St. Houghton
Reed, Henry R. '27 E
Walpole
Farsell, William '22 G

MINNESOTA

Adams
Fardahl, Nels '32 AE
Adrian
Prideaux, Cyril F. '32 E
Aitkin
Vishahn, Wm. V. '30 E
Albert Lea
Carlson, Chauncey M. '17 E
Dock, Chester '23 G
Jordahl, Melvin O. '32 C
Pearson, Elmer A. '20 ChE, '21 ChE, '31 PhD
Peterson, Lloyd L. '24 C
Pless, Arnold G. M '20 C
Sorenson, Russell J. '27 AE
Alexandria
McGhie, Kenneth M. '31 C
Altura
Schwager, Oliver '30 M
Anoka
Haugstad, Palmaine S. '26 ChE
Hill, Wm. C. '32 C
Mann, Alvin K. '26 E
Mellok, Arthur W. '32 E
Parkinson, Lindley A. '32 M
Reed, Arthur L. '06 C
Sanderson, Harold A. '32 E
Argyle
Youatt, Glenn B. '29 AE
Aurora
Erikson, Erik G. '32 C

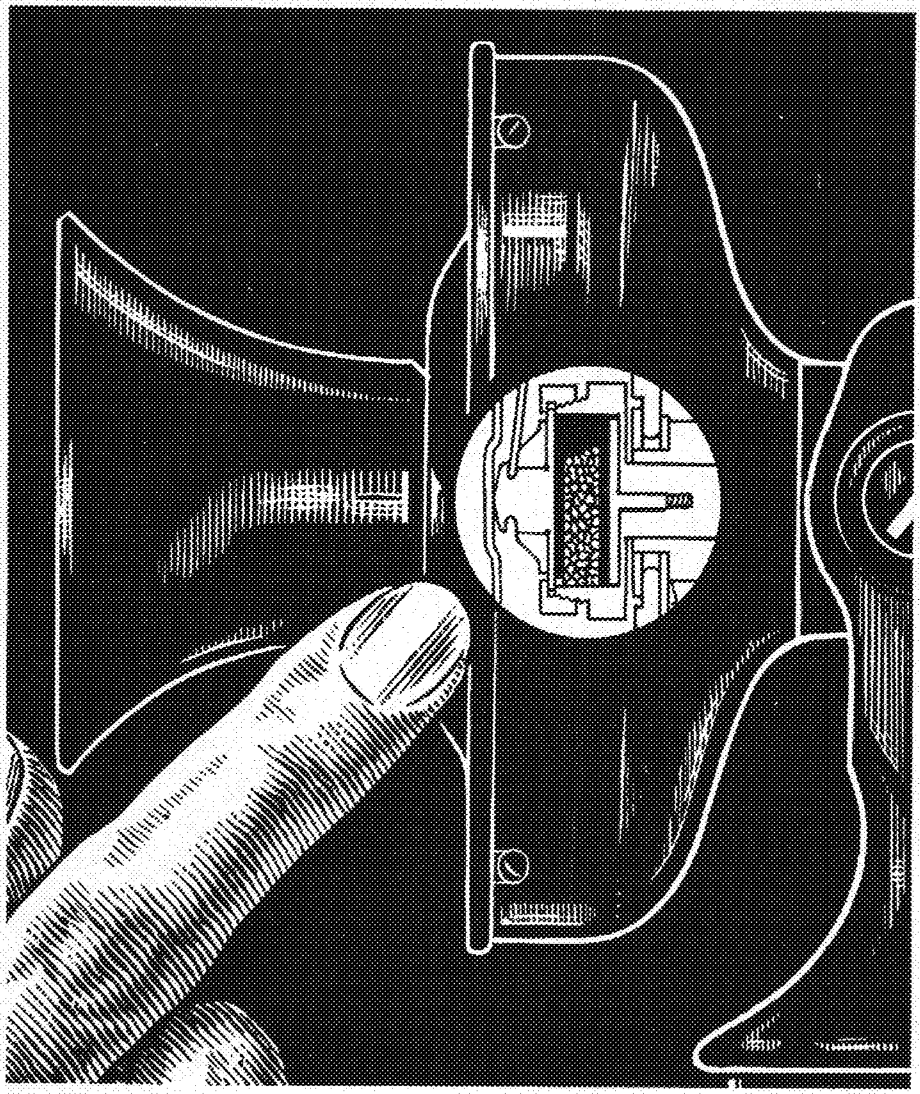
Austin
Anderson, George R. '32 E
Angell, Glenn H. '28 M
Hessler, Lyle '30 MS, '26 E, '31 MS
Mahachek, Ross '26 E
Balaton
Westbee, Robert L. '32 E
Belle Plaine
Groth, Arthur W. '20 E
Bellingham
Strege, Henry '24 E
Bemidji
Davison, Joseph H. '93 C
Bertha
Wieseke, Reuben C. '30 C
Bingham Lake
Redding, James A. '27 E
Blackduck
Peterson, Wm. R. '31 ChE
Bowlus
Johnson, Ralph P. '28 C
Brainerd
Anders, Milton F. '27 E
Croswell, Daniel R. '36 E
Gartner, Walter '32 M
Jones, Harold W. '25 C
Sewall, Joseph '32 E
Breckenridge
Holmgren, Charles E. '09 M
Mangskau, Hugh E. '31 E
Schlattman, Edw. C. '08 C
Browerville
Bemis, Roy L. '31 E
Buffalo
McCullough, R. '23 E
Buhl
Ambrosich, Frank '32 ChE
Revelsky, Leon A. '31 E
Butterfield
Raney, Donald G. '29 E
Cambridge
Bjorklund, Edw. E. '31 M
Ekman, Harold '28 A
Carlos
Hovey, Bertram K. '27 E
Carlton
Nickerson, Neal C. '18 C
Center City
Porter, Earl L. '31 C
Chisholm
Anderson, Geo. T. '15 C
Arko, Frank W. '28 M
Bloomquist, Walter C. '32 E
Borken, Gabriel '32 ChE
Ekar, Rudolph '32 C
Elstad, Rudolph T. '19 C
Frankovich, John J. '28 E
Mature, Rudolph '28 C
Michalson, Einar R. '32 ChE
Peterson, Roy C. '29 M
Cloquet
Carlson, Clifton C. '27 M
Hella, Roy P. '28 ChE
Hella, Udert W. '31 C
Schlenk, Hugo, Jr. '18 E
Stuart, Donald M. '28 E
Watkins, Stanley S. '31 C
Cokato
Hendrickson, Laurence E. '32 E
Peterson, Richard M. '20 E
Coleraine
Battles, Leon E. '18 C
Downing, Frank E. '04 C
Comfrey
Carlson, Elmer W. '27 C
Post, Edw. '29 C
Cottonwood
Windal, Sverri '32 M
Crosby
Darling, Wilfred D. '32 C
Mark, Arthur M. '32 Ch
Stark, John '29 E
Deer River
Backlund, Oscar E. '32 M
Delano
Brunkow, Herbert E. C. '12 ChE
Detroit Lakes
Chilton, Edw. G. '13 C, '14 CE
Shepard, Lewis S. '31 C
Shephard, Seth '31 C
Dodge Center
Kutzler, Robert J. '32 E
Donnelly
Peck, Leander C. '31 ChE
Duluth
Adams, John T. '32 E
Anderson, Milton J. '20 A
Anderson, Robert G. '32 C
Beschenbassel, Harlo P. '31 C
Bishop, Ira L. '11 M

Bradburg, Margaret B. '29 IA
Brose, Wm. C. '25 C
Buck, Frederick W. '09 M
Burke, Roy L. '05 C
Butterworth, Allan C. '11 E
Clark, Carroll A. '29 ChE
Close, Winston A. '27 A
Coe, Edward H. '19 C
Cosandey, Charles, Jr. '25 E
Dinsmore, Arthur T. '12 M, '13 ME
Dittman, Arthur D. '31 E
Donahoe, Robert E. '21 E
Dorsey, John G. '15 C, '15 C
Erickson, Vernon G. '31 AE
Fee, Ernest F. '07 M
Finch, James B. '30 E
Fredrickson, Fred C. '29 C
Grabek, Rosabelle B. '29 IA
Grant, Irving '31 M
Hargraves, Robert A. '23 E
Hibbard, Sampson '23 M
Hoff, John Edgar '20 Ch
Holbeck, John I. '24 E
Hopkins, Albert F. '31 E
Huey, John J. '32 E
Hunner, John C. '31 A
Hustad, Byron P. '10 E
Jaques, Robert '09 C
Johnson, Donald Lee '18 ChE, '20 ChE
Kapphahn, Raymond J. '12 C, '13 CE
Kelly, Earl W. '07 C
Knutson, Harry '17 M
Kosnierek, Clement J. '28 M
Larkin, Giles W. '31 C
Lighter, Clyde W. '26 A
Lostrom, Herbert W. '26 E
McDermott, Scott J. '32 E
McEachin, John L. '22 E
Markkanen, Carl A. '32 C
Martino, Anthony D. '25 M
Matzke, Walter W. '29 M
Melander, Albin R. '21 A
Merriman, John S. '30 E
Mielke, W. C. '30 E
Nelson, Edw. K. '24 M
Nelson, Einer '24 M
Norley, Wm. H. '29 M
Olin, Henry A. '23 E
Osmuske, Arthur B. '28 M
Pawlak, Frank J. '30 E
Peterson, Floyd D. '30 AE
Peterson, Geo. T. '08 M
Pierce, Alton L. '32 C
Pokorney, H. F. '31 E
Pulver, Richard F. '23 E
Ringsred, Arthur C. '06 M
Rodert, Lewis A. '30 Ae
Rose, Norman W. '06 M
Ross, Russell H. '18 E
Roy, Milo C. '21 M
Saltwick, Andrew '24 M
Schradle, Justen E. '30 AE
Schwedes, Walter F. '06 E
Scobie, Frank G. '08 E
Seashore, Ferris L. '32 A
Shoup, Geo. L. '29 ChE
Sneve, Jack S. '11 M
Spotts, Herbert J. '28 M
Spring, Willis W. '07 M
Stenrud, Melvin C. '32 A
Swift, Donald C. '24 E
Tenbrook, Chas. '29 M
Tondell, Mandell '07 C
Toogood, Loren S. '31 M
Turnquist, Axel A. '16 E, '17 EE
Waits, James G. '29 C
Wielde, John A. '28 C
Williams, Roy N. '23 E
Willox, J. Hebden '32 E
Elbow Lake
Boyce, Ellsworth R. '17 C
Elk River
Longfellow, Dwight W. '08 C
Ely
Anderson, Arnold O. '29 E
Banovetz, John A. '25 C
Bezek, Albert J. '27 E
Burcowich, Paul '27 E
Dahl, Paul E. '28 E
Kauppinen, Heino '25 E
Roiko, Wilho A. '30 E
Emhard
Gard, Donald L. '28 C
Eveleth
Erickson, Gust E. '29 ChE
Franks, Geo. E. '29 E
Golberg, Joe '32 E
Kochevar, J. S. '31 E, '32 MS (EE)
Sannicola, Jos. Felix '22 E

Excelsior
Huhn, Geo. P.
Roos, Frank T. W.
Schneider, Frank M.
Schuck, Roy D.
Eyota
Healy, Joe M.
Fairmont
Coult, Lyman H.
Eustis, I. N. '17 M
Evans, Ralph B.
Fahland, Frank, Jr.
Kasper, Walter F.
Starrett, Howard M.
Faribault
Crawford, Wallace T
Klemer, Frank H.
McKellip, Frank W.
Mabbott, Leonard E.
Farmington
Deegan, Raymond C.
Federal Dam
Poore, Orson B.
Fergus Falls
Christopherson, Arnol
Frankovitz, John J.
Hallan, Christian
Johnson, Carl J.
Steiner, Ed. F.
Swenson, Chas. F.
Swenson, Hot C.
Young, Joseph E.
Finlayson
Wallin, Milton A.
Florenton
Jyring, Eino A.
Forest Lake
Olson, Morris T.
Williams, Frederick J.
Fulda
Pruce, John R.
Gibbon
Stadtherr, Henry A.
Glenwood
Lee, Irvin H.
Good Thunder
Brescke, Karl H.
Gowan
Kanniainen, Henry
Graceville
Hartnett, John G.
Grand Meadow
Grimm, Raymond E.
Grand Rapids
Campbell, Vernon R.
Russell, Evelyn V.
Skagerberg, Rutcher
Granite Falls
Barthelemy, Carl E.
Lende, Henry M.
Hackensack
Fredrickson, Edna
Halstad
Forseth, Geo. O.
Hendricks
Larson, Maurice C.
Hibbing
Ahlstrom, Elmer W.
Anderson, Alvin P.
Becchetti, Etalo I.
Benesovitz, Abe
Blomberg, Evar H.
Dungay, Herbert I.
Friedman, Edwin A.
Leach, Edw. W.
Loye, Edw. S.
Lundquist, John V.
Maney, James E.
Markus, Benjamin
Pan, Wen Ping
Reeve, Chas. H.
Homer
Ramsden, Allyn M.
Hopkins
Anderla, Jos. T.
Douglass, Addison H.
Knuth, Lloyd J.
Nemec, Frank L.
Olmstead Chas. F.
Shellenbarger, L. R.
Smekal, Frank J.
Swanson, Edwin W.
Howard Lake
Farchmin, Roy H.
Hutchinson
Christlieb, Frank B.
Higgins, Elvin L.

TERNATIONAL FALLS
Cantwell, Wm. F. '11 Ch
Effertz, Orman G. '30 E
CKSON
Laugen, Gordon E. '31 ChE
NESVILLE
Kaplan, Clifford H. '32 AE
Monthey, Arthur E. '31 AE
Santo, Louis W. '29 A
NSON
Baak, Albert E. '32 Ae
RHAN
Hartmon, Philip F. '25 C
ANDIYOHI
Taylor, Richard G. '25 E
EWATIN
Bingen, Wm. J. '12 C, '13 CE
Sarti, Clifford L. '32 E
ENYON
Gates, Jos. A. '32 A
Kopp, David C. '23 C
IMBALL
Lehtinen, Arne V. '32 C
INNEY
Field, Eino M. '32 AE
Field, Wm. J. '30 E
A CRESCENT
Pilger, Clarence L. '27 E
AFAYETTE
Olin, Stanley C. '31 E
AKE CITY
Martin, Curtis R. '21 G
AKE PARK
Ekern, W. Stanley '31 C
Watland, Maynard B. '29 M
AKEVILLE
Weichselbaum, John F. '31 E
AMBERTON
Sahr, Frederick '32 E
ANESBORO
Lommen, Robert M. '32 E
Quanrud, O. Gerhard '31 E
E ROY
Meyers, Clare F. '28 AE
E SUEUR
Weis, Wallace D. '21 C
EWISTON
Sahr, Fred W. '29 E
ITTLE FALLS
Grettum, Walter A. '24 E
Johnson, Nels '23 C
Lenz, John J. '33 AgE
Ryan, Loiel S. '12 C, '13 CE
ONG LAKE
Kelly, Wm. S. '22 C
ONG PRAIRIE
Schroeder, Victor H. '31 ChE
ADISON
Hawick, Henry C. '28 E
Little, Alice V. '22 A
AHNOMEN
Chloupek, Wm. V. '30 C
AHTOMEDI
Love, Percival E. '21 E
ANKATO
Anderson, Don N. '31 C
Beach, Wm. E. '32 ChE
Christensen, Arthur L. '25 E
Draper, Howard C. '29 ChE
Foster, Winfield W. '32 ChE
Gerlach, Henry C. '22 A
Gerlach, W. D. '26 A
Harmer, Harland D. '31 E
Kleinschmidt, Armin R. '22 M
Pass, Melvin K. '31 AE
ANTORVILLE
Brossard, Henry F. '25 E
APLE PLAIN
Compton, Milton '23 E
APLETON
Borchert, Oscar H. '25 E
ARINE-ON-ST. CROIX
Gray, Wesley '29 E, '32 MS (EE)
INNEAPOLIS
Aasland, Arne '23 C
Abbott, Amos H. '16 E, '17 EE
Adams, Edw. H. '22 G
Ageton, Edwin O. '26 E
Anderson, Clifford H. '26 C
Alexander, Geo. D. '20 C
Algren, Axel B. '25 M
Alrick, Bannona G. '06 C
Amundson, Leland R. '29 AE
Anderson, Clifford H. '26 C
Anderson, David B. '32 AE
Anderson, Dean E. '32 E
Anderson, Emil '05 E
Anderson, Frank L. '16 E
Anderson, Harold R. '32 M
Anderson, Helmer N. '20 M
Anderson, Hilder A. '18 M
Anderson, LeRoy O. '31 A
Anderson, Lester R. '31 C
Anderson, Lowell W. '26 E
Anderson, Matthew '24 E
Anderson, Merle W. '29 E
Anderson, Ole A. '08 M
Anderson, Wilford A. '32 M
Andrus, Raymond J. '07 E
Arnold, J. Howard '27 ChE
Arstad, Leonard O. '24 E
Asfalt, Filip J. '27 E
Aske, Irving E. '20 E
Asleson, Hans '10 C
Austin, Paul D. '21 E
Bachelder, Wm. H. '24 C
Bachmann, John H. '31 ChE
Backman, Graydon A. '23 M
Backstrom, Kenneth A. '27 A
Backstrom, Wilburg A. '23 A
Bailey, James G. '30 E
Bailey, John T. '32 AE
Baker, Arthur W. '19 M
Baker, Lawrence G. '29 ChE
Bakken, Lawrence H. '22 A
Bancroft, Henry K. '26 M
Barber, Edw. W. '31 A
Barstow, Wm. F. '30 M
Baskerville, Ralph J. '30 M
Bayers, Donald R. '30 E
Bayliss, Dudley C. '29 A
Bayoff, Alexander '32 C
Beal, John L. '27 ChE
Beckel, Arthur C. '19 Ch
Beery, Chas. R. '09 M
Bell, Maurice Dwight '07 M
Bennette, John C. '26 M
Bennett, Walter J. '03 C
Benson, Ikel Carl '25 E, '27 MS (EE)
Bergford, Lester M. '23 C
Bergstrom, Marlow B. '22 E
Berner, John A. '30 E
Bertossi, Clarence F. '25 C
Bessler, Herman F. '25 M
Bestic, Gordon F. '31 A
Bestor, Geo. C. '24 C
Betlach, Elvira J. '31 IA
Beyer, Frederick C. '30 ChE
Biskup, Wm. Frank '16 C
Bliven, Paul '27 M
Blosjo, Herbert '28 Ch
Boden, Gordon E. '32 C
Boehnlein, Chas. '17 M, '19 ME
Borchardt, Lester F. '29 E
Bordeau, Sanford P. '25 E
Borne, Floyd O. '27 C
Borst, Wellington L. '24 M
Bowers Gordon G. '31 E
Boyce, Harold J. '27 E
Boyce, John '28 M
Boyce, Norman E. '27 M
Boyd, Harold M. '33 Ch
Boyum, Irvin '17 E
Braddock, Edw. '24 C
Brandt, Clifford A. '27 E
Braun, Cyril M. '29 E
Breding Lucene A. '29 ID
Brenchley, Harry E. '08 C
Briggs, Hiram K. '19 G
Brockman, Frederick H. '32 C
Brockway, Boyden R. '05 C
Brooks, Leslie C. '19 Ch
Bros, Bernard M. '23 M
Bros, Chester W. '22 M
Bros, Ernest T. '17 M
Bros, Kenneth D. '27 M
Bros, Raymond J. '19 M, '20 ME
Brown, Floyd W. '17 A
Brown, Harry E. '22 G
Brown, Homer '30 E
Brownell, Otto E. '10 C
Bruce, Hjalmar N. '16 C, '17 CE
Bruncke, Harry P. '30 E
Brunet, Henri B. '32 A
Brunet, James A. '30 A
Brunetti, Cledo '32 E
Brynteson, Harold R. '32 AE
Bugenstein, Arthur A. '30 E
Burch, Albert M. '96 C
Burch, Edw. P. '92 E, '98 EE
Burlingame, Robt. E. '25 E
Burnette, H. V. '14 C
Burris, Arthur F. '28 E
Burt, Fred Richard '16 E
Burt, Paul R. '26 M
Burtis, Wm. H. '92 E
Callaway, R. S. '11 ChE
Calverley, Chas. E. '31 Ch
Campbell, Douglas M. '27 C
Campbell, Robt. L. '30 E
Capstick, Donald W. '22 G
Carlbom Leonard H. '25 C
Carlson, C. Philip '21 E
Carlson, Harry '33 C
Carlson, Loraine O. '30 IA
Carr, Harvey C. '03 C
Carter, Robt. J. '08 E
Carter, Ruth '29 IA
Caswell, Thomas B. '25 M
Cerney, Glen C. '20 M
Chadbourne, L. Rodney '22 ChE, '23 ChE
Chalmers, Chas. H. '94 E, '03 EE
Chamberlain, Caroline A. '32 Ch
Cherems, Maurice C. '32 C
Christoferson, Everett W. '31 E
Clark, John S. D. '22 M
Clark, Kenneth M. '27 C, '32 MS (CE)
Clarke, Chas. P. '09 C
Clarke, Geo. L. '32 ChE
Clousing, Lawrence A. '28 E, '32 Ae
Cohen, Lillian '00 Ch, '01 MS, '13 PhD
Collins, Stewart G. '04 G
Colvin, James A. '14 M, '15 ME
Comb, Fred Rundle '10 M
Comfort, Thomas H. '26 C
Cooley, Kenneth J. '31 M
Cooper, Leo Henry '06 E
Corl, Cady S. '21 Ch
Cornell, Wallace L. '27 ChE
Coryell, Harry B. '30 E
Covell, Paul L. '25 ChE
Cramsie, Kenneth J. '29 AE
Crimmins, John E. '30 A
Croft, Edna K. '22 A
Croft, Ernest B. '11 C
Crounse, Avery F. '03 G
Cunningham, Owen E. '31 Ae
Cunningham, Robt. F. '31 E
Curry, Byron K. '23 C
Cutler, Alvin S. '05 C
Dahl, Hjalmer A. '22 E
Dahl, Sophus M. '32 C
Dahlstrom, Raymond E. '10 E
Daniel, T. Lester '00 M
Darin, Roy L. '31 E
Darrell, James E. '23 C
Dartt, Harvey S. '31 C
Davies, Edwin T. '07 ChE
Davies, Ralph M. '09 E
Deane, Geo. B. '19 A
Del Plaine, Carlos W. '21 C
Devoy, Edw. H. '32 E
Devoy, Wm. T. '29 E
Dillis, Lyle A. '21 G
Diment, J. Morton '24 E
Doell, Chas. E. '16 C, '17 CE
Donaldson, Frank A. '12 M
Doolittle, Wm. K. '14 C
Dorrance, Albert P. '12 E
Dowd, James E. '32 M
Dreveskracht, Wallace '28 C
Drinkall, Leon R. '11 E
Dunnavan, Ralph R. '23 E
Dunnigan, Merton A. '16 Ch
Du Toit, Geo. A. '10 M
Eck, Lester J. '23 ChE, '24 MS
Eckley, Wm. A. '30 M
Eckman, Adelaide '30 IA
Edey, Francis E. '29 E
Edgar, Donald E. '23 ChE, '27 PhD
Edlund, Ray C. '27 C
Edman, John H. '31 M
Edwards, Norma E. '30 IA
Eggers, Henry C. '15 E, '16 EE
Ek, Gustaf Albin '17 M
Ekberg, Carl E. '14 C, '15 CE
Ekman, Claes T. '10 C
Elfes, Donald B. '32 M
Ellestad, R. B. '22 Ch
Elliott, A. Douglass '14 E, '15 EE
Ellsworth, Chas. D. '20 E
Elmquist, Ralph C. '31 ChE
Elsberg, Wm. '09 C
Elstrom, Aldin A. '32 M
Enger, Edw. Henry '11 C
Engstrom, Leslie G. '19 Ch
Erickson, Henry A. '96 E, '08 PhD
Erickson, Hugo G. '28 C
Erickson, Russell F. '32 M
Ericson, Adolph E. '32 AE
Erskine, Lawrence F. '25 M
Erskine, Robt. K. '24 M
Ervin, Wilbur B. '30 M
Espeland, Bertha O. '31 IA
Estabrooks, Clyde F. '24 M
Evans, Earl J. '31 E
Everett, Wm. R. '13 E, '15 EE
Ewald, Earl '30 E
Fager, Simon B. '04 M
Farmer, John W. '21 M
Farnam, Julian P. '11 M
Fedders, Melvin P. '29 M
Fegan, Elmer Thomas '15 Ch, '16 MS
Felt, Earl J. '31 C
Finch, Edw. H. '31 E
Fire, Vladimir '30 E
Firth, Chas. V. '23 ChE
Fischer, Earl B. '19 ChE
Fischer, Harold W. '23 E
Fisher, Geo. Lee '28 E
Foker, Leslie W. '28 ChE
Ford, Robt. E. '95 E, '03 EE
Forfar, Donald M. '09 M
Forsberg, Elmer J. '21 M
Forsberg, Enock E. '18 A
Fossen, Geo. '17 C
Foster, Kenneth W. '26 C
Francis, Paul E. '18 M
Frantz, Willard F. '25 C
*Fredrickson, Edwin W. '28 E
*Frederickson, H. M. '23 ChE
Freeberg, Geo. '25 A
Fridlund, Harold W. '30 A
Fritzberg, Edw. L. '31 ChE
Fruen, Arthur Bernard '08 G, '09 CE
Fuller, Donald L. '29 ChE
Furber, J. R. '24 E
Furber, Richard D. '28 E
Furber, Stanley L. '31 E
Garber, Gabriel E. '06 M
Garthus, Ira B. '24 E
Garvey, Arthur H. '31 ChE
Garzon, Julian R. '24 C
Gee, Harry James '19 G
Gemmell, John H. '18 M
Gernes, D. C. '31 ChE
Gerrish, Harry E. '05 M
Giertsen, Marcus O. '13 C
Giessel, Paul A. '27 M
Gillette, Geo. L. '05 C
Gilloth, Paul J. '32 E
Gilman, James B. '94 C
Gislason, Carl F. '31 ChE
Glaser, David '29 ChE
Godward, Alfred C. '10 C
Goetzenberger, Ralph L. '13 E, '14 EE
Goldberg, Hymen '28 C
Gould, Edw. C. '26 C
Gould, Edw. S. '20 C
Grant, John W. '29 C
Grant, Russell S. '26 M
Graves, Harold Edw. '32 ChE
Gray, Eugene M. '31 A
Green, Chauncey L. '24 E
Greiner, Harry S. '24 E
Grout, Frank Fitch '04 Ch, '08 MS
Guesmer, Geo. O. '24 C
Guggisberg, Chas. F. '17 M
Guppy, Richard H. '30 M
Gustafson, J. M. '28 C
Gustafson, Lester W. '32 Ae
Gustafson, Reuben W. '24 C
Haberle, Edw. L. '13 C
Hall, John W. '27 M
Hall, Robt. J. '30 M
Halliday, Leslie L. '21 C
Halvorson, Halvor O. '22 ChE, '23 ChE
Halverson, L. C. '31 A
Hama, Geo. '32 ChE
Hamlin, Lehan H. '21 M
Hammond, Lawrence D. '14 M, '15 ME, '19 MB, '20 MD
Hankins, Nathaniel R. '24 C
Hansen, Theo. B. '28 Ch
Hanson, Leslie P. '30 M
Hanson, Manford P. '29 M
Hanson, Rudolph M. '31 E
Harich, Henry W. '32 C
Harris, Harold R. '15 E
Harris, Nathan '20 G
Harris, Sigmund '05 M
Hartig, Henry E. '18 E
Hartzberg, Edw. M. '19 M
Hauge, Morris J. '30 E
Hawkins, Harvey C. '23 E
Hayden, John F. '90 C
Hayden, Richard E. '31 M
Hayes, Mark N. '32 A
Hearn, Chas. A. '31 Ae
Heath, Donald C. '31 A
Heath, Owen M. '29 M
Heidelberger, Otto F. '23 E, '25 MS (EE)
Heidelberger, Roy J. '22 E
Heidemann, Herbert E. '31 ChE
Hendrickson, C. Edw. '25 C
Hendrickson, Norman E. '16 E
Herberg, Sanford '24 C
Herrick, Carl A. '02 M
Hibbard, Truman '97 E
Hickok, Jessie E. Stevens '96 G, '04 MS
Higgins, Ray G. '30 ChE
Hildebrandt, Henry A. G. '99 E
Hill, Edw. L. '25 E
Hobart, Walter R. '07 C
Hoffman, Everett J. '31 ChE
Hoffman, John R. '26 C
Holmes, Raymond H. '23 E
Holst, James E. '27 ChE, '29 MS
Holtan, Raymond N. '31 C
Hopkins, Jos. Irwin '04 Ch
Hopkins, Mark L. '09 E
Hoskin, Graydon J. '31 E
Hotchkiss, Fred W. '18 E
Houlton, Amos D. '01 E
Hovde, Fred L. '29 ChE, B.A. (Oxford) '31
Hovek, Lawrence E. '29 A
Hughes, Frank C. '03 M
Hultin, Clifford T. '31 ChE
Hunt, Donald W. '32 AE
Hupp, Eleanor K. '30 IA
Hustad, Andrew P. '09 C
Hustad, John C. '14 C, '15 CE
Hustrulid, A. '31 E
Irwin, Milton M. '12 ChE, '13 ChE
Jacobsen, Arthur C. '25 E
Jacobsen, Carl A. '29 E
Jacobson, Frank H. '24 E
Jacobson, Reuben A. '25 M
James, Vir N. '32 E
Jarchow, Theo. L. '28 E
Jennings, Gordon J. '31 C
Jensen, John A. '05 C
Jenson, Theo. R. '29 C
Jerabek, Henry S. '26 ChE
Jewett, Clifford L. '31 ChE
Johnson, Alphonse N. '21 C
Johnson, Edgar W. '14 C, '15 CE
Johnson, Elmer W. '14 E, '15 EE, '23 ME
Johnson, Enan C. '25 E
Johnson, Geo. V. '31 E
Johnson, Gustav A. '23 E
Johnson, Gustave F. '27 E
Johnson, J. Harry '32 Ch
Johnson, Kenneth C. '32 ChE
Johnson, Laurence V. '27 C
Johnson, Lawrence E. '29 AE
Johnson, Waldo C. '26 Ch
Johnson, Wendell E. '31 C
Johnston, Chas. K. '21 E
Johnston, Clinton J. '29 E
Jones, Edwin F. '17 M
Jones, E. Richard '31 E
Jones, Geo. R. '14 E, '15 EE
Jones, Gordon W. '28 AE
Jones, Kelyth G. '32 Ae
Jones, Noel W. '30 AE
Jordan, Richard C. '31 Ae
Judd, Maurice D. '23 C
Jurgensen, Delbert F., Jr. '31 ChE, '32 MS
Kaplan, Seeman '18 A
Kappel, Frederick R. '24 E
Karatz, Lucian '12 Ch
Karpen, Raymond J. '32 ChE
Kates, Vera '32 IA
Katter, Calvin K. '22 M
Katz, Julius R. '32 ChE
Katz, Leonard M. '32 C
Kiesner, Frank C. '24 M
Kindseth, Harold V. '31 ChE
King, Maurice '32 ChE
Kinsell, Wm. L. '31 E
Kline, Frank Wm. '24 E
Kline, Marvin L. '29 AE
Kloski, Leonard A. '30 E
Knoll, Franklin O. '25 E
Knox, C. Kenneth '32 ChE
Knutson, Melvin J. '28 M
Knutson, Reuben W. '28 Ch
Kopplin, C. Donald '28 C
Krafft, Edwin W. '24 A
Kranzfelder, Robt. H. '26 AE
Krefting, Arthur S. '26 C
Kreger, Stuart L. S. '28 C
Kreiss, Robt. E. '33 C

MINNEAPOLIS (*Continued*)
Kriechbaum, John P. '28 E
Kritzer, Louis W. '28 E
Krohn, Henry J. '31 C
Kroll, Arthur J. '25 C
Kronick, T. Gerald '26 A
Kullberg, Ray E. '31 M
Kulmpel, Leon L. '29 M
Kvitrud, Ingwald '11 C
Lagaard, Alex S. '13 E, '14 EE
Lambert, Edwin M. '09 M
Lampe, Bernard G. '32 A
Lander, Robt. M. '32 M
Lang, Chas. A. '06 E
Lang, Fred C. '08 C
Langer, Henry J. '32 C
Langkammerer, Carl M. '29 ChE
Langland, Harold S. '19 E
Languth, Karl H. '27 ChE
Larsen, Stanley J. '31 M
Larson, Amandus C. '20 C
Larson, Carl '16 C
Larson, Fred H. '25 C
Larson, Martin S. '31 M
Larson, Werner L. '28 M
Laurence, Paul A. '12 G
Leach, Stowell D. '29 A
Lee, Melville Richard '21 ChE, 22 ChE
Leerskov, Gerhard W. '21 ChE
Leonard, Thomas K. '15 C, '16 CE
Lethart, Carl W. '30 E
Levine, Herschel '31 AE
Lewis, John G. '24 E
Libby, Calvin R. '28 M
Liebenberg, Jacob J. '16 A
Lieske, Harold W. '30 C
Lilja, Albert E. '32 M
Lilly, Clarence W. '17 E
Lindert, Albert W. '31 ChE
Lindhjem, Geo. '33 C
Linstedt, Philip '26 C
Lobeck, Torarin '24 E
Lockhart, Harold A. '29 M
Lohn, Robt. N. '29 C
London, Wm. '29 E
Lowther, Wilfred W. '27 M
Lund, Clarence V. '26 C
Lund, Roy V. '24 C
Lund, Stanley D. '27 C
Lundquist, C. D. Vernon '25 M
Lundquist, Wilton G. '28 M
Lutz, Richard E. '15 E
Lux, Lester L. '27 Ch
McAndrews, Harry N. '25 C
McCubrey, Everett J. '31 C
McCullough, Bruce M. '16 C
McDonald, Neil J. '32 M
McDonnell, Lawrence '27 E
McElroy, Wyllys F. '32 C
McHugh, James L. '31 AE
McKenzie, Leonard F. '20 E
McLeland, Lyle K. '24 E
McMillen, Elliot L. '23 ChE, '27 MS
McVay, Margaret '31 IA
MacGowan, Irving S. '25 C
MacGregor, Helen J. '25 IA
Mackay, Donald H. '26 E
MacMullen, Clinton W. '30 ChE
Madden, John S. '30 E
Malakowsky, Irwin R. '31 A
Manger Henry J. '23 C
Mangney, Hilding O. '24 E
Mangney, Elmer J. '21 E
Mann, Fred Maynard '93C, '98 CE
Mannel, Douglas R. '22 ChE
March, Cecil C. '33 ChE
Markoe, James '12 M
Marple, Perry '32 M
Marshall, Chester R. '23 M
Martenis, Wm. W. '30 M '32 MS (ME)
Martinson, Lawrence E. '32 Ch
Mattison, Oliver '05 C
Mayer, Harris J. '14 M, '15 ME
Meili, Rudolph E., Jr. '22 G
Meindl, Hugh F. '32 ChE
Melick, Minnie '32 IA
Mehn, Kenneth R. '29 C
Mellin, Clifford O. '32 C
Meyer, Herbert W. '14 E
Meyette, Chas. L. '30 Ch
Mich, Kerwin '29 ChE, '30 MS
Michaelson, Geo. '32 ChE
Miller, Ervin J. '11 C
Miller, Robt. M. '30 ChE
Mindrum, Arthur I. '26 E
Mitchell, Donald F. '20 ChE, '21 ChE
Mitchell, Wm. J. '29 ChE
Mokres, John A. '32 Ae
Molskness, Nels S. '20 E
Moore, Clarence F. '20 G
Moore, John H. '24 M
Morton, Harry G. '04 E
Moses, Marlowe G. '27 E
Moyer, A. F. '10 M
Myers, Robt. M. '31 M
Nelson, Arthur '28 M
Nelson, Carl C. '23 E, '26 MS (EE), '30 EE
Nelson, Clarence E. '27 E
Nelson, Clarence L. '20 E
Nelson, Erling W. '29 A
Nelson, Floyd '31 ChE
Nelson, Gustaf A. '19 E
Nelson, Harry G. '18 Ch
Nelson, Neal N. '27 AE
Nelson, Nels B. '04 C
Nelson, Oscar R. '05 C
Nelson, Richard L. '21 E
Nelson, Robt. B. '26 E
Nelson, Thorwald E. '90 M
Nergaard, Leon S. '27 E
Netherly, Geo. '29 ChE
Newhall, Wm. B. '00 M
Newhouse, John C. '29 E
Newman, Morris '31 E
Newton, Kenneth H. '31 A
Nichols, Loren D. '31 A
Nicholson, Harry G. '21 ChE
Nickerson, Edw. '25 E
Nickey, Wm. E. '29 M
Nielson, Eunice V. '23 A
Nierling, Grant C. '25 E
Nissenson, Phineas P. '29 E
Noble, John F. '21 G
Noble, Theo. G. '30 AE
Noponen, Geo. E. '32 Ch
Nordeen, Harold E. '31 M
Nordenson, Arnold '22 M
Nordlien, Berger W. '22 E
Nordstrom, Carl T. '14 C
Nordstrom, Milton E. '25 C
Nordvall, Glenn '23 E
Norgarden, Oscar '31 E
Norrbom, Oscar '26 M
Northfield, Glenn '30 M
Norton, Lowell E. '32 E
Norton, Maurice E. '32 M
Nyvall, Clifford S. '26 C
O'Brian, Maurice '30 M
Odell, Raymond H. '32 Ae
Ohman, Leo S. '28 E
Ohrbeck, May E. '32 IA
Olaison, Clifford E. '16 E
Olsen, Leslie R. '15 Ch
Olson, Arthur O. '11 Ch
Olson, Edwin E. '25 A
Olson, Melvin L. '31 M
Olson, Milton P. '32 E
Oltman, Roy E. '33 C
Oman, Lloyd L. '29 E
Orning, Harold '26 E
Orr, Geo. M. '15 M
Osburn, Roy W. '27 E
Ostlund, Evert M. '31 E
Otterstein, Earl F. '13 Ch
Overholt, Harley G. '10 C
Ovestrud, Melvin '13 M, '14 ME
Parker, Robt. M. '24 C
Parry, John E. '26 E
Parten, Carl D. '27 M
Pass, Sigmund D. '30 ChE
Patterson, Donald M. '31 Ae
Paul, Frederick T. '09 C
Pause, Harold A. '23 E
Pavek, Wm. J. '20 M
Peck, Ralph E. '32 ChE
Pelen, Ellis '32 Ae
Pemble, Alice S. '30 Ch
Person, Otto C. '24 AE
Pesek, Cyril P. '25 AE
Peterson, Earl G. '32 A
Peterson, Earl V. '30 ChE
Peterson, Harold W. '21 E
Peterson, Henry '13 ChE, '14 ChE
Peterson, Lewis E. '25E, '29 MS
Peterson, Marshall A. '21 ChE, '22 ChE
Peterson, Oliver H. '32 Ch
Peterson, Perry '19 E
Petrok, Bernard '30 M
Pfeifer, Otto J. '29 M
Pittelkow, Henry B. '31 Ae
Powell, Knox A. '20 M
Pratt, Benj. A. '15 C
Pratt, Harold K. '33 C
Prendergast, Arthur A. '03 C
Prichard, Chas. E. '25 C
Priedeman, Geo. W. '08 M
Quiggle, Arthur W. '13 C '14 CE
Quinn, Edw. L. '25 C
Quinn, Ursula R. '25 C
Rademacher, Richard L. '23 ChE, '24 MS
Ramey, John M. '28 AE
Ramsdell, Robt. C. '31 C
Ramsey, Selmer '21 ChE
Raughland, Arnold I. '20 A
Redmond, Fabian '29 A
Reidhead, Frank E. '93 E, '98 EE
Reiter, F. Leonard '32 ChE
Rhoades, Herbert E. '26 E
Rice, Robt. E. '31 E
Riley, Philip J. '21 Ch, '24 MS
Ritchie, John R. '16 M, '17 ME
Robertson, Burton '14 E, '15 EE
Robertson, Haney M. '28 M
Robinson, H. Marjorie '28 Ch, '31 MS
Robinson, Parke Dickey '25 M
Robinson, Richard C. '32 AE
Rockwell, Harvard '14 C
Rollin, Harold E. '26 M
Rollins, Milo '30 E
Roscoe, Orvel L. '31 C
Rosenberg, Rahil A. '24 A
Rosendahl Harold R. '22 M
Rosenstein, Arnold '31 ChE
Rudser, Melnor '30 E
Rufsvold, Olav M. '16 C
Ryan, Robt. M. '23 E
Ryan, Wm. T. '05 E
Rykken, Nordahl T. '29 C
Salo, Paul W. '32 ChE
Sandell, Ernest B. '28 Ch, '29 MS
Salisbury, Willis R. '10 G
Sandness, Erling '30 C
Santelman, Ralph H. '27 C
Sawyer, Thomas P. '31 M
Saxon, Paul M. '29 E
Scandling, Jos. E. '23 ChE
Schaller, Louis M. '29 C
Scheibe, Walter K. '32 E
Schlafge, Wm. H. '26 ChE, '27 MS
Schow, Garfield G. '24 E
Schulze, Leroy E. '27 E
Schumacher, Maurice J '31 C
Schuster, Joe W. '32 ChE
Scott, Elmer '16 C
Scott, Herbert L. '23 E
Sebo, Arthur O. '24 M
Sedgwick, Harvey J. '31 E
Shavor, Geo. J. '25 E
Shenehon, Francis C. '95 C, '00 CE
Shepard, Seth F. '32 C
Shepley, Chas. R. '02 C
Shiffler, Glyne W. '29 A
Shippam, Willis '09 M
Shoemaker, Douglas '29 C
Sieberns, Jos. '30 E
Siegmann, Chester W. '20 E
Silverman, Emil M. '22 C
Silverman, Reuben R. '28 Ch
Siverson, Sigvel J. '11 C
Siverts, Samuel A. '09 C
Skanse, C. Theo. '29 M
Skovholt, Jos. '31 E
Smeby, Lynne C. '28 E
Smith, Harold D. '25 E
Snyder, Dorothy E. '26 M
Soderholm, Lauren V. '28 E
Solomonson, Lawrence '25 E
Souba, Wm. H. '09 M
Soules, Webster F. '31 E
South, Willard A. '12 C, '13 CE
Sparrow, Hubert '30 E
Specht, Walter A. '32 E
Speer, Paul R. '27 E
Spencer, J. B. '27 M
Sperling, Abe '27 C
Springer, Frank W. '93 E, '98 EE
Sprungman, Ralph E. '31 C
Stanley, Harold H. '31 Ae
Stein, Alex R. '32 ChE
Steinberg, Israel H. '30 AE
Stephens, Clifford '23 C
Stephenson, Oliver H. '07 M
Stevens, Bruce E. '28 E
Stimart, Elwood L. '24 E
Stodola, Frank H. '28 ChE
Stoep, Henry C. '31 ChE
Stolte, Sidney L. '27 AE
Stone, Chas. W. '16 M, '17 ME, '19 MS
Stoppel, Arthur E. '20 ChE, '21 ChE, '24 PhD
Stromback, Lillie '33 IA
Strout, James E. '31 Ch
Sullivan, Betty '22 Ch
Svendsen, Geo. P. '08 E
Swanson, Carl E. '27 E
Swanson, Clifford L. '22 C
Swanson, Martin G. '32 E
Swanstrom, Frank N. '08 E
Swedberg, M. R. '11 C
Swenson, Gustav A. '20 G
Swenson, H. S. '12 C, '13 CE
Swenson, Oscar J. '31 ChE
Tait, Geo. H. '32 ChE
Taylor, Dean M. '30 ChE
Teske, Frederick C. '27 C
Thayer, Paul '14 M, '15 ME
Thayer, Russell M. '31 M
Tholstrup, Walter W. '32 ChE
Thorshov, Olaf '21 A
Thorshov, Roy N. '28 A
Thorson, Harry L. '31 E
Thorson, Stuart '19 Ch
Thouren, Earl H. '30 AE
Tighe, James S. '26 E
Timmins, Gerald F. '32 C
Timperley, Wm. D. '10 C
Tinkham, Willis M. '14 ChE
Todd, Milo E. '09 E
Torrance, Ell '09 C
Townsend, Geo. B. '32 AE
Trask, Birney E. '90 C, '94 CE
Tryon, Philip D. '17 C
Tucker, Carl W. '26 M
Tupper, Chas. E. '15 M
Turner, Roy H. '15 E, '16 EE
Undine, Eugene A. '29 IA, '30 MS (A)
Ungerman, Carl M. '06 E
Untinen, August L. '25 E
Upton, Albert P. '25 E
Uttley, Gerald P. '32 E
Vallacher, Theo. L. '20 G
Van Fischer, Wm. '32 Ch
Vigness, C. Irwin '29 E
Vincent, Jay C. '03 E
Volkenant, Gordon W. '27 E
Von Rohr, Herbert H. '21 M
Von Sien, Ruth E. '28 IA
Von Stocher, Selmer G. '27 M
Walby, Arthur C. '11C
Wald, Reuben E. '30 E
Waldor, N. Theo. '25 C
Walker, Geo. W. '08 C
Wall, Cyril T. '30 E
Wallace, Bruce V. '30 A
Wallfred, Carl Luther '20 ChE, '21 ChE
Walling, Benj. B. '09 E
Wang, Clarence '30 Ae
Warner, Roy F. '32 C
Warren, Robt. E. '30 E
Warrington, W. G. '30 E
Watson, Fred O. '16 C
Watson, H. Duncan '31 M
Watson, Wm. W. '32 E
Webber, Clyde '27 E
Webber, Fredk. W. '97 ChE
Webster, Cora Helen '23 Ch
Webster, D. W. '13 C, '14 CE
Weigel, Geo. F. '32 C
Weigel, H. N. '14 C, '15 CE
Weiner, Phillip J. '31 E
Wentz, Clarence A. '27 C
Wentz, W. W. '14 E, '16 EE
Werdenhoff, James H. '21 C
Wessel, Hans J. '30 A
West, Jane '29 IA
Westegard, Glenn A. '25 E
Westerberg, Carl G. '21 Ch
Wherland, Fred C. '30 E
White, Robt. H. '23 ChE, '24 MS
Whited, Oric Ogilvie '08 Ch
Wilcox, H. B. '14 E, '16 MS
Wilkinson, Gladness B. '27 IA
Willson, Edwin A. '30 E
Wilson, Chas. A. '22 C
Wilson, John M. '32 E
Windus, Ray F. '30 ChE
Winslow, Raymond M. '19 ChE, '20 ChE
Witt, Edw. J. '27 C
Witts, Seth N. '27 E
Wolk, I. Louis '29 Ch
Won, Howard F.
Wood, Inez
Wood, Leslie L.
Wood, Rodney R.
Wood, Victor R.
Woodrich, Oscar F.
Young, Edw. F.
Yotzy, Henry C.
Zeuthen, Victor E.
Ziegler, R. Dale
Zima, Albert G.
MINNEOTA
Knutson, Otto N.
MINNESOTA LAKE
Wrucke, Adrian G.
MINNETONKA BEACH
Manson, Philip W.
Whitney, Alfred C.
Winding, Charles C.
MONTEVIDEO
Anderson, Nels S.
Dow, Clarence A.
Hecht, Henry W.
Lawrence, Scott
MANTORVILLE
Meskal, George
MOORHEAD
Hopeman, Albert M.
MOOSE LAKE
Handschu, C. E.
MORA
Dunns, Stener M.
Hanna, Cyril C.
MORRIS
Thompson, Claudius A.
MORRISTOWN
Knauss, Edison A.
MOUNTAIN LAKE
Janzen, William H.
NASHWAUK
Anderson, Olaf J.
Latvala, Aksel A.
NEW ULM
Backus, Gerald H.
Haeberle, Elmer H.
Hummel, Carl A.
Robertson, Charles N.
Vercoe, Walter R.
Witt, Edward H.
OAK TERRACE
Green, Alfred B.
Rathburn, George A.
OLIVIA
Kircher, Frank J.
Kircher, George A.
ONAMIA
Mohrenweiser, E. H. '2
OSTRANDER
Christensen, Carl W.
OWATONNA
Anderson, Harold V. '
Burrock, Richard '3
Hasfield, Raleigh W.
Sweeney, Frank C.
Young, Earl R.
PARKERS PRAIRIE
Hollins, Laurence H.
PARK RAPIDS
Condiff, Howard L. '3
PERHAM
Bouck, Leland H.
Schmidt, Milton E.
PINE ISLAND
Fahy, Francis M.
Schulz, Alex A.
PINE RIVER
Peterson, Volgar N.
*PLAINVIEW
Askew, Thomas A. J.
Eggers, Everett B.
*PIPESTONE
Anderson, Gordon S.
Mitchell, Wm. J. '29 ChE, '31 ChE, '32
Odquist, Carl
PROCTOR
Bohannon, Geo. W.
Stromberg, Hans B. '29 ChE, '29 ChE, '32
Swanson, Clarence
RAYMAN
Mohr, Daniel
RED WING
Barrows, Vera '06 BA, '
Cook, Harry C.
Cornell, Reuben W. '21 ChE, '2
Gustafson, Robert F.
Josephson, Eliot B.
Santelman, Walter W.
REDWOOD FALLS
Burmeister, Charles H.
Clipfell, Carroll D.



Vocal cords made of *coal!*

Typical of Western Electric care and precision in manufacturing Bell Telephone apparatus, is the making of the transmitter button which transforms spoken words into electrical impulses.

This transmitter button—the telephone's vocal cords—contains coal. Only a fine grade of selected anthracite, specially treated, is suited for this delicate work. First the coal is ground into fine granular form—next it is carefully sifted and washed. Then, after being roasted in special ovens, it is put into the transmitter button. Approximately 50,000 tiny grains must go into each button—too few or too many would impair transmission.

Such infinite care with "little things" is just one reason why Bell System apparatus serves the telephone-using public so faithfully.

BELL SYSTEM

TELEPHONE HOME ONE NIGHT EACH WEEK
. . . LOWER RATES AFTER EIGHT-THIRTY

REMER
Pohl, Loren F. '27 C
ROBBINSDALE
Bailey, Charles N. '31 M
Bauch, Russell C. '32 E
Busch, William A. '22 ChE
Damberg, Paul S. '22 A
Holcomb, Harry S. '26 E
Pippel, Herbert A. '20 Ch
ROCHESTER
Beltz, Francis J. '31 E
Brataas, Mark G. '17 C
Bross, Peter P. '25 A
Cowan, Cedric L. '31 C
Hansen, Carlos '20 C
Heck, Frank '19 Ch, '24 Ch
Laska, Frank V. '31 C
Leonard, Aubrey C. '23 C
Moe, Harold O. '31 E
Nelson, Mark L. '24 A
Pagenhart, Clarence C. '12 C
ROTHSAY
Lein, Olaf '32 C
RUSH CITY
Strom, Arthur '23 A
RUSHFORD
Engh, Harris S. '24 M
RUSSELL
Anderson, Nelson E. '32 E
SANDSTONE
Pearson, Einar O. '27 C
SAUK CENTER
Markson, Paul A. '31 E
Palmer, Harry A. '31 E
SAUK RAPIDS
Agather, Martin A. '31 E
SEBEKA
Johnson, Beatrice A. '31 IA
SHERBURN
Risley, Max I. '32 E
SPRINGFIELD
Blue, Clarence W. '25 C
SPRING VALLEY
Bolline, Flavio C. '31 AE
Molstad, Arnold R. '31 C
ST. CLOUD
Appert, John M. '32 M
Brouillette, T. R. '31 Ae
DesMarais, Stanley F. '33 C
Hoover, Lloyd H. '28 E
Jorgens, C. R. D. '12 C, '13 CE
LaChapelle, Robert L. '31 M
Pelley, Lloyd L. '24 E
Scholz, Edmund H. '27 E
Vouk, Frank J. '32 M
Wickman, Martin F. '22 E
ST. JAMES
Haugen, Kenneth B. '32 Ae
West, John C. '15 C
ST. PAUL
Abrahamson, H. B. '18 M
Albrecht, Ernest G. '25 E
Altstatt, Raymond C. '32 M
Anderson, Helmer N. '20 M
Anderson, Henry A. '27 E
Anderson, M. M. '20 Ch, '21 Ch
Andrews, George L. '05 M
Arnesen, Herbert P. '11 C
Aronovsky, Samuel I. '21 ChE, '22 ChE, '29 PhD
Aure, Roy '22 M
Bachelder, William H. '24 C
Backe, Edmund '24 ChE
Baker, Russel E. '11 ChE
Barlow, Harry E. '03 C
Barnaby, William E. '09 ChE
Barrett, Joseph O. '22 ChE, '23 ChE
Bauer, Albert E. '30 M
Beadie, William M. '31 C
Beatty, Leonard '31 ChE
Beaudin, Lawrence A. '28 C
Beek, Hiram D. '26 M
Bell, Alexander D. '16 ChE, '17 ChE
Bingham, Stanley E. '08 M
Blake, Robt. P. '97 M
Bohland, John A. '95 C
Boss, Harlan D. '32 IA
Boss, Ronald Wm. '25 M
Bosshardt, Willmert C. '22 E
Bowers, Raymon J. '28 M
Boyles, R. R. '15 M, '16 ME
Brobaugh, Gustave C. '27 C
Brownell, Edw. '26 C
Bruess, Edw. C. '29 M
Buenger, A. '13 M, '14 ME
Buenger, Edgar '19 A
Bumgardner, Louis T. '23 E
Burch, Cecil J. '29 C
Campbell, Ralph Louis '30 C, '32 MS (CE)

Carlson, A. Paul '17 M
Carlson, Ernest F. '32 M
Carlton, Richard Paul '21 G
Casey, Jos. T. '32 C
Chaley, Isadore '30 E
Chapman, Leslie H. '95 C
Childs, James A. '09 C
Christensen, Russell '30 AE
Christilaw, Geo. M. '21 C
Clysdale, Edw. G. '31 M
Comfort, Clifford E. '26 M
Cone, Earle R. '31 A
Crawford, Allen S. '12 M
Cummings, Elmer F. '13 C
Daum, Henry A. '12 E
Davidson, Henry A. '27 AE
Davidson, John E. '28 AE
Davis, Gilbert N. '04 M
Dawson, John W. '22 A
Dehn, Eltor '21 C
Deineus, Geo. R. '26 E
Deutsche, Richard E. '18 C
Dewars, Allen G. '14 E
De Witt, Jos. H. '10 Ch
Diedrich, Erwin H. '30 E
Dimond, Grover W. '12 C
Dimond, Harvey G. '14 C
Dominick, Earl H. '30 C
Dougan, Henry K. '08 C
Dunning, Robt. M. '28 M
Duvall, Arndt J. '25 C
Dystetheft, Geo. A. '26 Ch
Edgell, Ensign E., Jr. '30 E
Eggleston, Smith '25 M
Ellison, Jay T. '09 C
Elmburg, John C. '28 E
Engquist, Victor E. '20 E
Erickson, Clarence F. '25 A
Erickson, Lloyd R. '28 C
Felion, Arthur J. '13 Ch
Feyder, Wm. J. '32 E
Finley, Jos. E. '05 C
Fitzgerald, W. Geo. '30 E
Flanagan, Geo. W. '32 ChE
Fleming, F. R. '08 M, '09 EE
Ford, James M. '30 M
Frahm, Alfred R. '08 E
Fraser, Carlisle G. '22 C
Fraser, Geo. '19 A
Frenzel, Herman '26 A
Fryhofer, Willard W. '31 C
Fuhrman, Alvin O. '24 ChE
Garen, Geo. M. '10 C
Gessert, Geo. R. '07 M
Gillie, Willis H. '29 E
Gilstad, Arthur '23 M
Goebel, R. C. '13 E, '14 EE
Goffstein, Albert A. '31 E
Goldberg, Maurice G. '23 E
Goodkind, Leo '92 A
Gorman, Francis Y. '31 A
Grime, Edwin N. '00 C
Guerin, Geo. V., Jr. '24 C
Guesmer, Marie W. '26 IA
Halvorson, Henry A. '11 Ch
Hammerquist, E. '30 ChE
Hansen, Christian, Jr. '10 E
Hanson, Earl A. '32 E
Hanson, Edw. W. '30 A
Hargrove, Lorin D. '28 Ch
Harris, Wm. W. '32 Ae
Hartigan, James J. '29 C
Hatch, Lloyd '23 ChE
Havens, Paul M. '27 A
Hawkinson, Franklin '32 M
Hayden, Claude E. '24 C
Hayes, Roger J. '32 M
Heath, Delbert W. '29 C
Hedenstrom, Ernest A. '12 E
Hedke, Hellmuth '31 E
Heller, A. Robt. '30 E
Helmick, Don S. '15 C
Hendricks, Clifford '25 C
Hennesey, Hugh J. '11 Ch
Herrmann, Raymond '13 E
Hewitt, M. W. '13 C, '14 CE
Hill, Hibbert M. '23 C
Hiner, Walter G. '23 C
Hoff, Christopher '06 E
Hoff, Hans A. '33 C
Hoffman, Ambrose L. '32 ChE
Hoffman, Henry Jos. '12 Ch, '14 MS
Hoffman, Maurice B. '32 ChE
Hoffman, Michael J. '11 C
Hoffman, Walwin H. '29 M
Holder, Laurence E. '24 C
Holien, Gilman C. '28 A
Holmstrom, Helmer A. '32 C
Hooper, Roger B. '32 C
Hosmer, Orville H. '23 C
Houston, Geo. S. '02 C
Hovden, C. D. '12 E, '13 EE
Hoving, John E. '27 C

How, Francis W. '27 C
Irons, Geo. '26 E
Irons, Roy C. '27 M
Jacobson, Howard C. '21 G
James, Henry C. '11 E
Johnson, C. A. '21 M, '22 ME
Johnson, Clarence E. '32 C
Johnson, Einer '11 Ch, '12 MS
Johnson, Marvin O. '30 E
Johnson, Robertson B. '25 E
Johnson, William S. '31 C
Kaim, F. J. H. '32 ChE
Kaplan, Ray '31 Ch E
Kempe, Lloyd L. '32 ChE
Kennedy, Wm. W. '07 Ch
King, Lawrence W. '09 C
King, Wesley E. '05 C
Kinsell, Wm. L. '00 E
Knight, Ralph J. '15 C
Koch, Karl L. '31 E
Kochendorfer, Milton J. '05 E
Kocian, Chas. J. '30 C
Korba, Anton '29 E
Krauch, Wm. Louis '08 C
Krema, John H. '31 C
Kryger, Edw. R. '21 Ch
Kugler, Jos. H '26 ChE
Kuhfeld, Frank W. '31 C
LaBonte, Anton E. '25 C
Langseth, Axel O. '22 ChE
Larson, Albin '14 C
Larson, Edwin '21 A
LeBlond, Edmond J. '05 E
Lee, Oscar C. '19 E
Levy, Max L. '26 E
Lewin, Sherman W. '26 C
Lewis, Carroll E. '19 G
Lewis, Edw. B. '05 M
Lewis, Geo. R. '21 M
Lindberg, Arthur F. '30 AE
Linsley, Scott E. '32 E
Livermore, Harvey J. '22 ChE
Loeffler, H. S. '14 E, '15 EE
Logue, John F. '24 M
Lovering, H. D. '13 C, '14 CE
Luethi, Carl F. '27 C
Luft, Hans L. '24 ChE, MS
Lyden, Arvid E. '29 ChE
McAdam, Robt. M. '32 ChE
McCree, Andrew A. '08 C
McGladrey, Lyle L. '28 M
McIlvaine, Wm. D. '29 E
McLean, Milton D. '21 G
McMahon, John S. '31 A
McMiller, Paul R. '11 Ch
McNerney, Geo. W. '30 AE
McPherson, Wm. B. '02 E
Mackintosh, Wm. S. '21 C
Maehl, Kenneth A. '27 ChE
Mailand, Marjorie J. '30 IA
Maiser, Walter L. '23 C
Markson, Christian O. '22 C
Markus, Harry '30 C
Marofsky, Henry J. '31 E
Mayer, Albert F. '20 E
Mayer, Francis L. '29 E
Mayhugh, Ben F. '28 M
Maynard, Midas J. '31 E
Meixner, B. A. '10 M
Merrill, Grant S. '28 ChE
Mertz, Karl J. '14 E
Meserve, Ralph H. '23 E
Miller, Geo. '20 E
Midtlien, Norten O. '31 ChE
Miller, Geo. '20 E
Miller, Wm. Chas. '16 M
Miller, Wm. J. '24 E
Mintz, Nathaniel '22 E
Mitchell, John B. '09 C
Mixer, Walter R. '17 A
Moisesku, Wm. '29 M
Mooney, Geo. N. '32 M
Moore, Gordon B. '27 E
Moorman, Albert J. '18 A
Moorman, Frank S. '22 A
Morrison, John A. '31 AE
Morton, H. S. '12 M, '13 ME
Motl, Chas. L. '10 C
Mowery, Clarence W. '08 C
Mullen, Francis E. '30 A
Muller, Carl C. '18 M
Nason, Geo. L. '10 C
Nasvik, Adolph C. '26 C
Nelson, Edw. S. '09 C
Nelson, Raymond A. '32 AE
Neubauer, Loren W. '26 C, '32 MS (Hyd.)
Neville, Earle L. '20 C
Nichols, Freeman A. '31 M
Nier, Alfred O. '31 E
Norman, Vernon '30 E
Norton, C. W. '08 M, '09 ME
Okes, Day Ira '08 C
Okes, Sidney R. '09 C

Olson, Clarence '21 C
Oltman, Chas. A. '03 C
Otto, Fred A. '04 E
Otto, Robt. W. '04 M
Owens, Leo E. '11 M
Palda, Chas. H. '22 C
Parkin, Fremont P. '29 ChE
Parkin, G. G. '12 Ch, '13 MS
Paulsen, Geo. F. '17 A
Paulson, Jos. B. '27 C
Peckham, Harold E. '23 M
Pederson, Kenneth W. '32 C
Pennock, Edw. M. '05 AC
Peters, Walter C. '22 M
Peterson, A. M. '14 E
Peterson, Clarence R. '25 C
Peterson, Gerhard C. '30 A
Peterson, Harold C. E. '25 C
Peterson, Harold R. '18 G
Pinska, Lawrence F. '22 C
Piret, Edgar L. '32 ChE
Porter, R. E. '13 ChE, '14 ChE
Powell, Louis H. '24 C
Powles, James W. '10 E
Rauen, Theo. H. '26 ChE
Reardon, John M. '22 C
Redin, R. K. '26 AE
Reinhold, Robt. E. '31 E
Riedesel, Geo. M. '17 A
Rigg, Alvin E. '25 A
Robins, Maurice L. '31 ChE
Rockwood, Ralph H. '12 Ch
Roe, Chas. P. '29 Ch
Roe, Harry B. '08 G
Roe, J. H. '30 E, '32 MS (EE)
Roehrich, Victor H. '09 ChE, '10 MS
Roth, Lewis M. '11 C
Sandler, Theo. T. '30 C
Schaller, Geo. C. '23 C
Schlenk, John J. '23 C
Schuettler, James '31 C
Schroepfer, Geo. J. '30 MS (CE), '32 (E)
Schwenke, H. H. '30 ChE
Sheire, James B. '28 E
Shepard, Geo. M. '09 C
Sickel, Edwin C. '23 E
Smith, Sheldon H. '10 ChE
Smith, Willis H. '32 M
Snow, C. J. '14 M, '15 ME
Sonnen, Chas. G. '31 C
Soshnik, Edw. J. '22 C
Souther, M. E. '12 C, '13 CE
Spehr, Peter E. '27 M
Staffeld, Paul R. '31 C
Stanton, Raymond E. '04 M
Stevens, Everett B. '25 M
Stewart, Clarence H. '03 C
Stewart, John P. '30 E
Streich, Harry C. '12 E
Sutton, Theo. M. '31 IA
Swanstrom, Alfred E. '31 AE, '32 MS (AE)
Swanstrom, Glenn H. '33 C
Swendson, Lyman '31 E
Swenson, Geo. W. S. '28 Ch
Swenson, Theo., Jr. '12 E
Tallmadge, E. S. '14 E, '15 EE
Tauber, Jos. H. '28 C
Teberg, Lawrence E. '22 C
Tenenbaum, M. J. '32 ChE
Tews, Arthur W. '24 C
Thian, Helen M. '30 IA
Thomas, Theo. W. '28 C
Tierney, Hubert J. '30 ChE
Toncheff, Stanil T. '15 Ch
Tubbesing, Norman F. '27 M
Turner, Leslie E. '09 E
Vievering, Wm. A. '25 Ch
Villaume, Walter F. '23 C
Waidelich, Clarence O. '32 M
Waligora, John M. '32 E
Walker, Basil G. '31 E
Wall, Gordon A. '32 A
Waltz, Kenneth W. '32 E
Waterous, Fred A. '20 M
Weber, Eugene W. '30 C
Welin, A. G. '12 C, '13 CE
Wellisch, Walton '23 E
Weom, Laurel A. '27 E
Wettels, Albert J. '31 Ae
Whaley, Frank J. '31 M
Wheeler, Roger B. '27 ChE
Whitman, Edw. A. '00 C
Whitman, Edw. G. '32 C
Willard, Arthur C. '22 E
Willis, Roy '08 C
Wilson, Frank W. '23 E
Wolf, Milton C. '25 C
Wolfangle, Raymond J. '17 C
Wolff, Wm. S. '15 M, '16 ME
Woolery, Herbert M. '32 AgE

Wunderlich, Milton S. '19 M, '20 ME
Yager, Louis '07 E
Young, Donald '29 M
Youngquist, Eder B. '23 C
ST. PETER
Galles, Boniface P. '32 E
*STEWARTVILLE
Beach, Geo. H. '27 E
*STEPHEN
McMillan, Godfrey H. '31 C
STILLWATER
Englin, Chrs. F. '06 E
Lewis, Berkeley R. '25 E
Newman, Prescott H. '32 Ae
Reutiman, F. R. '29 M
Stoehe, Rolland W. '31 C
Swanson, John A. '31 C
TAYLORS FALLS
Rydeen, James P. '28 C
TINTAH
Doleman, Geo. H. '31 E
TWIN VALLEY
Croswell, Thomas L. '15 C
Nilson, Wilhelm '02 E
TWO HARBORS
Johnson, Austin G. '05 M
Holmstrom, Geo. '29 E
TYLER
Johnson, Anton A. '24 A
Nielson, Walter M. '22 E
UNDERWOOD
Aune, Albert W. '31 E
VIRGINIA
Beddow, Willard G. '32 AE
Harvey, Howard G. '31 AE
Lackrie, Wm. J. '31 E
Riddell, Donald J. '28 E
Staff, Clarence E. '31 E
Whitten, Robt. C. '25 M
WADENA
Iosande, Fred L. C. '25 C
Taylor, Wesley D. '31 E
*WALNUT GROVE
Wiggins, Oswald J. '31 M
*WARREN
Swennes, Tilford G. '31 E
WARROAD
Johnston, Dorrance '31 E
WASECA
Johnson, Edgar F. '21 E
Zimmerman, Louis P. '08 E
WATERVILLE
Kanne, Donald W. '31 E
WAYZATA
Gerow, Theron G. '29 M
Hill, Erwin G. '30 C
WESTBROOK
Anderson, Leslie A. '31 E
WEST CONCORD
Blecker, Geo. W. '16 E
Whiting, L. M. '31 AgE
WHEATON
Heggen, Reuben '24 E
WHITE BEAR LAKE
Bloom, Clifford D. '32 A
Fiske, Frederick W., Jr. '09 C
Fredericks, John C. '32 C
Gehrenbeck, G. B. '28 ChE
Lux, Arthur E. '16 C
Murphy, Frank W. '32 Ae
Murray, Robt. '26 ChE
Schwantes, Arno K. '32 AgE
Thomas, Wm. A. '17 E
WILLMAR
Mattson, Dewey F. '22 C
Rivkin, Solomon M. '31 E
Swenson, Chas. '07 C
WILLOW RIVER
Walta, John C. '32 E
WINONA
Boynm, Benj. C. '10 C
French, Wm. O. '23 M
Green, Gilbert B. '32 A
Grettum, LeRoy A. '23 E
Kinzie, Roy W. '31 ChE
Miller, Archibald T. '24 E
Miller, Wm. L. '97 E
Slaggie, Eucharius L. '26 E
Werner, Alfred J. '31 Ae
WINTHROP
Larson, Karl O. '30 Ae
Malmberg, Victor A. '20 C
WINTON
Larson, Harold O. '29 E
WRIGHT
Hagman, Walter '27 C
ZUMBROTA
Grover, Roy L. '31 E

MISSISSIPPI

LAUREL
Nee, Harold E. '24 E
UNIVERSITY P. O.
Woolett, Guy Haines '10 Ch, '16 MS, '18 PhD

MISSOURI

GASCONADE
Chapman, Barton L. '10 C
HANNIBAL
Curtis Thomas H. '12 C
JEFFERSON CITY
Espenett Edw. L. '22 C
KANSAS CITY
Daley, Harvey S. '32 A
Etem, Victor '26 E
Glass, Clifton A. '98 C
Halden, Herbert O. '23 M
Johnston, Chas. L. '25 ChE
Look, Frank '30 C
Luedeman, C. H. '25 AE
Tibbling, Ernest F. '14 Ch
Wright, Harris H. '09 M
KNOB LICK
Rydeen, Francis G. '05 M
MACON
Donegliy, Wm. V. '30 A
MARSHALL
Meeks, E. Donnell '29 E
Pettjohn, Earl S.L.A. '06, '11 Ch, '18 PhD
NEW LONDON
Glascock, Henry H. '06 E
NORMANDY
Langman, Harley R. '24 M
ROLLA
Eyberg, Carl J. '29 C
ST. LOUIS
Antilla, Geo. W. '30 C
Beck, Vernon S. '10 E
Brick, Bayard R. '29 Ch
Grabert, H. T. '30 E
Grant, Elberth R. '24 C
Haines Allen K. '13 E
Hawkey, Harold K. '19 ChE, '19 ChE
Hemenway, Edw. L. '28 M
Johnson, Noah '94 C
Krantz, R. W. '24 ChE, '25 MS
McCann Reslino V. '27 A
Norman, Henry R. '27 C
Oscarson, Gerhard L. '22 E
Read, Leland B. '29 M
Sverdrup, Leif J. '21 C
TROY
Ball, Hampton B. '28 M
VICKSBURG
Olson, Clarence E. '28 C
WILLOW SPRINGS
McDanield, Loran A. '28 C

MONTANA

BILLINGS
Berg, Karl A. E. '20 C
Coleman, Frank D. '05 E
Corbett, Theo. R. '26 M
BOZEMAN
Thaler, James A. '00 E
BUTTE
Jordan, Frank W. '19 E
Pratt, Arthur C. '99 E
Rolfe, West A. '13 C
Stussy, Wm. '00 E
DEER LODGE
Towey, James M. '28 E
GLASGOW
Joselowitz, Goodwin '18 Ch
GLENDIVE
Adams, Benj. W. '10 C
Ainslie, Arthur F. '11 C
GREAT FALLS
Conrad Gordon '30 M
Dow, James C. '00 E
Hansen, Maurice J. '11 E
Hogan, Sander '21 E
HELENA
Christoffer, Forton A. '32 M
Kivley, Warren O. '16 C
HOGELAND
Wiprud, Roy '31 E
KALISPETH
Byrno, John P. '33 M
PARADISE
Hauge, Clifford J. '32 E

NEBRASKA

CRETE
Hawlick, Henry I. '19 C
GRAND ISLAND
Melkus, Leonard A. '30 A
LINCOLN
Japs Barney G. '09 E
OMAHA
Buchak, Kirk '31 E
Bunce, Paul F. '06 E
Christensen, Edgar W. '19 E
Eddy, H. T. '95 E, '96 EE
Ellifson, Selmer '16 E
Hanson, James B. '29 C
Johnson, James P. '23 E
Joyce, Thomas R. '30 ChE
Normann, Olav K. '28 C
Quinn, John L. '08 C
Teal, Clarence W. '24 E
Wilcox, Halsey H. '15 E
Wild, Carl D. '15 C

NEW HAMPSHIRE

BERLIN
Burningham, F. A. '17 ChE, '18 ChE

NEW JERSEY

ASBURY PARK
Frils, Robt. W. '30 E
BAYONNE
Schwartz, John Saul '19 A
BLOOMFIELD
Heins, Harold H. '25 E
Nelson, Chester '29 M
Widell, E. Gideon '17 ChE
BOONTON
Smith, Donald C. '18 E
CAMDEN
Corson, Benj. J. '17 Ch
Emlein, Harold '30 E
Koch, Winfield R. '25 E
CEDAR GROVE
Robinson, Lawrence T. '26 E
COLLINGSWOOD
Berglund, Erick R. '27 E
Engstrom, Elmer W. '23 E
CRAWFORD
Mitchel, Alexander C. '20 E
DOVER
Becker, Ward E. '17 E
EAST ORANGE
Boman, Carl E. '05 E
Gustafson, Thor A. '28 E
Johnson, Eward J. '11 E
Johnson, Wilton V. '26 E
EDGEWATER
Rose, Anton Richard '04 Ch
ELIZABETH
Aultfather, David H. '22 E
Franzen, Roy O. '25 E
Fritzberg, Hilding L. '28 M
Skidmore, John G. '30 C
FANWOOD
Peterson, Vance C. '20 E
FT. HANCOCK
Scott, Willard W. '17 E
HADDARFIELD
Burrell, Chas. M. '23 E
HILLSIDE
Frederickson, Harry B. '11 E
JERSEY CITY
Mikesh, M. A. '12 M, '13 ME
KENVIL
Linden, Carlyle '29 ChE, MS
LYNDHURST
Kannenberg, Walter F. '23 E
Thyberg, Clarence W. '25 E
MAPLEWOOD
Burns, Harvey L. '02 E
MATAWAN
Wiggins, Gerald G. '06 E
MILBORN
Ireland, Roy R. '03 E
Wheeler, Herbert H. '17 E
MERCHANTVILLE
Smith, Jerome C. '27 E
MONTCLAIR
Kingsley, Norman W. '20 E
NEWARK
Vartdal, Victor K. '29 E
NEW BRUNSWICK
Von Kuster, Edith I. '07 Ch
NEW MILFORD
Velz, Clarence '24 C
ORANGE
Laird, Lee R. '03 E
Wright, Roydon V. '98 M
PLAINFIELD
Dowd, Archie J. '19 M
PRINCETON
Shortley, Geo. '30 E
Sprung, Murray M. '25 ChE, '28 PhD
RED BANK
Feldman, Carl B. H. '26 E, '28 MS
Sharpless, Wm. M. '28 E
RIDGEFIELD
Thompson, Niles J. '27 E
RIDGWOOD
Cassel, N. S. '22 ChE, '23 ChE
ROSELLE
Pangburn, Carroll G. '22 E
Steffens, Robt. A. '22 E
Thompson, Boyd '29 ChE
SUMMIT
Strothman, Russell A. '20 E
Williams, Fred M. '09 E
WESTFIELD
Hilierty, Chas. D. '96 M
Houts, Guy Jos. '01 E
*Demarest, Chas. S. '11 E
*Ellestad, Irwin M. '22 E
WEST ORANGE
Elmer, Lloyd A. '21 M
WOODBURY
Kurtz, Kerwin K. '28 ChE
Nelson, Carl H. '10 E
Nygard, Edwin M. '21 Ch
Petry, Theo. '29 ChE, '30 MS
Schriver, Frederick J. '30 Ch
Shabaker, H. Arthur '29 ChE, '30 MS

NEW MEXICO

ALBUQUERQUE
Gilman, Gaylord '25 E

NEW YORK

ALBANY
Engstrom, LeRoy '28 C
ATTICA
Anderson, E. I. '17 M, '19 ME
BALLSTON LAKE
Fiene, Marcus '26 E
BRANKVILLE
Loye, Edwin M. '20 A
BROOKLYN
Bauer, Ruben B. '20 E
Brattlof, Clifford '27 C
Buhl, John E. '09 M
Ely, Irving R. '05 E
Goldberg, Will M. '28 ChE
Hastad, C. Jerome '30 E
Holt, Leo G. '28 E
Krueger, Walter R. '29 E
LeTourneau, Edw. H. '05 E
Moe, Claude F. '20 Ch
Morris, John E. '09 M
Nygaard, Herman '30 E
Stoppel, Ernest A. '11 Ch
BUFFALO
Fawcett, Robt. Best '28 ChE
Green, Arthur T. '30 E
Hammer, Geo. E. '20 Ch
Johnson, L. L. '25 ChE, '27 MS
Pendergast, Webster G. '25 M
Peterson, Garvin E. '26 C
Sverdrup, E. F. '26 ChE
CHENANGO FORKS
Harshaw, John R. '12 Ch
FLUSHING
Woolman, Jos. C. '11 M
FULTON
Korlhage, Roy F. '20 Ch
GOVERNOR'S ISLAND
Weeks, Wm. C. '94 C
GREAT NECK
Bouman, Bernhard M. '04 E
ITHACA
Barr, John H. '83 M, '
KENMORE
Holmes, Roland W.
LONG ISLAND CITY
Barnum, Marvin C.
Myers, Mortimer
Poss, John A.
LYNBROOK
Eckberg, Curtis R.
MASSENA
Heath, Arthur C.
MT. KISCO
Robertson, Phillip
MT. VERNON
Wahlquist, Hugo W.
MERCHANTVILLE
Painter, Wm. H.
NEW ROCHELLE
Bierman, H. C. '14 Ch, '
NEW YORK CITY
Abbott, Arthur L.
Backstrom, Emil F.
Bolme, Ole M.
Cameron, Grace
Case, Gerald F.
Cherne, Realto
Clark, Chas. J.
Cooper, R. Conrad
Cousins, Van Meter
Covell, Russell O.
Crabbe, Geo. N.
Craig, Robt.
Eddy, Clarence J.
Emerson, Lynn A.
Finnell, Thomas C.
French, Edwin C.
Gannett, D. K. '16 E, '
Gilman, Howard B.
Hendrickson, C. T.
Isaacson, Arthur M.
Johnson, Elving L.
Koepke, W. E. '13 C, '
Kuhlman, Rudolph H.
Lundeen, Arvid G.
Lieb, Janet
Lehnert, Walter
McKay, Earle D. '15 C, '16 CE, '23 MS
McKesson, Lewis J.
Mowry, Harry W.
Rankin, Renville S.
Ransom, Glen B.
Schneckloth, Harry H.
Silverman, Isadore W.
*Thordarson, Wm. '23 ChE, '
Thorne, Donald E.
Thurus, A. L. '12 E, '
*Stowe, Geo. E.
Tunell, Clement R.
Vye, Geo. F.
Wicklund, Paul E. '
NIAGARA
Bemer, Raymond C. '
Buehl, Walter M. '3
Elston, Arthur A. '2
French, Edwin L.
Jackman, R. E. '29 Ch
Paul, Karl F. '

Paulson, Paul M. '23 ChE, '24 MS
Schermer, Oscar C. '21 ChE, '22 ChE
verhead
Braaten, Arthur M. '28 E
chester
Eaton, Wentworth '29 ChE
Matthews, Glenn E. '20 Ch, '21 MS
Savage, Edw. S. '97 M
Seymour, Merrill W. '21 Ch
arsdale
Lockwood, Raymond A. '20 E
henectady
Allie, David A. '02 C
Beardmore, Albert '21 E
Bottemiller, Edw. L. '27 E
Brightfelt, John C. '27 E
Cady, Richard C. '31 E
Danielson, E. H. '30 M
Edgar, Robert F. '27 E, '29 MS (EE)
Gogins, John F. '30 E
Graf, Alois W. '26 E
Grobel, Lloyd P. '24 M
Haidecke, August D. '26 E
Harris, Gordon C. '29 E
Heinemann, John R. '19 E
Ives, Kenneth S. '29 M
Mittag, Albert H. '11 E
Morton, Lysle W. '24 E
Orth, Robt. W. '31 M
Rask, Louis G. '03 E
Sheppard, Raymond '30 M
Williams, W. Glenn '29 E
Wilgen, Edw. '00 E
Wyman, LeRoy L. '22 BSc, '23 ChE
otia
Dunham, Roy O. '15 E
Grant, Fred R. '09 E
Hartley, Lowell J. '26 E
Mears, Leon A. '30 E
Tollar, Chas. E. '01 E
Warren, Laurence C. '24 E
aten Island
Grimes, David '19 E
Reichow, Wm. A. '30 M
racuse
Jones, Robt. A. '15 E, '16 EE
Meyer, Malcolm B. '09 M

Troy
Huchthausen, Walter J. '28 A
White Plains
Adams, Geo. F. '95 E
Cheney, Edw. J. '04 E
Schottler, Geo. J. '23 E
Yonkers
Harwood, Stanley G. '03 M
Rice, Edgar W. '02 Ch

NORTH CAROLINA

Charlotte
Bonner, Arthur L. '27 E
Freeman, Frank S. '29 M
Palmer, Roy A. '21 E
Durham
Haines, Howard N. '22 A
Raleigh
Halversen, John O. '07 Ch

NORTH DAKOTA

Beach
Thompson, Randal T. '32 AE
Cando
Brightbell, Linwood J. '31 AE
Carrington
Lee, Albert C. '27 E
Crosby
Rossean, Clifton C. '24 M
Devils Lake
Breakey, Tom W. '32 Ae
Hovde, John E. '32 Ae
Enderlin
Alderson, Anthony D. '29 C
Fargo
Farel, Gordon M. '30 E
Grafsland, Geneva L. '27 IA
Jones, Paul W. '28 A
Jumrud, Edwin C. '17 E
Petrick, Edw. L. '30 AE
Sheffield, Fred W. '09 C
Skarolid, Chas. T. '24 E
Stoutland, Oliver A. '22 C
Tarbell, Wm. P. '22 C
Waechter, Raymond C. '31 A
Grand Forks
Anderson, Edw. X. '08 Ch, '09 MS
Gordon, Moses '29 ChE
Kilpatrick, Porter W. '27 A
Lavine, I. '24 ChE, '30 PhD
Mayer, Jos. S. '24 E
Schulz, Elton A. '16 E
Jamestown
Weinke, Ernest H. '17 C
Langdon
Burke, John F. '32 Ae
Mandan
McCall, Harry J. '08 C
Minot
Huston, David B. '07 C
Molander, Edwin W. '25 A
Peterson, Wm. W. '16 C
Weeks, Leonard H. '27 E
Williams, Wm. R. '26 E
Stanley
McGregor, Frazer A. '24 E
Williston
Jackson, Myron B. '05 AC

OHIO

Akron
Benson, Donald G. '30 ChE
Gerlicher, Robt. A. '28 ChE
Gustafson, Hugo F. '28 M
Pettersen, Wilbur E. '28 M
Rehfeld, Harold '29 ChE
Tronson, John L. '26 ChE, '28 MS
Barberton
Heinemann, Gustave '29 Ch E, '30 MS
Jordre, Wm. S. '31 M
McNeil, Lawrence L. '31 M
Straub, Wm. '29 ChE
Canton
Hektner, Joel '17 M
Cincinnati
Bevan, R. Louis '24 C
Harrington, Marzy V. '24 C
Peterson, Randall '28 E
Strain, Bruce '30 ChE
Young, Truman P. '26 C
Cleveland
Anderson, Oscar P. '10 E
Christen, Ray L. '26 E
*Dever, Francis A. '20 C
*Conley, Wilfred E. '10 E
*Cowin, Clifford C. '21 G
Drinkall, John F. '19 E
Grant, James A. '07 C
Johnson, Carl Sigfrid '21 C
Johnson, Leonard T. '10 E
Lund, Jeffery L. '25 E
Olt, Leonard E. '15 C
Ronning, N. B. '27 E
Salstrom, Paul S. '26 E
Schilling, Theo. F. '24 E
Tuve, Geo. L. '20 M, '21 ME
Cleveland Heights
Merriell, E. W. '12 E, '13 EE
Columbus
Berzelius, Carl E. '29 AE
Moffat, G. N. '19 M, '20 ME
Robinson, Richard R. '27 E
Youngquist, C. V. '27 C
Cuyahoga Falls
Nelson, Edgar M. '24 E
Dayton
Smith, Rolf M. '29 M
Tholstrup, Henry L. '26 E
Findley
Robison, Arch. R. '09 E
Uzzell, Geo. W. '07 E
Hartwell
Nelson, L. W. '29 ChE
Ivorydale
Jewett, Ernest E. '25 ChE
Lakewood
Crane, Eugene C. '13 M
Heidmann, Karl R. '29 E
Marr, Horace S. '17 Ch
Sillman, Paul D. '28 C
Yngve, Victor '13 Ch, '14 MS
Lima
Cutter, Francis C. '05 M
Mansfield
Gaalaas, Geo. L. '26 E
Ginnaty, J. Robt. '29 E
Kotchwar, Jos. F. '28 E
Lee, Paul R. '27 E
Wieland, Willard W. '25 E
Marion
Barron, John H. '26 E
Orrville
Specht, James E. '29 E
Perrysburg
Buckhout, Donald H. '17 A
Rocky River
Miller, Andrew L. '21 E
Salem
Ros'ng, Donald C. '27 C
Sandusky
Ackermann, Robt. W. '28 E
Shaker Heights
Hinman, Chas. H. '24 A
Sidney
Moore, Norman R. '23 C
Springfield
Keller, Raymond W. '25 E
Toledo
Kendall, Donald R. '30 E
Van Wert
Flatzer, Geo. J. '27 C
Wickliff
Arneson, Lloyd O. '21 M
Willoughby
Taylor, Lyman D. '13 E
Xenia
Schliep, Carl J. '28 E
Youngstown
Birnberg, Zingel C. J. '09 M
Bohl, Paul S. '07 M
Elmburg, LeRoy M. '25 AE
Lee, Walter J. '20 E
Leider, Albert E. '27 E
Ramm, Theo. D. '13 E
Van Cleve, Horatio P. '07 C

OKLAHOMA

Bartlesville
Norberg, Hans A. '27 E
Stauffacher, Edw. L. '24 M
Oklahoma City
Rader, Clarence M. '17 C
Tulsa
Ellingson, Elmer '16 C
Fortune, Harry G. '20 M
Thompson, Warren L. '26 Ch

OREGON

Corvallis
Martin, Wallace H. '10 M
Eugene
Walquist, John A. '23 A
Forest Grove
Taplin, Geo. C. '24 E
Klamath Falls
Smith, Leighton H. '03 C
Maplewood
Sterling, Faith '09 Ch
Medford
Brockway, Alvah E. '09 E
Waldron, Ralph E. '20 E
Merrill
Bogue, Nathan H. '04 C

COVER DESIGN CONTEST

A contest for the best cover design for the 1933-34 Techno-Log is open to all students of the College of Engineering and Architecture, and the School of Chemistry. Designs are to be submitted to the Minnesota Techno-Log office on or before October 5, 1933. The designs will be judged by the editor and business manager of the Techno-Log, and Prof. Arnal of the Architectural Department. The award, to be given October 7, 1933, will be a silver loving cup.

Ontario
Countryman, Peter F. '07 E
Portland
Andersen, Christian '88 C
Anderson, Frank A. '08 E
Bjurge, Oscar B. '07 M
Cook, Robertson '02 M
Cotton, Richard J. '30 E
Couper, G. B. '93 M, '02 ME
Doeltz, Wm. F. '08 C
Felthous, Donald G. '29 M
Hubbard, Fred A. '09 C
Meany, James M. '07 M
Nelson, Donald O. '20 C
Nichol, Frank E. '25 C, '26 MS (CE)
Rawson, Ralph H. '07 M
Rockwood, F. '14 E, '15 M
Tualatin
McAfee, Allan L. '08 E
Vernonia
Knauss, A. C. '16 C, '17 CE

PENNSYLVANIA

Allentown
Reque, Styrk G. '01 E
Altoona
Olson, Vernon H. '25 C
Ambridge
Washburn, Delos C. '93 A
Bellview
Smith, Cedric B. '14 BA, '18 C
Bethlehem
Gjesdahl, Maurice S. '21 M
Jensen, Cyril D. '21 C
Kantor, Max '29 ChE
Luce, A. W. '21 M, '23 ME
Bradford
Leavenworth, F. M. '11 Ch
Brookline
Parsons, Sidney A. '25 E
Chambersburg
Bolton, John M. '28 C
Devon
Irwin, Vincent H. '14 E
Donora
O'Connell, Thomas C. '13 Ch
Dormant
Bleifuss, Donald J. '20 C
Lee, Albert A. '26 E
East Pittsburgh
Gemmell, Robt. W. '26 E
Erie
Bill, Earl M. '12 E
Downie, John M. '22 E
Sjoberg, Roy H. '26 E
Sturtevant, Percy G. '08 E
Harrisburg
Didrikson, Philip '20 G
Morse, Geo. H. '93 E, '11 EE
Hollywood
Granbois, Kenneth J. '29 E
Marcroft, Harold C. '24 E
Jenkintown
Lowe, John M. '08 Ch
Johnstown
Satari, Roy H. '21 E
Library
Rosenthal, Oscar L. '19 C
Morton
Stone, Leslie F. '22 ChE, '23 ChE, '27 PhD
New Kensington
Taylor, Cyril S. '13 Ch
Weber, Ludwig J. '20 ChE, '23 ChE, '24 PhD
Norristown
Dunnum, Orney E. '22 E
Oakmont
Edwards, Junius D. '12 ChE, '13 ChE
Frary, Francis C. '05 Ch
Overbrook
O'Brien, Raymond J. '11 E
Philadelphia
Childs, John C. '06 C
Cross, Roland E. '23 M
Currie, Neill, Jr. '08 E
Fairchild, Albert R. '07 E
Jordan, Wallace E. '25 ChE
Pearson, Chas. W. '21 E
Peterson, H. L. '16 C, '17 CE
Sartell, Page M. '24 M
Swift, Geo. E. '23 E
*Young, Chas. N. '12 E
*Westin, Lloyd J. '30 E
Pittsburgh
Blackshaw, Joe L. '28 M
Gibson, Chas. B. '05 E
Hauft, Hugo H. '25 E
Johnson, Sheldon F. '28 E
Kaplan, Eugene V. '10 M
Luft, Oscar W. '17 ChE
Luger, Karl E. '22 ChE
Morrison, John E. '22 C
Nelson, Elmer A. '23 C
Selvig, Walter A. '09 Ch
Souther, Benj. L. '16 Ch
Swanberg, John H. '25 C, '29 MS (CE)
*Ridley Park
Johnson, Edw. L. '30 E
Riegelsville
Peterson, Clifford E. '23 ChE
Scranton
Eberhardt, Otto J. '03 E
Ringer, Adolph '30 M
Sharon
Steinert, Emil '25 E
Wentz, Edw. C. '26 E
State College
Tebo, Frank A. '28 C
Swissvale
Tunnell, Robt. H. '24 E
Trafford
Locklin, Robt. R. '29 E
Upper Darby
Hathaway, Herbert F. '28 M
Wilkinsburg
Bierwagen, Rudolph '29 E
Brown, Louis M. '16 E
Goss, Harold R. '20 E
Joestings, Frederick D. '26 E
Johnson, Douglas O. '28 E
Knutson, Manches '30 E
LeVescoote, L. B. '26 E
Rudman, Mirko '30 E
Soufal, R. N. '30 E
Towle, Neal C. '12 E
Wilson, Abner W. '22 E

RHODE ISLAND

Pawtucket
Knapp, Lester H. '12 E
Providence
Tappen, Ruth W. '22 Ch
(Mrs. J. Dowling)
Vaule, Sven A. '21 M

SOUTH CAROLINA

Walterboro
Mitchell, Lloyd S. '25 C

SOUTH DAKOTA

Aberdeen
Odegaard, Harold T. '20 M
Brookings
Mark, Reuben A. '11 C
Firesteel
Blake, Henry B. '01 E
Huron
Beddow, Earl E. '32 A
Hagedorn, Erwin S. '32 M
Langford
Cook, J. Marvin '28 E
Lead
Gadler, Steve '32 E
Mitchell
Bjodstrup, Eugenia L. '32 IA
Giese, Howard D. '31 M
Miller, Ralph H. '13 Ch
Rapid City
Dimmick, Merton A. '26 C
Sioux Falls
Benson, Kenneth E. '32 C
Boyce, Leonard F. '12 M
Gran, Conrad L. '29 E
Hult, George A. '16 E
Johnson, Ellwood L. '30 M
McKee, J. B. '25 ChE, '26 ChE
Millman, George '32 M
Ransom, Ralph W. '23 M
Robertson, Kenefick '25 E

TENNESSEE

Bristol
Butterworth, Russell I '15 E, '17 EE
Chattanooga
Withee, Warren '15 C
Copperhill
Haywood, L. W. '21 E
Kerns, Clinton E. '15 M
Knox, Charles E. '28 C
Longworth, Fred J. '05 Ch
Crossville
Wannamaker, Homer F. '26 C
Isabella
Anderson, Edgar G. '27 Ch
Memphis
Grachau, Earl H. '21 C
Tvedt, Lawrence A. '24 AE
Tvedt, L. (Mrs.) '25 ID
Newport
Morrow, Leon W. '16 Ch

TEXAS

Amarillo
Bolnick, Harry W. '27 C
Smith, Allen S. '26 ChE
Austin
Crowell, Sidney H. '27 C
Beaumont
Bernhagen, Lewis O. '06 Ch
Dallas
Chestnut, George L. '97 E
Fernald, Frank O. '04 C
Honey, Paul K. '31 M
Meffert, George H. '31 C
Rounds, Fred M. '95 E
Zerlik, William J. '25 ChE
Edinburg
Nutting, Horace W. '23 C
El Paso
Wurzbach, Henry A. '25 E
Houston
Bakke, Oliver M. '03 Ch
Lubbock
Helwag, William F. '30 E
Kleinschmidt, Florian A. '20 A
Pampa
Kernkamp, Lloyd E. '30 Ae
Port Arthur
Ost, Roland E. '22 C
Westman, Bruce '26 Ch

UTAH

Salt Lake City
Ashworth, Roy H. '11 E
Beyer, Theodore A. '03 C
San Antonio
Crane, Fremont '87 C
Eggen, Karl M '29 C

VERMONT

St. Johnsbury
Stillman, Marcus H. '09 E

VIRGINIA

Hampton
Rollin, Vern G. '29 M
Hilton Village
Holmstine, Arthur G. '17 M
Petersburg
Morris, Thomas C. '08 M
Richmond
Cornell, George M. '25 C
Richardson, Wilbur F. '99 M
Riegel, Louis F. '11 E

WASHINGTON

Camas
Glenn, Harry W. '24 ChE
Everett
Beaulieu, Richard L. '02 C
Kelso
Phelps, Ray R. '10 E
Longview
Hetherton, Percival '08 M
Oroville
Norelius, Lewis M. '06 C
Port Angeles
Parrett, Arthur N. '20 ChE, '21 ChE
Prosser
Smith, Hugh A. '13 E
Puget Sound
Benedict, George F. '03 E
Seattle
Bowen, Fred P. '06 C
Bushnell, Charles S. '78 M
Curtiss, Lindsley B. '09 G
Erickson, Carl G. '03 E
Hayward, George I. '06 C
Guthrie, J. D. '93 E
Hillman, Charles K. '12 E
Jenkins, Clifford H. '25 M
Johnson, Ivar W. '24 E
Kobe, Kenneth A. '26 ChE, '28 ChE, '30 PhD
Linton, James H. '97 ChE
McKenzie, Lauren F. '09 E
Magnusson, Carl E. '96 E, '97 EE, '05 EE
Nelson, George A. '25 C
Nelson, Glen H. '23 C
Pearce, John H. '07 E
Petrick, Alfred C. '19 E
Quense, John '01 C, '02 M
Ringstrom, H. '15 Ch, '17 MS
Shuck, Gordon R. '06 E
Silfman, Henry D. '97 M
Smithson, John E. '07 E
Sternberg, Carl
Westberg, Russell E.
Wiesner, Frederick E.
Wolff, Henry E.
Skykomish
Walters, Robert P.
Spokane
Adams, Elmer E.
Alton, Herbert D.
Grimshaw, William E
Kjosness, Ingraham G
Nelson, Lyle C.
Tacoma
Lewis, Lloyd W.
Lumm, A. Gordon
Yakima
Gilman, Nicholas A.

WEST VIRGIN

Alexandria
Anderson, Rex S.
Charleston
Giltinan, David M. '15 M,
Glen Ferris
Fenton, Paul C.
Morgantown
Amidon, Lee L.
Gill, J. H. '92 M,

WISCONSIN

Alma
Christensen, Elmer J.
Russell, Charles J.
Amherst
Shilel, Frederic C.
Appleton
Darling, Stephen F. '24 MS, '28 PhD (H
Lande, Clarence C.
*Lewenstein, Abraham
Poppe, F. W. '11
Baldwin
Neevel, Max L.
Beloit
Cole, Ernest C.
Hoss, Paul O.
Holt, Gunnard T.
*Palmer, Howard F.
Kaplan, Donald J.
Lindfors, Onni
Spicola, James A.
Swart, Richard H.
Brillion
Lawson, Ivan R.
Chater
Weston, William S.
Chippewa Falls
Berdan, Hubert J.
Cray, S. R. '22 C,
Vaudreuil, Lionel H.
Colfax
Anderson, Allan S.
Deer Park
Lorentzen, Carl C.
Eau Claire
Bergford, John F.
Cotton, Ernest H.
Deterling, Edward W.
Holm, Edwin R.
McMillen, James S.
Meyer, Carl F.
Monsen, Manley A.
Montgomery, Albertus
Peters, Charles M.
Thurston, Harold H.

ountain City
Dresser, Harry S. '16 M
antsburg
Nelson, Martin E. '24 C
een Bay
Dimmitt, Bruce S. '30 C
Hartney, J. L. '14 M, '15 ME
Moody, C. S. '16 M, '17 ME
enosha
Marx, C. Cheffe '32 IA
oblez
Hvoslef, F. W. '17 M, '19 MS
Crosse
Bergsland, Grant C. '23 M
Buhr, Leo '23 C
Cerney, Robert G. '32 A
Hoglund, Milton L. '31 AE
Knutsen, Lloyd B. '32 A
Meader, Glenn S. '26 E
Ralphe, Wendell W. '30 C
Willson, Stuart V. '24 M
adison
Ball, Dean G. '32 A
Cameron, Lester W. '27 A
Church, Bruce R. '28 A
Daniels, F. '10 Ch, '11 MS
Hubbard, Henry A. '09 C
Hubbard, Robert T. '06 E
Hulett, Susan B. '31 IA
Knudsen, Esther M. '25 C
Larson, Ludvig C. '21 E, '23 EE, '26 C
Luxford, Ronald F. '17 C
McCully, James P. '25 E
Nystrom, Paul E. '24 A
Turrittin, Hugh L. '27 C
Van Duzee, Edward M. '28 ChE, '30 ChE
arinette
Hornibrook, James W. '09 E
enomonie
Mitchell, Ralph W. '32 Ch
ilwaukee
Albrecht, George M. '06 E
Barton, James P. '27 E
Borden, John C. '29 E
Brimeyer, F. J. '25 AE
Brown, Glendon C. '28 E
Bunnell, Charles W. '26 C
Clark, Fred S. '27 E
Comstock, Roy H. '30 E
Cote, Rhoda H. '25 ID
Edwards, William H. '27 A
Epstein, Hymen '21 Ch
Flegal, A. C. '27 A
Gehring, Lester G. '27 C
Harrington, Russell A. '24 E
Hart, Maurice W. '26 E
Hunt, Gates E. '20 E
Johnson, Herman R. '09 E
Kastner, Arthur H. '27 A
Kendall, Walter A. '25 A
Larson, Louis J. '14 C, '15 CE
Ludvigsen, Elliot L. '25 M
Lundsten, Frank R. '27 C
Miller, Standish '30 ChE
Mork, George W. '26 M
Newman, John M. '23 E
Papenthien, Roy O. '21 G
Potter, Robert F. '26 A
Price, Clarence R. '20 E
Reed, Albert I. '85 C
Sesseng, Gunnar '24 M
Skrukrud, Odean M. '25 C
Small, Gordon J. '31 E
Sutherland, Samuel J. '23 AE
Wallin, Stanton E. '29 C
Oconto Falls
Busch, John S. '20 ChE
Oshkosh
Knobla, Bernard N. '32 A
Prescott
Miller, Kenneth H. '32 M
Racine
Adams, Robert S. '30 ChE
Olson, Arthur L. '24 M
Rood, Arnold E. '22 E
Taylor, Ralph G. '02 M
Tyvand, James A. '24 E
Rice Lake
Thelin, Ruben E. '28 E
Sheboygan
Nimmer, Walter B. '26 E
Spooner
Putz, John H. '14 BS, '15 EE
Stevens Point
Cheney, Russell S. '30 C
Hammond, Kathryn D. '22 Ch (Kelley)
Superior
Deneen, Davis J. '19 A
Jewett, Robert H. '31 Ae
McGrath, William L. '32 AE
Two Rivers
Plank, Howard G. '22 E
Wauwatosa
Cross, Charles H. '97 M
Foltz, Ross M. '19 M
Kampa, Edmund P. '23 Ch
Roberts, Earl H. '16 M
West Allis
Larson, Victor F. '17 M
Lee, William B. '30 M
Marek, Glenn '30 M
Smart, George A. '16 M

WYOMING

Cheyenne
Johnson, Elmer W. '30 AE
Sheridan
O'Marr, James L. '32 C
Pearson, George O. '28 AE

ALASKA

Ketchikan
Smith, Byron E. '07 E

CANADA

Coutts, Alberta
Jallings, K. R. '28 ChE
Edmonton
Morris, Robert '05 E
Montreal
Adams, Wm. C. '05 E
Beyer, Randall R. '27 E
Moore, Leonard P. '29 ChE
Pierce, Walter H. '26 M
Spence, Wm. J. '02 E
Wesbrook, Donald M. '10 M
Ontario
Anderson, Edw. S. '21 E
Saskatchewan
DuBois, N. Warren '26 M
Thetford Mines
Johnson, Raymond V. '24 C
Toronto
Anderson, Oscar V. '10 E
Jules, Harold A. '20 E
Winnipeg
Borrowman, Leroy F. '08 C
Schumacher, John H. '03 E

CHINA

Canton
Wong, Joe Kwum '16 M
Lumpuk
Loo, Yuson '27 M
Peiping
Liu, Maoling '29 E
Peking
Liu, Shu Ming '20 A
Loo, Pang Chieh '28 AE
Shanghai
Williams, Edw. H. '03 M

CUBA

Havana
Romero, Cirilo '17 M, '18 ME

ENGLAND

Essex
Tronson, Carl A. '10 Ch

FINLAND

Kymi
Morris, Frank A. '24 M

HAWAII

Honolulu
Ferguson, George E. '28 C
Haakensen, N. Theo. '26 C

ICELAND

Reykjavik
Gunnarsson, Jon '29 C

INDIA

Bengal
Dewaji, Gunaker '26 M
Bombay
Cooley, Gilbert '22 E
Shellenberger, H. R. '20 M
Jamshedpur
Merten, Howard V. '14 Ch

MEXICO

Torreon Coah
Maine, Basil C. '21 E

PHILIPPINE ISLANDS

Aringay, La Union
Sobejana, Etalo V. '32 Ae
Bay, Laguna
Galvez, Nicolas L. '25 Ch
Fort William McKinley
Linden, Henning '17 C
Mattison, George C. '11 C

SOUTH AMERICA

Chile
Carlson, Victor H. '20 E
Knowles, Everett H. '20 E
Liese, Carl K. '26 C
Venezuela
Gerdes, Carl H. '25 C

WHAT'S NEW IN ENGINEERING?

A SYNTHETIC AURORA BOREALIS

An aurora borealis, common phenomenon of the northern skies, will be presented all summer, this year, at the Century of Progress. The aurora will be formed by an arch of searchlights and will appear as if formed in the air without connection with the earth.

The aurora will appear about 100 feet above a 90 foot combination fountain and pillar of light which is to feature the court of the Electrical Building. The beams of the searchlights will intersect directly above the pillar, but will not be visible until they intersect and form the aurora. Such an arrangement will illuminate all facades and varying levels of the Electrical Building and send a characteristic glow over the city.

ROTARY VOLTMETER

A NEW electrostatic voltmeter for measuring either a-c or d-c potentials has been developed recently in this country. This meter has a range limited only by its insulation, and with the high voltage insulations now available, the meter can be made to have practically an unlimited range.

The meter draws no current, has no detectible temperature errors, and is not unreasonably difficult or expensive to construct. It has a very high accuracy and an absolutely linear scale characteristic over its entire range, a feature highly desirable where both a-c and d-c potentials are being measured.

The new meter may really be called an electrostatic generator for it consists merely of a simple armature rotating between two smooth electrodes which serve as pole pieces. The armature is a piece of metal tubing which has been sawed longitudinally into two equal semi-cylinders insulated from each other and connected electrically through a commutator and a sensitive galvanometer. The armature, driven at a constant speed by a synchronous motor generates a direct current which is directly proportional to the potential difference applied to the pole pieces.

The instrument may also be used as a wave form meter by advancing or retarding the rotor in its synchronous rotation and taking readings for different points in one cycle of the applied voltage wave. Where only the peak values of a-c are desired the rotor may be adjusted for the maximum current.

These meters have been used in a few experimental X-ray laboratories, but their dependable and inconspicuous performance in these first trials suggests that they will be found useful in a variety of other applications.

Alpha Alpha Gamma, architectural sorority, has six new pledges. They are Mabel Johnson, Evelyn South, Miriam Bend, Mary Emmel, Stella Wallace, and Helen McBroom.

ANSWERS TO MAY MENTAL TILTS

Malven L. Olson, sophomore engineer, was the first to turn in the correct solutions to these, the last set of problems for the school year, and he therefore receives a year's subscription to the Minnesota Techno-Log.

SHADOW ON THE WALL

The shadow moved at the rate of 48 ft. per second.

ROPES AND TREES

The intersection of the ropes is 15 ft. above the ground.

ADDRESSES UNKNOWN

Letters to the following addresses have been returned undelivered. Information or corrections will be welcomed by the Dean's office.

1883
Peters, William G. C

1884
Hoag, William R. C

1888
Loe, Eric H. M

1892
Felton, Ralph P. M
Howard, Monroe S. E

1893
Dewey, William H. E

1895
Weaver, Albert C. M

1897
Markhus, Olaf G. E
Woodman, Howard H. C

1898
Willson, Manton F. M

1899
Anderson, John G. C
Graling Verney E

1900
Johnston, William W. M
Parkhurst, Harleigh E

1901
McKettrick, James C

1902
Bean, William L. M
Graham, Eugene C. G
Lambert, Fred T. C
McClelland, Claude L. C
Stone, Melvin O. M

1903
Madden, Francis C

1904
Roth, Paul C
Stevens, Jessie E. G
Taplin, Robert B. E

1905
Bates, Albert H. M
Bisbee, Elmer C
Gregg, Tresham D. G
Jackson, Earl D. E
Smith, Donald T. C
Wood, John W. E

1906
Alsop, Ernest B. C
Armstrong, Thomas S. M
Calmeyer, John P. E
Childs, Harvey R. C
Malloy, Charles J. C
Swensen, Karl F. G

1907
Cram, Clyde M. C
Dunham, John A. C
Eddy, Lynne W. E
Haverson, Henry D. C
Kerns, Ralph W. E
Krag, Walter G. M
Nekola, John W. M
Norcross, Arthur F. E
Wagner, Otto H. M
Woehler, William L. E

1908
Bachrach, Alfred E
Brown, George J. E
Casberg, James W. E
Comstock, John W. C
Councilman, Halstad P. M
Fleming, Douglas R. C
Furber, Pierce P. C
Gage, Hugh N. C
Kauffman, Roy E
Pancratz, Frank J. E
Peterson, Clarence A. E
Prentice, Robert S. E
Schild, William F. E
Schoepf, Alfred W. E

1909
Esser, Frank F. C
Harris, Clayton E
Knapp, William R. M
Walsh, James E

1910
Finke, Walter J. E
Pease, Maynard W. M

1911
Boerner, Francis C. C
Chapman, Arthur G. E
Fieldman, David P. C
Forsberg, William P. E
Jones, Watkin W. E
Markuson, Oscar S. E
Nebel, Walter H. E
Olstad, Oscar A. M
Pengilly, Joseph H. E
Shepard, Donald D. E
Walker, William A. E

1912
Adams, John W., Jr. C
Anderson, Arthur R. E
Thompson, Herbert L. M
West, Robert W. C

1913
Anderson, Harvey B. C
Bergquist, John E. C
Chapin, Harold S. M
Hirleman, Clark W. M
McCartney, Floyd A. M
Mathes, Robert C. E
Pardee, Charles A. E
Pease, Raymond A. C
Ringstrom, Ivan G. E
Wangaard, Oscar H. C

1914
Hoern, Frederick W. E
Layden, Arthur L. E

1915
Aasland, Christopher C
Adler, Eugene H. E
Anderson, Joseph W. E
Crosby, Milton E. M
Fallon, Eugene L. E
Jackson, Otto E. E
Johnson, Alexander B. C
Jones, Idres V. C
Laurence, Philip L. C
Schroeder, Carl W. E

1916
Arenzon, Timothy G. E
Fastenau, Karl D. E
Russell, Carl A. E
Skon, Herman W. M
Skurdalsvold, P. C
Williams, Charles A. C

1917
Irwin, Frank H. E
Jacobs, Arthur R. E
Mori, Nathaniel R. E
Nelson, Otis S. M
Riekman, Herman W. C
Taylor, Duane L. M

1918
Elliassen, Sigurd C
Konstant, Nicholas C
Levin, Jake M.
Smolensky, Martinian
Talbot, Thomas E.

1919
Bierman, George H.
Elliot, Harry C.
Klass, Frederick
Kroeze, Herbert A.
Olson, Richard H.
Pierson, Joe W.
Sander, Theodore, Jr.
Sushan, H. M.

1920
Beneke, Walter E.
Bernt, Hans E.
Curry, Ezra B.
Egilskud, F. S.
Fitzgerald, William J.
Joachim, William F.
Larson, Walter J.
Lebeck, Carl E.
Madsen, Olav
Noel, Clay W.
Peterson, Peter I.
Seemann, Ernest W.
Sherwood, Edward B.
Swenson, Clarence Q.

1921
Berg, Samuel A.
Colson, Laureu G.
Dahl, George
Daly, Richard T.
Hammerstrom, Aleck A.
Henry, Burt C.
Podosin, John
Simmonds, Richard R.
Wills, Arthur D.
Wilson, Paul R.

1922

ndrus, Harry J.	C
rtis, Verne F.	M
ickson, Edwin C.	C
oler, Max	C
rost, Herbert J.	C
reenberg, Jack	C
agelin, Lawrence W.	E
emsey, Clayton E.	M
hnson, Ellsworth	C
atter, Reuben L.	M
eeler, Jasper F.	C
reinkamp, Herbert	A
Magnuson, John E.	E
ewberry, Lester W.	C
ordstrom, Ernest A.	M
aulsen, Thorwald S.	C
osenthal, Paul	C
lade, Loring	C
ewart, George A.	A
ierney, Festus P.	C
Villiams, Percival H.	E
'illmer, William E.	A

1923

bramson, Harry W.	C
erg, Swan P.	C
ergford, Rolf E.	C
lausen, Elmer W.	E
isdorf, Edward C.	C
lindt, Richard H.	C
olien, Edward O.	A
ohnson, Albert W.	C
earney, Adrian A.	E
otz, Walter E.	E
rodelien, Eugen	M
und, Earl	C
loreno, Gerardo	E
ash, Russell O.	E
ath, Harvey C.	E
chweiso, Clifford C.	E
clarow, Abraham	C
ime, Theodore L.	A
wanson, Paul H.	C
ennstrom, Carl H.	C
immerschild, Clarence	E

1924

nderson, Emil G.	E
nderson, Fayette C.	E
auer, Roscoe W.	C
erry, George F.	M
lodgett, Charles R.	M
onsall, Wallace C.	A
ullis, Everard J.	C
arlson, Warren E.	E
assidy, Walter J.	E
ollis, N. Stuart	M
ahl, Harold W.	E
rickson, Carl E.	C
razee, Leonard M.	E
aufman, Morris B.	C
lagoon, Herbert A.	A
larshman, Irving H.	E
lathes, Richard E.	E
onseth, Ingwald T.	E
ormann, Rolf A.	C
eterson, Arthur S.	M
oot, Frank R.	AE
omero, Waino M.	C
toddart, Hugh A.	C
toner, Clifford M.	C
homas, W. Alan	M
hompson, Theodore S.	C
Vilson, Walter E.	C
Volfe, George E.	E
Voolman, Harry D.	M

1925

uxer, William L.	C
artholomew, Neal W.	C
eeze, Harold U.	C
erg, Thorsten H.	C
oe, Lester L.	E
urns, Dwight T.	C
ameron, Harry D.	E
hilds, Morris P.	E
onnelly, William H.	M
alton, Edwin G.	C
alanter, Samuel S.	C
obell, Arthur W.	C
lammer, Harold E.	E
ussey, Norman W.	E
acobi, Alfred J.	M
arson, Emil L.	AE
IcClung, Karl R.	E
lark, Max B.	C
lills, Hartzel C.	M
loris, Russell F.	C
elson, Clarence H.	E
elson, Edwin W.	C
eterson, Everett L.	A
eterson, Laurence L.	M
Souba, John L.	M
Sullivan, Frederic V.	C
Thomas, Richard L.	E
Thomson, Andrew	E
Ward, John, Jr.	C
Wilson, Roy A.	M

1926

Ayshford, Loren C.	E
Balkin, Samuel W.	C
Coon, Lawrence C.	E
Ehrenberg, Muriel L.	ID
Faulkner, Louis L.	E
Ferguson, Kenneth R.	E
Forsmark, Ulrik E.	E
Gross, Leon A.	E
Hargrave, William A.	E
Johnson, Clarence A.	E
Johnson, James R.	C
Johnson, Raymond A.	C
Kelly, William J.	E
Letson, Donald E.	M
Linseg, Alex	C
Lundgren, Carl W.	M
Meyerdeck, Clarence C.	C
Murdock, George B.	E
Naslund, Gustave A.	A
Nordenson, Willard H.	M
Pike, Jay R.	M
Quine, William M.	E
Rasey, Raymond R.	C
Roberts, Norman A.	M
Sandvig, Lawrence A.	C
Schweppe, Walter A.	E
Scott, Franklin B.	E
Slaby, Louis J.	M

1927

Amidon, Roger E.	C
Anderson, Lawrence B.	A
Borrowman, John K.	C
Brayden, Giles W.	E
Briggs, Luard E.	C
Broderick, Vere H.	A
Bull, Alvah S.	AE
Chapman, Wilbur J.	M
Coates, J. Edwin	M
Cook, Lyle M.	M
Decanay, Lino P.	M
Farmer, Herbert F.	E
Gilfillan, Donald W.	AE
Hartberg, Reynold O.	E
Hutchinson, Edwin T.	M
Lamon, Harold J.	M
Little, Fred	M
MacDonald, George A.	M
Murray, Harold E.	C
Nolan, George C.	E
Nyquist, Roy A.	AE
Pajari, Tamo	C
Pearson, Harold T.	C
Peterson, Frederick G.	C
Rauscher, Paul F.	E
Roberts, Dimon A.	M
Rogers, H. Barrett	E
Roth, Fred L.	C
Schultz, Albert W.	E
Wold, Joseph H.	E
Ward, Stanley A.	E
Woloshin, Boris	E

1928

Anderson, Elwood C.	E
Barnes, James C.	E
Blackmore, Frank E.	M
Burke, James J.	M
Carjola, Chester L.	A
Corliss, Charles V.	E
Daly, Frank A.	C
Heywood, George L.	E
Jerabek, Daniel A.	AE
Klammer, Kalmer K.	E
Koerner, Allen M.	E
Krieger, Keith M.	E
Leode, Williard H.	E
McGinnity, William J.	E
McNally, Lee D.	C
Nogueira, Frederico P.	E
Parker, Clyde H.	C
Rakov, Avner	A
Rinell, Eric A.	C
Roberts, Henry M.	M
Seeger, Franklin H.	E
Thwing, George	C
Vorisek, Jerry J.	C

1929

Abrahamson, Arthur L.	E
Abrahamson, LeRoy M.	E
Anderson, Fred S.	C
Anway, Fred L.	AE
Ben-Ora, Samuel	A
Bernick, Leslie L.	C
Bohrer, Donald M.	E
Brauch, Harold N.	E
Brewer, Carlos W.	M
Dutcha, Lloyd L.	AE
Eck, Melvin C.	C
Fergestad, Marvin L.	AE
Fisher, Addison M.	E
Foss, Athie	M
Goodner, Theodore C.	E
Gray, Wesley	E
Halverson, Vernon E.	E
Hansen, Oliver S.	AE
Johnson, Roy M.	M
Juran, Nathan H.	A
Kneller, Edward L.	E
Millunchick, John W.	E
Mueller, Robert	E
Rowell, Lester J.	M
Russ, Lloyd A.	E
Sanders, Paul A.	M
Schilken, Donald R.	AE
Shannon, Harold	M
Sinnott, Irving G.	M
Tanner, Elo C.	M
Teller, Louis	M

1930

Allison, Ralph E.	E
Carsberg, Edgar	E
Conner, Henry F.	M
Elmstrom, Raymond E.	E
Ewy, Albert	E
Hansen, Tom W.	AE
Hawkinson, Conroe F.	M
Jacobs, William A.	E
Johnson, Arthur B.	C
Johnson, Floyd M.	E
Karageorges, George	E
Otterson, George L.	C
Pappenfus, Clarence	M
Pehrson, Elmore L.	E
Punkari, Helgi	E
Tanglin, Ernest S.	M
Warrington, J. Lamont	E

1931

Ackerman, C. Julian	E
Bingham, Erwin W.	A
Dovolis, James J.	AE
Dunn, James W.	AE
Dunshee, Donald	C
Griggs, Myrle E.	C
Hanlon, Edward B.	C
Hubbard, Frank E.	AE
Larson, Carl M.	C
Merzweiler, John M.	C
Olsen, Clarence J.	A
Olson, Roy W.	C
Pedersen, William E.	AE
Swanstrom, Alfred E.	AE
Trimble, Myrl	E
Webster, Marvin J.	AE
Witcher, Dean L.	AE

1932

Anderson, Clifford O.	M
Koester, William R.	A
Lowe, Howard H.	M
Moore, Thomas R.	C
Radow, Himan	M
Simpson, Page M.	E
Weyer, Herbert	E

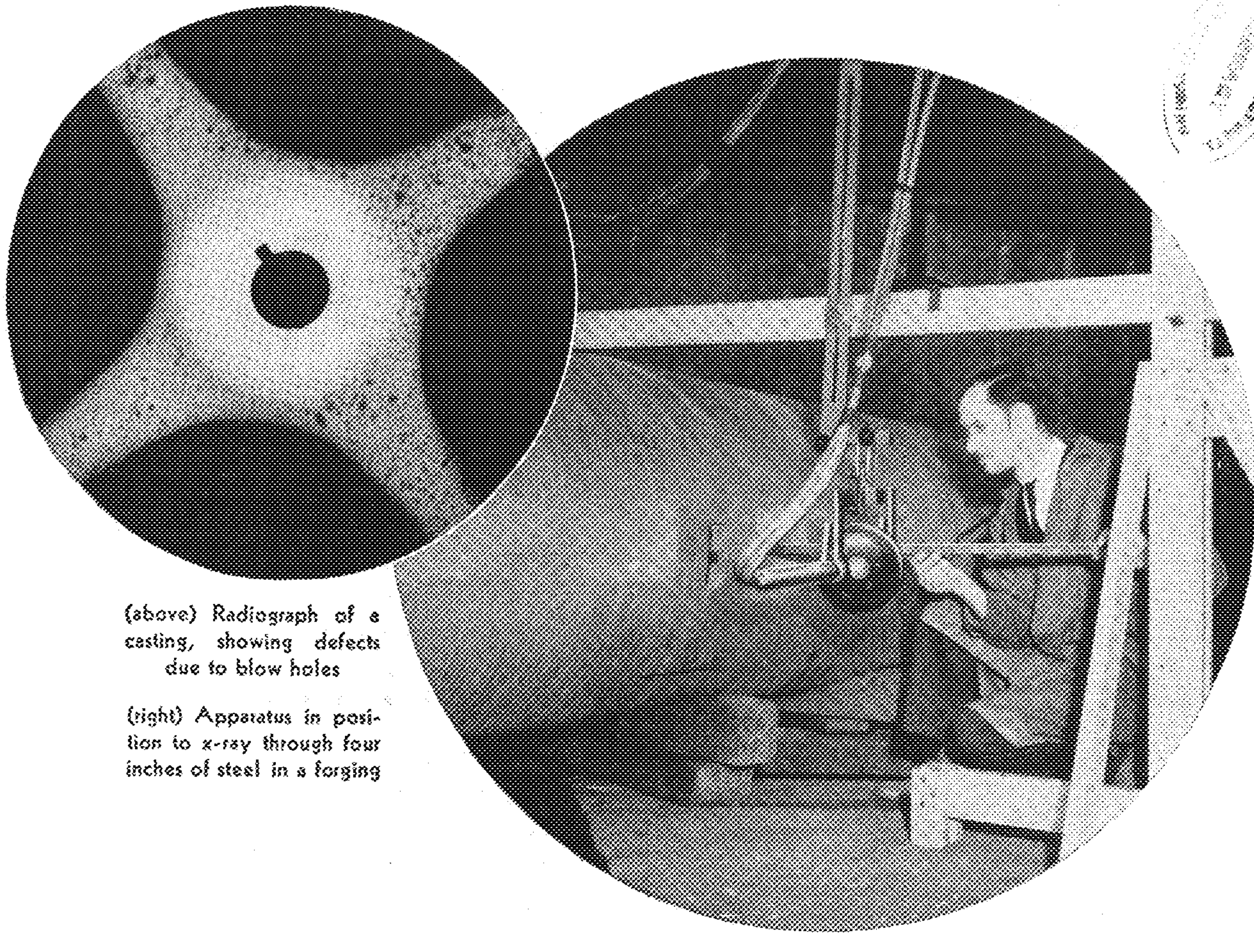
THE MINNESOTA TECHNO-LOG

UNIVERSITY OF MINNESOTA

October, 1932 Volume XIII June, 193

INDEX

Seeing through steel



(above) Radiograph of a casting, showing defects due to blow holes

(right) Apparatus in position to x-ray through four inches of steel in a forging

WHEN Prof. Röntgen announced his discovery of the x-ray, in 1895, he intimated that medical science would not be the only beneficiary. Since then, General Electric has been a pioneer in the development of the x-ray for industrial as well as medical use. • As a result, a new science — industrial radiography — enables us to peer at the internal structure of almost any material. Radiography reveals most microscopic defects in metals — blow holes, shrinks, pinhole porosity, cracks, dross inclusions, etc. — without destruction of the specimen. Even four inches of steel is no obstacle to the modern radiographer. • "Seeing through steel" has become a reality with the new and more powerful x-ray tubes developed by General Electric. These tubes, using as much as 400,000 volts, make possible the most powerful x-rays available to industry. Such developments are largely the accomplishments of college-trained engineers. They are leading the way to even greater progress in the electrical industry and are helping to maintain General Electric's leadership in this field.

95-953DH

GENERAL ELECTRIC